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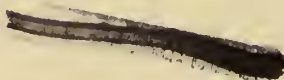
SWEET'S ENGINEERING CATALOGUE

SIXTH
ANNUAL
EDITION

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SWEET'S ENGINEERING CATALOGUE

A Catalogue Filing System
of
Industrial Plant and Engineering
Materials, Equipment and Supplies
Completely Indexed

Sixth Annual Edition

Compiled, Edited and Published Annually by
SWEET'S CATALOGUE SERVICE, INC.
119 West 40th Street, New York

Boston, 114 Federal Street
Philadelphia, 1821 Chestnut Street
Detroit, Penobscot Building

Pittsburgh, Bessemer Building
Cleveland, Citizens Bank Building
St. Louis, Title Guaranty Building

Chicago, Monadnock Block
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The publishers have spared no effort in this presentation, to secure and present, through documentary information, the characteristics and functions of the various products, together with such standards as fulfil the requirements of both manufacturers and engineers.

The text, drawings and illustrations have been treated with a view to meeting the needs of the user rather than the varied preferences of the individual manufacturer. It has been the aim of the editor to include only essential facts required by the specification writer or prospective purchaser and, so far as possible, irrelevant or merely general information has been eliminated.

To facilitate the constant endeavor of the editor to improve this publication, and to make it render an even more valuable service in the future, it is asked that professional suggestions be freely offered by the users of the book.

EDITOR

1027001

INFORMATION SERVICE

Engineers, engineering contractors and others identified with engineering work are invited to write for information concerning any special class or make of engineering materials or equipment. Detailed information is on file concerning the products of the principal manufacturers of materials of construction, contractors' plant, power plant equipment and allied lines.

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A list of the products catalogued in this volume, arranged alphabetically, followed by the names of the firms manufacturing them.

Products are usually indexed under the main noun (Fire Brick, for example, being indexed as Brick, Fire) except where common usage makes it desirable to have the adjective precede the noun, as, for instance, Gas Producers, Metal Lath, etc.

Trade names (shown in *italics*) follow the firm names listed under the various products except where such trade names would appear simply as an unnecessary repetition of the preceding firm names without giving any additional information.

This index relates to the contents of the book only, and does not include items which might be inferred but are not actually mentioned.

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Anchors, Wall, Concrete
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Products are indexed under the noun except where common usage makes it desirable to index under the adjective.

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SKF Industries, Inc.	848-849
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Pittsburgh-Des Moines Steel Co.	625

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Tagliabue, C. J., Mfg. Co.	568-569
Taylor Instrument Companies	570-571
Tycos	570-571

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Sweet's Steel Co.	122
Youngstown Sheet & Tube Co.	406-407

Bars, Muck, Puddled Iron

Youngstown Sheet & Tube Co.	406-407
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See Caps and Bases, Post

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Basins and Covers, Catch

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Products are indexed under the noun except where common usage makes it desirable to index under the adjective.

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Hyatt Roller Bearing Co.	842-843
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Royersford Foundry & Machine Co.	846-847
SKF Industries, Inc.	848-849
Valley Iron Works	838-839
Wood's, T. B., Sons Co.	840-841
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Bearings, Step

Valley Iron Works	838-839
Wood's, T. B., Sons Co.	840-841

Bearings, Thrust

Chicago Pulley & Shifting Co.	824-825
G-A Ball Bearing Mfg. Co.	844
Norma Co. of America	845
SKF Industries, Inc.	848-849

Bedford Stone

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Robins Conveying Belt Co.	923
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Belting, Conveyor, Wire

Cyclone Fence Co.	386-388
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Cork Insert Co.	827
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Belting, Fabric or Cotton

Main Belting Co.	858-859
Russell Mfg. Co.	861
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Russell Mfg. Co.	861
Anaconda	858-859
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Main Belting Co.	858-859
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Benders, Bar

Koehring Machine Co.	94-95
Ransome Concrete Machinery Co.	96-99

Benders and Straighteners, Hydraulic

Metalwood Mfg. Co.	1129
Southwark Foundry and Machine Co.	1130-1131
Watson-Stillman Co.	1132-1133

Bends, Pipe

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Crane Co.	440-441
Kellogg, M. W., Co.	420-421
Kelly & Jones Co.	450-459
National Pipe Bending Co.	790-791
National Valve & Mfg. Co.	422
Pittsburgh Piping and Equipment Co.	423
Pittsburgh Valve, Foundry & Construction Co.	484-486
Roessing-Ernst Co.	424
Simmons Pipe Bending Works	405
Walworth Mfg. Co.	425
Whitlock Coil Pipe Co.	794-796
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Youngstown Sheet & Tube Co.	406-407
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Valley Iron Works	838-839
Wood's, T. B., Sons Co.	840-841

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Gurley, W. & L. E.	10-11
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Bins, Coal and Ash

(See also Steel Plate Construction)

Brown Hoisting Machinery Co.	891
Burhorn, Edwin, Co.	801
Dover Boiler Works	600-601
Gifford-Wood Co.	895
Guarantee Construction Co.	898-899
Haiss, George, Mfg. Co., Inc.	61
Heyl & Patterson, Inc.	904-905
Petroleum Iron Works Co.	605-607
Pittsburgh-Des Moines Steel Co.	625
Specialty Engineering Co.	926-927
United States Cast Iron Pipe and Foundry Co.	410-412
Brownhoist	891
G-W	895

Bins, Storage, Steel Plate

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Bins and Racks, Storage, Metal

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Hercules Powder Co.	38-39
Little Giant	36-37

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Atlas Powder Co.	36-37
Du Pont de Nemours, E. I., & Co., Inc.	40
Hercules Powder Co.	38-39

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National Asbestos Mfg. Co.	427
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Jones, W. A., Foundry & Machine Co.	854-855
Royersford Foundry & Machine Co.	846-847
SKF Industries, Inc.	848-849
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Wood's, T. B., Sons Co.	840-841
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Clarage Fan Co.	974-975
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Crowell Mfg. Co.	977
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General Electric Co.	1050-1084
Green Fuel Economizer Co.	687
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Ilg Electric Ventilating Co.	979-981
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Sturtevant, B. F., Co.	985-1003
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Boiler and Engine Trimmings

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American Steam Gauge & Valve Mfg. Co..... 553-557
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Lunkenheimer Co.	470-475
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Including:—Steam, Cylinder, Service, Plug, etc.

Kelly & Jones Co.	450-459
Lunkenheimer Co.	470-475
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Bond Foundry and Machine Co.	820-822
Chicago Pulley & Shafting Co.	824-825
Dodge Sales and Engineering Co.	828-831
Medart Patent Pulley Co.	835
Royersford Foundry & Machine Co.	846-847
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Chicago Pneumatic Tool Co.	784-785
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Ingersoll-Rand Co.	781-783
Novo Engine Co.	786
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<i>Imperial</i>	786

Compressors, Air or Gas

Allis-Chalmers Mfg. Co.	1114-1115
American Steam Pump Co.	720
Chicago Pneumatic Tool Co.	784-785
Crowell Mfg. Co.	977
De Laval Steam Turbine Co.	712
Fairbanks, Morse & Co.	699
Goulds Mfg. Co.	738-741
Ingersoll-Rand Co.	781-783
Johnson Service Co.	526-527
Lammert & Mann Co.	750
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 Automatic Refrigerating Co.....1014
 Vilter Mfg. Co.....1018-1019
 Vogt, Henry, Machine Co.....1017
 York Mfg. Co.....1020

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American Steam Pump Co.....720
 Kellogg, M. W., Co.....420-421
 Wheeler Condenser and Engineering Co.....787
 Worthington Pump and Machinery Corp.....772-777
Buckley.....420-421

Condensers, Odor

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Buffalo Foundry & Machine Co.....1138-1141
 Duriron Castings Co.....1146
 Graver Corp.....622
 Petroleum Iron Works Co.....605-607
 Pittsburgh-Des Moines Steel Co.....625
 Ross Heater & Mfg. Co., Inc.....435

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 Tippet & Wood.....613
Bullovak.....1138-1141
Lenan.....605-607

Condensers, Static

General Electric Co.....1050-1084

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Alberger Heater Co.....788
 Ingersoll-Rand Co.....781-783
 Nordberg Mfg. Co.....704-705
 Ross Heater & Mfg. Co., Inc.....435
 Tippet & Wood.....613
 Wheeler Condenser and Engineering Co.....787
 Whitlock Coil Pipe Co.....794-796
 Worthington Pump and Machinery Corp.....772-777

Condensers, Synchronous

Allis-Chalmers Mfg. Co.....1114-1115
 General Electric Co.....1050-1084

Conductors, Lightning

Arrow Conductor & Mfg. Co.....640
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Sprague Electric Works.....1086-1087
 Youngstown Sheet & Tube Co.....406-407
Realflex.....406-407

Conduit, Electrical, Rigid

Sprague Electric Works.....1086-1087
 Youngstown Sheet & Tube Co.....406-407
Buckeye.....406-407

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Containers, Shipping, Welded Steel

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 Armstrong Cork & Insulation Co.....1021
 Johns-Manville, H. W., Co.....1024-1025

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 Cheney & Co., Inc.....239
 General Kompolite Co.....240
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 Special Service Flooring Corp.....254
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 Jennison-Wright Co.....245
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 Guarantee Construction Co.....15
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Armstrong Cork & Insulation Co.....1021
 Johns-Manville, H. W., Co.....1024-1025

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 National Valve & Mfg. Co.....422
 Pittsburgh Piping and Equipment Co.....423
 Pittsburgh Valve, Foundry & Construction Co.....484-486
 Simmons Pipe Bending Works.....405
 Walworth Mfg. Co.....425

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 Biegler, E. N., Mfg. Co.....276
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 Robertson, H. H., Co.....277-279
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Payne, F. S., Co.....934

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 Browning, Victor R., & Co.....865
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Tagliabue, C. J., Mfg. Co.....568-569

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 Worthington Pump and Machinery Corp.....772-777

Converters, Synchronous

Allis-Chalmers Mfg. Co.....1114-1151
 General Electric Co.....1050-1084

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Conveyors.

Conveyor Belting

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Conveyor Rollers

See Rollers, Conveyor.

Conveyors, Apron

Alvey Mfg. Co.	887
Alvey-Ferguson Co., Inc.	888
Bartlett, C. O., & Snow Co.	890
Dow Wire and Iron Works	894
Gifford-Wood Co.	895
Jeffrey Mfg. Co.	906-909
Olson, Samuel, & Co.	920
G-W.	895

Conveyors, Ash, Steam Jet

American Steam Conveyor Corp.	889
Brady, James A., Foundry Co.	666
Girtanner Engineering Corp.	900

Conveyors, Bucket

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Conveyors, Coal

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Alvey Mfg. Co.	887
Alvey-Ferguson Co., Inc.	888
Dow Wire and Iron Works	894
Gifford-Wood Co.	895
Haslett Spiral Chute Co.	902
Lamson Co.	910-911
Lowerator Co., Inc.	903
Mathews Gravity Carrier Co.	914-917
Olson, Samuel, & Co.	920
Standard Conveyor Co.	930
A F.	888
Amco.	887

**Conveyors, Pneumatic—Coke, Ashes,
Cement, Lime, etc.**

(See also Pneumatic Tube Systems)

Guarantee Construction Co.	898-899
Airveyor.	898-899

Conveyors, Portable

Alvey Mfg. Co.	887
Alvey-Ferguson Co., Inc.	888
Brown Portable Conveying Machinery Co.	892
Dow Wire and Iron Works	894
Haiss, George, Mfg. Co., Inc.	901
Jeffrey Mfg. Co.	906-909
National Conveying Equipment Corp.	918-919
Portable Machinery Co., Inc.	922
Revolator Co.	935
Specialty Engineering Co.	926-927
Wellman-Seaver-Morgan Co.	928-929
A F.	888
Amco.	887
Auto-Piler.	892

Conveyors, Power—Belt, Chain, Slat

Alvey Mfg. Co.	887
Alvey-Ferguson Co., Inc.	888
Bartlett, C. O., & Snow Co.	890
Brown Portable Conveying Machinery Co.	892
Dow Wire and Iron Works	894
Gifford-Wood Co.	895
Haiss, George, Mfg. Co., Inc.	901
Haslett Spiral Chute Co.	902
Jeffrey Mfg. Co.	906-909
Lamson Co.	910-911
Link-Belt Co.	56-57
Mathews Gravity Carrier Co.	914-917

**Conveyors, Power—Belt, Chain, Slat—
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National Conveying Equipment Corp.	918-919
Olson, Samuel, & Co.	920
Perrine Store Service Co.	921
Pyott, Geo. W., Co.	836-837
Robins Conveying Belt Co.	923
Specialty Engineering Co.	926-927
Standard Conveyor Co.	930
A F.	888
Amco.	887
G-W.	895

Conveyors, Scoop

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Conveyors, Scraper

Jeffrey Mfg. Co.	906-909
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Bartlett, C. O., & Snow Co.	890
Link-Belt Co.	56-57
Pyott, Geo. W., Co.	836-837

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**Cooking Utensils—Aluminum, Cast Iron,
Copper, Glass, etc.**

Van, John, Range Co.	1171
Pyrex.	1171

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Alberger Heater Co.	788
Griscom-Russell Co.	789
Parks-Cramer Co.	1010-1011
Ross Heater & Mfg. Co., Inc.	435
Whitlock Coil Pipe Co.	794-796

Coolers, Brine

Arctic Ice Machine Co.	1013
Automatic Refrigerating Co.	1014
Carbondale Machine Co.	1015
York Mfg. Co.	1020

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Struthers-Wells Co.	608-611
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Bonnot Co.	941
Buffalo Foundry & Machine Co.	1138-1141
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Ruggles-Coles Engineering Co.	1148
Stacy-Schmidt Mfg. Co.	1149
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Atmospheric Conditioning Corp.	1006-1007
Badger, E. B., & Sons Co.	798
Carrier Air Conditioning Co. of America.	1005
Carrier Engineering Corp.	1008
Spray Engineering Co.	814-815
Star Brass Works	816
Spraco.	814-815
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Cooperage Coating Sprays

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Americore.	1092-1108

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American Steel & Wire Co.	1092-1108
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American Steel & Wire Co.	78-84
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Chicago Pulley & Shafting Co.	824-825
SKF Industries, Inc.	848-849
Wood's, T. B., Sons Co.	840-841
SK F.	824-825; 848-849

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Pyott, Geo. W., Co.	836-837
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Fawcus Machine Co.	851
Jones, W. A., Foundry & Machine Co.	854-855
Wood's, T. B., Sons Co.	840-841
Grundy.	819

Couplings, Friction Clutch, Cut-off

Bond Foundry and Machine Co.	820-822
Brown Clutch Co.	823
Caldwell, W. E., Co., Inc.	618
Chicago Pulley & Shafting Co.	824-825
Conway & Co.	826
Dodge Sales and Engineering Co.	828-831
Gifford-Wood Co.	895
Hill Clutch Co.	832
Johnson, Carlyle, Machine Co.	833
Jones, W. A., Foundry & Machine Co.	854-855
Kinney Mfg. Co.	834
Link-Belt Co.	56-57
Medart Patent Pulley Co.	835
Muncie Oil Engine Co.	703
Pyott, Geo. W., Co.	836-837
Reliance Gauge Column Co.	543
SKF Industries, Inc.	848-849
Valley Iron Works	838-839
Wood's, T. B., Sons Co.	840-841
Cleveland.	838-839
Crowell.	838-839
Lemley.	854-855
Smith.	832
Spiro.	820-822
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Byers, A. M., Co.	402
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Hunt, C. W., Co., Inc.	118-120
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Bond Foundry and Machine Co.	820-822
Chicago Pulley & Shafting Co.	824-825
Conway & Co.	826
Dodge Sales and Engineering Co.	828-831
Hill Clutch Co.	832
Jones, W. A., Foundry & Machine Co.	854-855
Medart Patent Pulley Co.	835
Pyott, Geo. W., Co.	836-837
Royersford Foundry & Machine Co.	846-847
Valley Iron Works.	838-839
Wood's, T. B., Sons Co.	840-841
Hendershot.	838-839
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Armstrong Cork & Insulation Co.	1021
Johns-Manville, H. W., Co.	1024-1025
Norristown Magnesia & Asbestos Co.	1029
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<i>Nonpareil</i>	1021
<i>Union Lith</i>	1030
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Armstrong Cork & Insulation Co.	1021
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Johns-Manville, H. W., Co.	1024-1025
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National Asbestos Mfg. Co.	427
Norristown Magnesia & Asbestos Co.	1029
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Cranes, Cantilever	
Brown Hoisting Machinery Co.	48-49
Heyl & Patterson, Inc.	904-905
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Brown Hoisting Machinery Co.	48-49
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Heyl & Patterson, Inc.	904-905
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Browning, Victor R., & Co.	865
Euclid Crane & Hoist Co.	884-885
Niles-Bement-Pond Co.	872-873
Richards-Wilcox Mfg. Co.	924-925
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Euclid Crane & Hoist Co.	884-885
Lane Mfg. Co.	881
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Buffalo Foundry & Machine Co.	1138-1141
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Allis-Chalmers Mfg. Co.	1114-1115
Bartlett, C. O., & Snow Co.	890
Heyl & Patterson, Inc.	904-905
Hooen, Owens, Rentschler Co.	701
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Jeffrey Mfg. Co.	906-909
Link-Belt Co.	56-57
Marion Machine, Foundry & Supply Co.	672-675
Raymond Bros. Impact Pulverizer Co.	943
Robins Conveying Belt Co.	923
Specialty Engineering Co.	926-927
Stroud, E. H., & Co.	944
Sturtevant Mill Co.	945-947
Wilmot Engineering Co.	948
Worthington Pump and Machinery Corp.	772-777
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Detroit Lubricator Co. 588
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General Electric Co. 1050-1084
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Buffalo Foundry & Machine Co. 1138-1141
- Derrick Fittings**
Buffalo Hoist & Derrick Co. 47
Haiss, George, Mfg. Co., Inc. 61
Lidgerwood Mfg. Co. 59
- Derrick Hoists**
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- Derricks, Circle Swing**
Buffalo Hoist & Derrick Co. 47
Sasgen Derrick Co. 76-77
- Derricks, Guy**
Lidgerwood Mfg. Co. 59
- Derricks, Pole and Setter**
Sasgen Derrick Co. 76-77
- Derricks, Portable**
Byers, John F., Machine Co. 52-53
Haiss, George, Mfg. Co., Inc. 61
Richards-Wilcox Mfg. Co. 924-925
Sasgen Derrick Co. 76-77
- Derricks, Stiff Leg**
Buffalo Hoist & Derrick Co. 47
Lane Mfg. Co. 881
Lidgerwood Mfg. Co. 59
Sasgen Derrick Co. 76-77
- Derricks, Tripod and "A" Frame**
Sasgen Derrick Co. 76-77
- Desiccators**
See Dryers.
- Desks, Factory, Steel**
Lyon Metallic Mfg. Co. 1166-1167
- Destructors, Refuse**
See Incinerators.
- Devulcanizers, Rotary**
Biggs Boiler Works Co. 1136
- Dies**
Royersford Foundry & Machine Co. 846-847
- Diffusers**
Walsh's Holyoke Steam Boiler Works. 614-615
- Digesters**
American Process Co. 1135
Blaw-Knox Co. 102-103
Devine, J. P., Co. 1144-1145
Koven, L. O., & Brother. 603
Petroleum Iron Works Co. 605-607
Smith, Samuel, & Son Co. 654-655
Struthers-Wells Co. 608-611
Walsh's Holyoke Steam Boiler Works. 614-615
- Disinfectants**
Carbolineum Wood Preserving Co. . . 233
Protexol. 233
- Disks—Clutch, Brake, Slipping Tension**
Cork Insert Co. 827
- Disks, Valve**
Durabla Mfg. Co. 586
Goetze Gasket & Packing Co. 587
Jenkins Bros. 446-449
- Distillate Chilling Machines**
See Refrigerating and Ice Making Machinery.
- Distilling Apparatus**
(See also Stills)
Devine, J. P., Co. 1144-1145
International Oxygen Co. 951
Jewell Polar Co. 805

- Distributing Boards**
See Switchboards; Panelboards.
- Distributors and Sprayers, Road Oil**
See Road Oiling Equipment.
- Ditching Machines**
(See also Cranes, Locomotive)
Byers, John F., Machine Co. 52-53
Pawling & Harnischfeger Co. 46
P & H. 46
- Domes, Revolving, Astronomical**
Duvinage, Pierre. 373
- Door Checks and Closers**
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- Door Hardware**
See Hardware.
- Door Jams or Frames**
See Jams, Door, Metal.
- Door Opening Devices, Sidewalk**
Ernst, Chas. K., Specialty Co. 931
Gillis & Geoghegan. 937
G & G. 937
- Doors, Asbestos Composition**
Alignum Fireproof Products Co., Inc. . 322
- Doors, Ash Pit or Clean-out**
American Steam Conveyor Corp. . . . 889
Banner Iron Works. 124-125
Creswell, Samuel J., Iron Works. . . . 123
Duvinage, Pierre. 373
- Doors, Bronze or Copper**
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- Doors, Elevator, Counterbalanced**
Johnson, Geo. W., Mfg. Co. 324
Kinnear Mfg. Co. 326-333
- Doors, Fire, Fixtures for**
See Hardware.
- Doors, Fire, Sliding or Swinging**
Alignum Fireproof Products Co., Inc. . 322
Howie Co., Inc. 294-295
Johnson, Geo. W., Mfg. Co. 324
Kinnear Mfg. Co. 326-333
Penn Metal Co. 325
Schoedinger, F. O. 320
Ajax. 326-333
Penco. 325
- Doors, Folding, Warehouse or Factory**
Johnson, Geo. W., Mfg. Co. 324
Kinnear Mfg. Co. 326-333
- Doors, Hollow Metal**
Dahlstrom Metallic Door Co. 1143
Penn Metal Co. 325
Penco. 325
- Doors, Kalamein**
See Doors, Metal Covered.
- Doors, Metal Covered**
Howie Co., Inc. 294-295
Newark Cornice & Skylight Works. . . 313
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Reliance Fireproof Door Co. 340
Vaile & Young. 298-299
Penco. 325
- Doors, Rolled Steel**
Truscon Steel Co. 352-354
- Doors, Rolling, Steel**
Cornell Iron Works. 323
Johnson, Geo. W., Mfg. Co. 324
Kinnear Mfg. Co. 326-333
Wilson, J. G., Corp. 334-339
Acme. 326-333
Akbar. 326-333
Atlas. 326-333
Superior. 326-333
- Doors, Rolling, Wood**
Kinnear Mfg. Co. 326-333
Wilson, J. G., Corp. 334-339

- Doors, Sidewalk**
American 3 Way-Luxfer Prism Co. 290-291
- Doors, Sidewalk, Safety**
Ernst, Chas. K., Specialty Co. 931
Gillis & Geoghegan 937
G & G 937
- Doors, Sliding Swing, Warehouse**
Wilson, J. G., Corp. 334-339
- Doors, Steel Clad Asbestos**
Alignum Fireproof Products Co., Inc. 322
- Doors, Tin Clad**
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- Doors, Toilet**
Betz Bros., Inc. 1033
Carpenter, R. F., Mfg. Co. 1034
Hughes-Keenan Co. 1035
Weis, Henry, Mfg. Co. 1036-1037
Hygea 1035
Sanymetal 1034
Steelbilt 1033
Weisteel 1036-1037
- Doors, Tubular Steel**
Bogert & Carlough Co. 348-349
Lupton's, David, Sons Co. 341-347
Boca 348-349
- Doors, Vent, Sidewalk**
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- Doors, Vulcanizer**
Biggs Boiler Works Co. 1136
Simplex 1136
- Doors, Wood**
Brown Co. 236
Long-Bell Lumber Co. 156-157
- Draft Apparatus, Mechanical**
(See also Fans; Blowers)
American Blower Co. 964-967
Bayley Mfg. Co. 963
Buffalo Forge Co. 970-971
Carling Turbine Blower Co. 972-973
Clarage Fan Co. 974-975
Coppus Engineering & Equipment Co. 976
Green Fuel Economizer Co. 687
Ilg Electric Ventilating Co. 979-981
Massachusetts Blower Co. 982
Sturtevant, B. F., Co. 985-1003
Wing, L. J., Mfg. Co. 1004
- Draft Regulation, Boiler**
Engineer Co. 684-685
Balanced Draft 684-685
- Draft Tube**
See Steel Plate Construction.
- Dragline Excavators**
See Excavators, Dragline.
- Drainage Grates**
See Gratings, Drainage.
- Drainers, Cellar, Electric**
See Ejectors, Sewage; Pumps.
- Drains, Double Drainage**
Including:—Floor, Roof, Garage, Shower Stall.
Josam Mfg. Co. 1044-1045
- Drains, Refrigerator**
Josam Mfg. Co. 1044-1045
- Drains, Roof**
Jeter, A. H., & Co., Inc. 296-297
Josam Mfg. Co. 1044-1045
- Drawers, Bench, Steel**
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- Drawing Boards and Tables**
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- Drawing Instruments and Materials**
Gurley, W. & L. E. 10-11
Hamilton Mfg. Co. 3
Pease, C. F., Co. 6-7
- Drawn Metal Work**
Benjamin Electric Mfg. Co. 1118
- Dredges, Dipper**
Browning, Victor R., & Co. 865
Pittsburgh-Des Moines Steel Co. 625
- Dredges, Hydraulic**
Browning, Victor R., & Co. 865
Morris Machine Works 754-759
- Dredging Machinery**
See Buckets; Cranes, Locomotive; Hoists; Derricks, etc.
- Dressing, Belt**
See Belting Accessories.
- Drill Presses**
See Presses, Drill.
- Drill Sharpeners**
See Sharpening Machines, Drill.
- Drilling and Boring Machines**
Keystone Driller Co. 31
Pawling & Harnischfeger Co. 46
- Drills, Core**
Sullivan Machinery Co. 34-35
- Drills, Electric**
Chicago Pneumatic Tool Co. 32-33
General Electric Co. 1050-1084
Fort Wayne 1050-1084
Little Giant 32-33
- Drills, Feather and Plug**
Chicago Pneumatic Tool Co. 32-33
- Drills, Hammer, Rotating**
Chicago Pneumatic Tool Co. 32-33
General Electric Co. 1050-1084
Ingersoll-Rand Co. 781-783
Sullivan Machinery Co. 34-35
Hummer 32-33
Jackhammer 781-783
Sergeant 781-783
- Drills, Hand**
Chicago Pneumatic Tool Co. 32-33
- Drills, Pneumatic**
Chicago Pneumatic Tool Co. 32-33
Ingersoll-Rand Co. 781-783
Walworth Mfg. Co. 425
Little David 781-783
Little Giant 32-33
- Drills, Rock**
Chicago Pneumatic Tool Co. 32-33
General Electric Co. 1050-1084
Ingersoll-Rand Co. 781-783
Sullivan Machinery Co. 34-35
Fort Wayne 1050-1084
Gatling 32-33
Jackhammer 781-783
Sergeant 781-783
Slogger 32-33
- Drinking Fountains**
See Fountains, Drinking.
- Drinking Water Cooling Systems, Factory**
See Water Cooling Systems, Industrial.
- Drives, Agitator**
New England Tank & Tower Co. 624
- Drives, Chain**
(See also Power Transmission Machinery)
Link-Belt Co. 56-57
Morse Chain Co. 864
- Drives, Gear**
(See also Gears)
Fawcus Machine Co. 851
Sturtevant, B. F., Co. 985-1003
- Drives, Rope Transmission**
Chicago Pulley & Shafting Co. 824-825
Dodge Sales and Engineering Co. 828-831
Hill Clutch Co. 832
- Drives, Rope Transmission—Continued.**
Medart Patent Pulley Co. 835
Roebbing's, John A., Sons Co. 88-89
Wood's, T. B., Sons Co. 840-841
- Drop Test Machines**
Whiting Foundry Equipment Co. 1150-1151
- Drums, Barking**
Walsh's Holyoke Steam Boiler Works 614-615
- Drums, Hoisting or Winding**
Flory, S., Mfg. Co. 42-43
Haiss, George, Mfg. Co., Inc. 61
Hayward Co. 66-69
Sprague Electric Works 1086-1087
Waterloo Construction Machinery Co. 101
Wellman-Seaver-Morgan Co. 928-929
- Drums, Steel**
Petroleum Iron Works Co. 605-607
Tippett & Wood 613
Presteel 605-607
- Drums, Steel Plate**
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- Dryers, Air, Steam Heated**
American Blower Co. 964-967
American Process Co. 1135
Atmospheric Conditioning Corp. 1006-1007
Bartlett, C. O., & Snow Co. 890
Bayley Mfg. Co. 963
Buckeye Dryer Co., Inc. 1137
Carrier Engineering Corp. 1008
Christie, L. R., Co. 1142
Fleisher, W. L., & Co., Inc. 1009
Gordon, Robert, Inc. 978
Ilg Electric Ventilating Co. 979-981
Massachusetts Blower Co. 982
Ruggles-Coles Engineering Co. 1148
Skinner Bros. Mfg. Co., Inc. 983
Sturtevant, B. F., Co. 985-1003
- Dryers, Blue Print**
American Drafting Furniture Co. 1
Paragon Machine Co. 4-5
Pease, C. F., Co. 6-7
- Dryers, Direct Heat**
American Process Co. 1135
Bartlett, C. O., & Snow Co. 890
Buckeye Dryer Co., Inc. 1137
Christie, L. R., Co. 1142
Ruggles-Coles Engineering Co. 1148
- Dryers, Indirect Heat**
American Process Co. 1135
Buckeye Dryer Co., Inc. 1137
Christie, L. R., Co. 1142
Ruggles-Coles Engineering Co. 1148
- Dryers, Rotary**
American Process Co. 1135
Bartlett, C. O., & Snow Co. 890
Bayley Mfg. Co. 963
Bonnot Co. 941
Buckeye Dryer Co., Inc. 1137
Buffalo Foundry & Machine Co. 1138-1141
Christie, L. R., Co. 1142
Devine, J. P., Co. 1144-1145
Farrar & Trefts, Inc. 602
Fleisher, W. L., & Co., Inc. 1009
Koven, L. O., & Brother 603
Ruggles-Coles Engineering Co. 1148
Stacey-Schmidt Mfg. Co. 1149
Struthers-Wells Co. 608-611
Tippett & Wood 613
Whiting Foundry Equipment Co. 1150-1151
Buftovak 1138-1141
- Dryers, Shelf**
Bayley Mfg. Co. 963
Fleisher, W. L., & Co., Inc. 1009
- Dryers, Spray**
Fleisher, W. L., & Co., Inc. 1009
- Dryers, Tunnel**
See Dryers, Rotary.

Dryers, Vacuum—Drum, Rotary and Shelf

Buffalo Foundry & Machine Co. 1138-1141
Devine, J. P., Co. 1144-1145
Buřlovak 1138-1141

Duct Work, Galvanized

See Pipe, Heating and Ventilating.

Dumbwaiters

Kaestner & Hecht Co. 933
Payne, F. S., Co. 934
K & H 933

Dumpers, Car

Wellman-Seaver-Morgan Co. 928-929

Dust Collectors

See Collectors, Dust.

Dynamite

Atlas Powder Co. 36-37
Du Pont de Nemours, E. I., & Co., Inc. 40
Hercules Powder Co. 38-39
Coalite 36-37
Red Cross Extra 40
Vigorelle 36-37

Dynamometers

Sprague Electric Works. 1086-1087

Dynamos

See Generators, A. C. and D. C.

E

Eaves Trough

Stark Rolling Mill Co. 282
Toncan Metal 282

Economizers, Fuel

See Fuel Economizers.

Efficiency Devices, Punch Press

See Safety Devices, Punch Press

Eggs, Acid

Buffalo Foundry & Machine Co. 1138-1141
Devine, J. P., Co. 1144-1145

Ejectors, Ash, Locomotive or Marine

(See also Conveyors, Ash)

American Steam Conveyor Corp. 889

Ejectors, Sewage

Blackburn-Smith Corp. 799
Chicago Pump Co. 729
Dayton-Dowd Co. 733
Economy Pumping Machinery Co. 736
Yeomans Brothers Co. 778-779
Shone 778-779

Ejectors, Steam

Chaplin-Fulton Mfg. Co. 524
Lunkenheimer Co. 470-475
Morris Machine Works. 754-759
Fulton 524

Electric Appliances, Household

Western Electric Co. 1119

Electric Locomotives

See Locomotives, Electric.

Elevating and Conveying Machinery

(See also Elevators; Conveyors)

Alvey Mfg. Co. 887
Alvey-Ferguson Co., Inc. 888
Barber-Foster Engineering Co. 883
Bartlett, C. O., & Snow Co. 890
Brown Portable Conveying Machinery Co. 892
Columbus Conveyor Co. 893
Dow Wire and Iron Works. 894
Gifford-Wood Co. 895
Guarantee Construction Co. 898-899
Haiss, George, Mfg. Co., Inc. 901
Haslett Spiral Chute Co. 902
Heyl & Patterson, Inc. 904-905
Hunt, C. W., Co., Inc. 118-120
Jeffrey Mfg. Co. 906-909
Jones, W. A., Foundry & Machine Co. 854-855

Elevating and Conveying Machinery—Continued.

Lamson Co. 910-911
Link-Belt Co. 56-57
Love Brothers, Inc. 604
Lowerator Co., Inc. 903
Mathews Gravity Carrier Co. 914-917
National Conveying Equipment Corp. 918-919
Olson, Samuel, & Co. 920
Perrine Store Service Co. 921
Portable Machinery Co., Inc. 922
Pyott, Geo. W., Co. 836-837
Revolator Co. 935
Robins Conveying Belt Co. 923
Specialty Engineering Co. 926-927
Sprague Electric Works. 1086-1087
Standard Conveyor Co. 930
Sturtevant Mill Co. 945-947
Wellman-Seaver-Morgan Co. 928-929
A F 888
Amco 887
American 883

Elevators, Ash

See Hoists, Ash.

Elevators, Automatic, Inclined or Vertical

Alvey Mfg. Co. 887
Alvey-Ferguson Co., Inc. 888
Bartlett, C. O., & Snow Co. 890
Brown Portable Conveying Machinery Co. 892
Dow Wire and Iron Works. 894
Haslett Spiral Chute Co. 902
Lamson Co. 910-911
Lowerator Co., Inc. 903
Mathews Gravity Carrier Co. 914-917
Olson, Samuel, & Co. 920
Pyott, Geo. W., Co. 836-837
Standard Conveyor Co. 930
A F 888
Amco 887

Elevators, Automatic, Push Button

Graves Elevator Co., Inc. 932
Kaestner & Hecht Co. 933
K & H 933

Elevators, Bucket

Bartlett, C. O., & Snow Co. 890
Columbus Conveyor Co. 893
Gifford-Wood Co. 895
Haiss, George, Mfg. Co., Inc. 901
Jeffrey Mfg. Co. 906-909
Jones, W. A., Foundry & Machine Co. 854-855
Link-Belt Co. 56-57
National Conveying Equipment Corp. 918-919
Olson, Samuel, & Co. 920
Sturtevant Mill Co. 945-947

Elevators, Compressed Air

Whiting Foundry Equipment Co. 1150-1151

Elevators, Contractors

(See also Hoists, Contractors)

Novo Engine Co. 60
Sasgen Derrick Co. 76-77

Elevators, Electric

Ernst, Chas. K., Specialty Co. 931
Graves Elevator Co., Inc. 932
Kaestner & Hecht Co. 933
Payne, F. S., Co. 934
Smith Elevator Co., Inc. 936
K & H 933

Elevators, Hand

Kaestner & Hecht Co. 933
Lamson Co. 910-911
K & H 933

Elevators, Hydraulic

Kaestner & Hecht Co. 933
Payne, F. S., Co. 934
Whiting Foundry Equipment Co. 1150-1151
K & H 933

Elevators, Portable

See Conveyors, Portable.

Elevators, Sidewalk

Ernst, Chas. K., Specialty Co. 931

Elevators, Tray

See Elevators, Automatic, Inclined or Vertical.

Enamel, Concrete Floor

See Paint—Brick, Cement, Concrete, Plaster, Stone.

Enamels, Bituminous

Wails Dove—Hermiston Corp. 228

Enamels—Decorative, Machinery, Piping, Laboratory, etc.

Biggler, E. N., Mfg. Co. 276
Billings-Chapin Co. 198
Cheesman-Elliott Co. 200-201
Detroit Graphite Co. 202-203
Du Pont de Nemours, E. I., & Co., Inc. 204-205
Goheen Corp. 207
Hampden Paint & Chemical Co. 208
Lowe Brothers Co. 211
Sherwin-Williams Co. 216-217
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Tropical Paint & Oil Co. 222-223
Truscon Laboratories. 224-225
B & P 222-223
Ce-Co. 200-201
Degraço Lile. 202-203
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Keep White. 200-201
Specifications. 224-225

Enclosures, Steel Panel

See Partitions, Metal.

Enclosures, Wire, Stock and Tool Room

See Partitions, Wire; Fencing, Wire or Woven Wire.

Engine and Boiler Trimmings

See Specific Headings.

Engineers, Consulting

Including—Mechanical, Civil, Hydraulic, Chemical, Electrical
Hunt, Robert W., & Co. 18

Engineers, Heating and Ventilating

See Heating and Ventilating Apparatus; Heating Systems.

Engineers, Illuminating

Edison Lamp Works. 1085
Westinghouse Lamp Co. 1120

Engineers, Inspection and Testing

Hunt, Robert W., & Co. 18

Engineers, Structural Steel

See Structural Steel or Iron Work.

Engineers, Timber Treatment

Carbolineum Wood Preserving Co. 233

Engineers or Contractors, Building

See Contractors, General.

Engineers or Contractors, Chimney Construction

See Chimneys.

Engineers or Contractors, Concrete Construction

Barton Spider-Web System. 12-13
Concrete Engineering Co. 170
Concrete Reinforcing and Engineering Co. 171
Concrete Steel Co. 168-169
Ferguson, H. K., Co. 22-23
Foundation Co. 14
Guarantee Construction Co. 15
Industrial Engineering Co. 16-17
Kalman, Paul J., Co. 180
North Western Expanded Metal Co. 181-183
Raymond Concrete Pile Co. 130-131
Rust Engineering Co. 19
Turner Construction Co. 20

- Engineers or Contractors, Concrete Construction—Continued.**
 Waterproofing Co. 229
 Withrow Steel Co. 187
- Engineers or Contractors, Foundation**
 Foundation Co. 14
 MacArthur Concrete Pile & Foundation Co. 129
 Raymond Concrete Pile Co. 130-131
 Rust Engineering Co. 19
 Smith & Brennan Pile Co. 134
- Engineers or Contractors, Power Plant**
 Ferguson, H. K., Co. 22-23
 Foundation Co. 14
 Gordon, Robert, Inc. 978
 Guarantee Construction Co. 15
 Rust Engineering Co. 19
 Turner Construction Co. 20
- Engineers or Contractors, Sewage Disposal**
 Aten Sewage Disposal Co. 126
 New York Sewage Disposal Co. 127
- Engineers or Contractors—Suspension Bridges, Tramways, Cableways, etc.**
 Roebling's, John A., Sons Co. 88-89
- Engineers or Contractors, Temperature Control**
 See Regulators, Temperature.
- Engineers or Contractors, Water Purification**
 See Filters, Water, Gravity or Pressure.
- Engineers or Contractors, Water Supply Systems**
 Layne & Bowler Co. 744-747
 New York Sewage Disposal Co. 127
- Engineers or Contractors, Water Works**
 See Water Supply Systems; Pumps.
- Engineers or Contractors, Waterproofing and Dampproofing**
 (See also Waterproofing)
 Anti-Hydro Waterproofing Co. 197
 General Fireproofing Co. 206
 Hydrolithic Waterproofing Co., Inc. 210
 Permanent Ironite Waterproofing Co. 215
 Waterproofing Co. 229
 Waterproofing Co. of America. 230
- Engines, Corliss**
 See Engines, Steam, Stationary; Engines, Steam, Compound.
- Engines, Diesel**
 National Transit Pump & Machine Co. 760-762
 Nordberg Mfg. Co. 704-705
- Engines, Fire, Portable**
 Foamite Firefoam Co. 1046
- Engines, Gas or Oil**
 See Engines, Internal Combustion.
- Engines, Hoisting**
 See Hoists.
- Engines, Internal Combustion**
 Allis-Chalmers Mfg. Co. 1114-1115
 Baltimore Cooperage Co. 616
 Chicago Pneumatic Tool Co. 784-785
 Fairbanks, Morse & Co. 699
 Foos Gas Engine Co. 700
 Hooven, Owens, Rentschler Co. 701
 Muncie Oil Engine Co. 703
 National Transit Pump & Machine Co. 760-762
 Nordberg Mfg. Co. 704-705
 Novo Engine Co. 764-765
 Pittsburgh Filter & Engineering Co. 710
 Standard Scale & Supply Co. 940
 Sterling Engine Co. 708-709
 Worthington Pump and Machinery Corp. 772-777
 Brons Hvid. 710
 Hamilton. 701
 Ingeco. 772-777
 Snow. 772-777
- Engines, Semi-Diesel**
 Chicago Pneumatic Tool Co. 784-785
 Muncie Oil Engine Co. 703
 Giant. 784-785
- Engines, Steam, Automatic or Throttling**
 American Blower Co. 964-967
 Automatic Furnace Co. 664-665
 Badenhause Co. 697
 Bayley Mfg. Co. 963
 Brownell Co. 643
 Chandler & Taylor Co. 698
 Clarage Fan Co. 974-975
 Houston, Stanwood & Gamble Co. 702
 Leffel, James, & Co. 713
 Morris Machine Works. 754-759
 Sturtevant, B. F., Co. 985-1003
 Troy Engine & Machine Co. 711
 ABC. 964-967
 Model Acme. 664-665
- Engines, Steam—Compound, Tandem or Cross**
 Badenhause Co. 697
 Chandler & Taylor Co. 698
 Erie City Iron Works. 646-647
 McGowan, John H., Co. 752-753
 Morris Machine Works. 754-759
 Nordberg Mfg. Co. 704-705
 Ridgway Dynamo & Engine Co. 706-707
 Vilter Mfg. Co. 1018-1019
- Engines, Steam, Marine**
 Badenhause Co. 697
 Hooven, Owens, Rentschler Co. 701
 Morris Machine Works. 754-759
 Hamilton. 701
- Engines, Steam, Poppet Valve**
 Erie City Iron Works. 646-647
 Hooven, Owens, Rentschler Co. 701
 Nordberg Mfg. Co. 704-705
 Vilter Mfg. Co. 1018-1019
 Hamilton. 701
 Lentz. 646-647
 Uniflow. 704-705
- Engines, Steam—Stationary, Horizontal or Vertical**
 Allis-Chalmers Mfg. Co. 1114-1115
 American Blower Co. 964-967
 Automatic Furnace Co. 664-665
 Badenhause Co. 697
 Bayley Mfg. Co. 963
 Brownell Co. 643
 Chandler & Taylor Co. 698
 Clarage Fan Co. 974-975
 Erie City Iron Works. 646-647
 Hooven, Owens, Rentschler Co. 701
 Houston, Stanwood & Gamble Co. 702
 Leffel, James, & Co. 713
 McGowan, John H., Co. 752-753
 Morris Machine Works. 754-759
 Nordberg Mfg. Co. 704-705
 Ridgway Dynamo & Engine Co. 706-707
 Sturtevant, B. F., Co. 985-1003
 Troy Engine & Machine Co. 711
 Vilter Mfg. Co. 1018-1019
 Worthington Pump and Machinery Corp. 772-777
 American-Ball. 697
 Hamilton. 701
 Lentz. 646-647
 Model Acme. 664-665
- Engines, Steam, Triple Expansion**
 Badenhause Co. 697
 McGowan, John H., Co. 752-753
 Morris Machine Works. 754-759
- Engines, Steam, Variable Speed**
 See Engines, Steam—Stationary, Horizontal or Vertical.
- Engines, Steering, Marine**
 Flory, S., Mfg. Co. 42-43
 Lidgerwood Mfg. Co. 59
- Erasers**
 Pease, C. F., Co. 6-7
 Sunbeam. 6-7
- Erectors Tools**
 Roebling's, John A., Sons Co. 88-89
- Evaporators**
 Blaw-Knox Co. 102-103
 Buffalo Foundry & Machine Co. 1138-1141
 Devine, J. P., Co. 1144-1145
 Duriron Castings Co. 1146
 Farrar & Trefts, Inc. 602
 Griscom-Russell Co. 789
 Ross Heater & Mfg. Co., Inc. 435
 Steacy-Schmidt Mfg. Co. 1149
 Struthers-Wells Co. 608-611
 Wheeler Condenser and Engineering Co. 787
 Whitlock Coil Pipe Co. 794-796
 Bufllovak. 1138-1141
 Lillie. 787
 Reilly. 789
- Excavators, Cableway**
 See Cableways and Accessories.
- Excavators, Derrick**
 See Cranes, Locomotive; Cranes, Auto; Excavators, Traction; Derricks.
- Excavators, Dragline**
 Brown Hoisting Machinery Co. 48-49
 Browning, Victor R., & Co. 865
 Hayward Co. 66-69
 Industrial Works. 54-55
 Link-Belt Co. 56-57
 Pawling & Harnischfeger Co. 46
 P & H. 46
- Excavators, Dragline, Cableway**
 Sauerman Bros. 44-45
- Excavators, Drainage or Trench**
 Byers, John F., Machine Co. 52-53
 Pawling & Harnischfeger Co. 46
 P & H. 46
- Excavators, Ladder**
 See Excavators, Drainage or Trench.
- Excavators, Pipe Line**
 See Excavators, Drainage or Trench.
- Excavators, Traction**
 (See also Cranes, Auto)
 Keystone Driller Co. 41
- Exciter Units, Turbo**
 Terry Steam Turbine Co. 715-717
- Exciters**
 General Electric Co. 1050-1084
- Exhaust Heads**
 American Spiral Pipe Works. 416-417
 Burt Mfg. Co. 304-305
 Kieley & Mueller, Inc. 529
 Koven, L. O., & Brother. 603
 Ohio Body and Blower Co. 314-317
 Pittsburgh Valve, Foundry & Construction Co. 484-486
 Sturtevant, B. F., Co. 985-1003
 Wright-Austin Co. 550-552
 Cyclone. 550-552
 Swartwout. 314-317
- Exhausters**
 See Fans, Ventilating or Exhaust; Blowers, Pressure.
- Expanded Metal**
 See Concrete Reinforcement, Expanded Metal or Sheet Metal Mesh; Metal Lath, Expanded.
- Expanders, Gas**
 Worthington Pump and Machinery Corp. 772-777
- Expansion Bolts**
 See Bolts, Expansion.
- Expansion Joint Cement**
 See Cement, Expansion Joint.
- Expansion Joints**
 See Joints, Expansion, Pipe.

Explosives

Atlas Powder Co.	36-37
Du Pont de Nemours, E. I., & Co., Inc.	40
Hercules Powder Co.	38-39

Extinguishers, Fire

Foamite Firefoam Co.	1046
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Extractors, Chemical

Devinc, J. P., Co.	1144-1145
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Extractors, Gasoline

Chicago Pneumatic Tool Co.	784-785
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Extractors, Grease and Oil

American Steam Gauge & Valve Mfg. Co.	553-557
Bartlett, C. O., & Snow Co.	890
Blackburn-Smith Corp.	799
Boylston Steam Specialty Co.	512-513
Griscom-Russell Co.	789
Kieley & Mueller, Inc.	529

Extractors, Tar

Flinn & Dreffien Co.	950
Smith Gas Engineering Co.	954-955
Struthers-Wells Co.	608-611

F**Fabricated Steel**

See Structural Steel or Iron Work.

Facings—Brake, Clutch, Disk or Block

Cork Insert Co.	827
Russell Mfg. Co.	861
Rusco.	861

Fans, Ceiling, Wall, Desk or Bracket

Newark Cornice & Skylight Works.	313
Western Electric Co.	1119

Fans, Ventilating or Exhaust

(See also Blowers, Pressure)	
American Blower Co.	964-967
Bayley Mfg. Co.	963
Buckeye Blower Co.	968-969
Buffalo Forge Co.	970-971
Carling Turbine Blower Co.	972-973
Clavage Fan Co.	974-975
Coppus Engineering & Equipment Co.	976
General Electric Co.	1050-1084
Green Fuel Economizer Co.	687
Hersh & Brother.	1012
Ilg Electric Ventilating Co.	979-981
Massachusetts Blower Co.	982
Newark Cornice & Skylight Works.	313
Raymond Bros. Impact Pulverizer Co.	943
Skinner Bros. Mfg. Co., Inc.	983
Sprague Electric Works.	1086-1087
Sturtevant, B. F., Co.	985-1003
Wing, L. J., Mfg. Co.	1004
Bi-cal-ky.	1012
Four-Leaf Clover.	313
Massachusetts-Davidson.	982
Plexiform.	963
Scruplex.	1004
Sirocco.	964-967
Ventura.	964-967
Specifications.	985-1003

Fans, Ventilating or Exhaust, Acid Resistant

Duriron Castings Co.	1146
Sturtevant, B. F., Co.	985-1003

Fasteners, Belt

(See also Lacing, Belt, Leather)	
Bristol Co.	862
Crescent Belt Fastener Co.	863
Main Belting Co.	858-859

Fasteners and Adjusters, Casement or Sash

Payson Mfg. Co.	358-361
Signal.	358-361

Faucets

See Cocks and Bibbs.

Feed Water Grease Extractors

See Extractors, Grease and Oil; Filters, Feed Water.

Feed Water Heaters

See Heaters, Feed Water.

Feeder Regulators

See Regulators, Voltage.

Feeders, Chemical, Venturi

See Regulators, Chemical Feed, Venturi.

Feeders, Coal

Bartlett, C. O., & Snow Co.	890
Columbus Conveyor Co.	893
Gifford-Wood Co.	895
Robins Conveying Belt Co.	923
Specialty Engineering Co.	926-927

Feeders, Water

See Regulators, Feed Water.

Felt, Insulating and Sheathing

Lehon Co.	280
Standard Paint Co.	218-219
Union Fibre Co., Inc.	1030
Linofelt.	1030
Ru-ber-oid.	218-219
S P C.	218-219

Fencing, Iron

American Fence Construction Co.	375-377
Anchor Post Iron Works.	380-384
Brook, A. T., Iron Works.	385
Cyclone Fence Co.	386-388
Fiske, J. W., Iron Works.	389
Page Steel and Wire Co.	390-392
Afcco.	375-377

Fencing, Non-climbable

American Fence Construction Co.	375-377
American Steel & Wire Co.	378-379
Anchor Post Iron Works.	380-384
Brook, A. T., Iron Works.	385
Cyclone Fence Co.	386-388
Page Steel and Wire Co.	390-392
Afcco.	375-377

Fencing, Wire or Woven Wire

American Fence Construction Co.	375-377
American Steel & Wire Co.	378-379
Anchor Post Iron Works.	380-384
Brook, A. T., Iron Works.	385
Cyclone Fence Co.	386-388
Fiske, J. W., Iron Works.	389
Page Steel and Wire Co.	390-392
Wisconsin Iron & Wire Works.	374
Youngstown Sheet & Tube Co.	406-407
Afcco.	375-377
Buckeye.	406-407

Fertilizer Apparatus

Devine, J. P., Co.	1144-1145
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Field Glasses

Gurley, W. & L. E.	10-11
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Filing Equipment, Drafting Room

American Drafting Furniture Co.	1
Economy Drawing Table & Mfg. Co.	2
Hamilton Mfg. Co.	3
Pease, C. F., Co.	6-7

Filing Equipment, Metal

Federal Steel Fixture Co.	1162-1163
Lyon Metallic Mfg. Co.	1166-1167

Fillers, Barrel

Pennsylvania Flexible Metallic Tubing Co.	592
Penflex.	592

Fillers, Paving, Asphaltic

Standard Asphalt & Refining Co.	255
Standard Oil Co.	256-257
Sarco.	255
Stanolin.	256-257

Filling Station Equipment

Including:—Pumps, Tanks, Hose, Nozzles, Filters, Gages, Fill Pipe, Valves, Filler Boxes, etc.
Bowser, S. F., & Co., Inc. 596-597

Filling Station Equipment—Continued.

Wayne Oil Tank & Pump Co.	598-599
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Filtering Materials

Including:—Sand, Quartz, Alum, Powder, etc.

Celite Products Co.	1023
Graver Corp.	802
International Filter Co.	804
Filter-Cel.	1023

Filtering and Circulating Systems, Lubricating Oil

Bowser, S. F., & Co., Inc.	596-597
Burt Mfg. Co.	593-595
Wayne Oil Tank & Pump Co.	598-599

Filters, Bag

Buffalo Foundry & Machine Co.	1138-1141
Steady-Schmidt Mfg. Co.	612

Filters, Charcoal

Norwood Engineering Co.	806
Scaife, Wm. B., & Sons Co.	813

Filters, Chemical

Blaw-Knox Co.	102-103
Buffalo Foundry & Machine Co.	1138-1141
Graver Corp.	622
Buflowak.	1138-1141

Filters, Feed Water—Grease, Oil, etc.

American Steam Gauge & Valve Mfg. Co.	553-557
Blackburn-Smith Corp.	799
Griscom-Russell Co.	789
International Filter Co.	804
Multiscreen.	789

Filters, Oil

Burt Mfg. Co.	593-595
Wayne Oil Tank & Pump Co.	598-599
American.	593-595
Cross.	593-595
Gary.	593-595
Warden.	593-595

Filters, Swimming Pool

See Filters, Water, Gravity or Pressure.

Filters, Water, Gravity or Pressure

American Water Softener Co.	797
Booth, L. M., Co.	800
Graver Corp.	802
International Filter Co.	804
Jewell Polar Co.	805
Koven, L. O., & Brother.	603
Norwood Engineering Co.	806
Permutit Co.	808-809
Pittsburgh Filter & Engineering Co.	807
Refinite Co.	812
Roberts Filter Mfg. Co.	810-811
Scaife, Wm. B., & Sons Co.	813

Filtration Plants, Water

See Filters, Water, Gravity or Pressure.

Finishes, Wood

See Paint; Enamels; Varnishes.

Fire Brick Linings

See Linings, Furnace; Brick, Fire.

Fire Clay

See Clay, Fire.

Fire Escapes

Johnson, Geo W., Mfg. Co.	324
Wisconsin Iron & Wire Works.	374

Fire Escapes, Spiral

Olson, Samuel, & Co.	920
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Fire Protection Systems

Foamite Firefoam Co.	1046
Globe Automatic Sprinkler Co.	1047

Fire Wall Sleeves

See Sleeves, Fire Wall.

Fittings, Hose

McNab & Harlin Mfg. Co.	476-481
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Fittings, Pipe, Acid Resistant
Duriron Castings Co. 1146

Fittings, Pipe, Ammonia
Arctic Ice Machine Co. 1013
Carbondale Machine Co. 1015
Continental Machinery Co. 1016
Vogt, Henry, Machine Co. 1017
York Mfg. Co. 1020

Fittings, Pipe, Brass or Bronze
Atlas Valve Co. 507-509
Crane Co. 440-441
Kelly & Jones Co. 450-459
Lunkenheimer Co. 470-475
Simmons, John, Co. 404
Williams, D. T., Valve Co. 496-498

Fittings, Pipe—Cast Iron, Malleable Iron, Cast Steel, Screwed or Flanged
Banner Iron Works. 124-125
Clow, James B., & Sons. 408-409
Crane Co. 440-441
Josam Mfg. Co. 1044-1045
Kellogg, M. W., Co. 420-421
Kelly & Jones Co. 450-459
Lunkenheimer Co. 470-475
McNab & Harlin Mfg. Co. 476-481
Morris Machine Works. 754-759
National Valve & Mfg. Co. 422
Peerless Iron Pipe Exchange, Inc. 403
Pittsburgh Piping and Equipment Co. 423
Simmons, John, Co. 404
Simmons Pipe Bending Works. 405
United States Cast Iron Pipe and Foundry Co. 410-412
Walworth Mfg. Co. 425
Williams, D. T., Valve Co. 496-498
Kewanee. 425
Walmanco. 425

Fittings, Pipe, Drainage
Crane Co. 440-441
McNab & Harlin Mfg. Co. 476-481

Fittings, Pipe, Hydraulic
McNab & Harlin Mfg. Co. 476-481
Metalwood Mfg. Co. 1129
Pittsburgh Valve, Foundry & Construction Co. 484-486
Simmons, John, Co. 404

Fittings, Pipe, Steel, Forged
American Spiral Pipe Works. 416-417
Crane Co. 440-441
Metalwood Mfg. Co. 1129
Simmons, John, Co. 404

Fittings, Pipe, Steel, Welded
Kellogg, M. W., Co. 420-421
Standard Spiral Pipe Works. 418-419

Fittings, Pipe, Steel Plate
American Spiral Pipe Works. 416-417
East Jersey Pipe Co. 413-415
Standard Spiral Pipe Works. 418-419

Fittings, Pipe, Wood
Michigan Pipe Co. 398
Standard Wood Pipe Co. 399
Wyckoff, A., & Son Co. 400-401

Fittings, Wire Rope
See Rope Fittings, Wire.

Fittings, Wood Pipe, Cast Iron
See Fittings, Pipe, Wood; Fittings, Pipe—Cast Iron, etc.

Flagging, Slate
Monson Maine Slate Co. 1125

Flagpoles, Metal
Brook, A. T., Iron Works. 385

Flagstaffs, Surveyors
Gurley, W. & L. E. 10-11

Flakers, Caustic
Buffalo Foundry & Machine Co. 1138-1141

Flanges, Pipe
See Fittings, Pipe.

Flashings, Roof
See Roof Trimmings.

Flat Slab Construction
See Floor Construction Systems, Reinforced Concrete, Girderless.

Floats, Seamless
Reliance Gauge Column Co. 543

Flood Lighting Projectors
See Projectors, Flood Lighting.

Floor Construction Systems, Hollow Tile
National Fire Proofing Co. 148-149
Natcoflor. 148-149

Floor Construction Systems, Hollow Tile and Reinforced Concrete, Combination
National Fire Proofing Co. 148-149
Natco. 148-149

Floor Construction Systems, Reinforced Concrete
Composite Metal Lath Co. 166-167
Concrete Engineering Co. 170
Concrete Reinforcing and Engineering Co. 171
Corrugated Bar Co. 173
General Fireproofing Co. 174-176
Brikloth. 166-167
Corr Plate. 173

Floor Construction Systems, Reinforced Concrete, Girderless
Barton Spider-Web System. 12-13
Corrugated Bar Co. 173
Corr-Plate. 173

Floor Construction Systems, Reinforced Gypsum
Robertson, H. H., Co. 277-279
United States Gypsum Co. 283-285

Floor Construction Systems, Steel Joist
(See also Lumber, Pressed Steel)
Berger Mfg. Co. 164
National Pressed Steel Co. 178-179

Floor Lights
See Lights, Vault and Sidewalk.

Floor Stands, Shaft
See Stands, Floor, Shaft.

Flooring, Asphalt, Block
Hastings Pavement Co. 241

Flooring, Asphalt, Mastic
Biegler, E. N., Mfg. Co. 237
General Kompolite Co. 240
Johns-Manville, H. W., Co. 1024-1025
Lehon Co. 280
Special Service Flooring Corp. 254
Standard Asphalt & Refining Co. 255
Thomas Moulding Brick Co. 258
Mas-Oleum. 237
Mastolith. 240
Mule-Hide. 280
Sarco. 255
T-M-B. 258
Specifications. 255; 258

Flooring, Asphalt, Sheet
(See also Pavements)
Special Service Flooring Corp. 254

Flooring, Brick
Hocking Valley Fire Clay Co. 141
Kushequa Brick Co. 144-145
National Paving Brick Manufacturers Association. 248-249

Flooring, Cement, Plain and Colored
Special Service Flooring Corp. 254

Flooring, Composition, Cork
Marbleloid Co. 246-247
Tredlite. 246-247

Flooring, Composition, Magnesite
American Mason Safety Tread Co. 266-268
Biegler, E. N., Mfg. Co. 237
Cheney & Co., Inc. 239
General Kompolite Co. 240
Imperial Floor Co., Inc. 244
Marbleloid Co. 246-247
Special Service Flooring Corp. 254
Almada. 237
Karbolith. 266-268
Kompolite. 240
Troegerlith. 239

Flooring, Glass
See Glass Concrete Construction.

Flooring, Long Leaf Pine
Great Southern Lumber Co. 154-155
Bogalusa. 154-155

Flooring, Non-slip
Special Service Flooring Corp. 254
Solry. 254

Flooring, Oak
American Hardwood Manufacturers Ass'n. 152-153
Long-Bell Lumber Co. 156-157

Flooring—Pine, Spruce, Fir, etc.
Brown Co. 236
Long-Bell Lumber Co. 156-157

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Flooring, Soapstone
Alberene Stone Co. 1134

Flooring, Wood Block, Built-up
Carter Bloxonend Flooring Co. 238
Bloxonend. 238

Flooring, Wood Block, Creosoted
Carter Bloxonend Flooring Co. 238
Jennison-Wright Co. 245
Long-Bell Lumber Co. 156-157
Ohio Wood Preserving Co. 250
Republic Creosoting Co. 251
Southern Wood Preserving Co. 252-253
Bloxonend. 238
Century. 250
Creolignum. 252-253
Kreodone. 251
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Flooring, Wood Block, Untreated
Carter Bloxonend Flooring Co. 238
Wilson, J. G., Corp. 334-339
Bloxonend. 238

Flour Blenders
See Blenders, Flour.

Flour Mill Machinery
Allis-Chalmers Mfg. Co. 1114-1115

Flue Gas Analyzers
See Analyzers, Flue Gas.

Flues, Boiler
See Boilers; Steel Plate Construction.

Flues, Chimney
See Chimneys; Steel Plate Construction.

Flues, Gas or Smoke
See Steel Plate Construction.

Flues, Smoke, Cast Iron
United States Cast Iron Pipe and Foundry Co. 410-412

Flues, Soapstone
Alberene Stone Co. 1134

Flumes
(See also Steel Plate Construction)
Blaw-Knox Co. 102-103
Dover Boiler Works. 600-601

Flumes—Continued.

Penn Metal Co.	325
Petroleum Iron Works Co.	605-607
Struthers-Wells Co.	608-611
Tippett & Wood	613
Walsh's Holyoke Steam Boiler Works	614-615

Flux, Asphalt

Standard Oil Co.	256-257
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Flywheels

Dodge Sales and Engineering Co.	828-831
Hill Clutch Co.	832
Wood's, T. B., Sons Co.	840-841

Food Preparation and Serving Equipment

Van, John, Range Co.	1171
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Forge Blowers

See Blowers, Pressure.

Forges

Buffalo Forge Co.	970-971
Sturtevant, B. F., Co.	985-1003

Forging Furnaces

See Furnaces, Heat Treating.

Forgings

Farrar & Trefts, Inc.	602
Standard Spiral Pipe Works	418-419
Struthers-Wells Co.	608-611

Form Ties

See Ties, Form.

Forms, Metal Concrete—Beam Floor Construction

Berger Mfg. Co.	164
Concrete Engineering Co.	170
General Fireproofing Co.	174-176
Truscon Steel Co.	184-186
Witherow Steel Co.	187
Berloy	164
Floredomes	184-186
Florestyles	184-186
GF End-Tile	174-176
GF Steel-Tile	174-176
Meyer	170
Wisconsin	187

Forms, Metal Concrete—General Concrete Construction

Blaw-Knox Co.	102-103
Concrete Engineering Co.	170
Hydraulic Steelcraft Co.	26-27
Metal Forms Corp.	104-105
Metaform	104-105
Meyer	170

Forms, Steel—Curb, Sidewalk, Road

Blaw-Knox Co.	102-103
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Forms and Reinforcing, Septic Tank

Aten Sewage Disposal Co.	126
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Foundation Engineers or Contractors

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Foundations, Chimney

(See also Chimneys)

American Chimney Construction Co.	632
American Chimney Corp.	633
Custodis, Alphons, Chimney Construction Co.	634
Heinicke, H. R., Inc.	638
Rust Engineering Co.	639

Foundations, Tank

(See also Tanks; Water Towers and Tanks)

Caldwell, W. E., Co., Inc.	618
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Founders

See Castings; Ornamental Metal Work.

Fountains, Drinking, Sanitary

Central Brass Mfg. Co.	1038
Clow, James B., & Sons	408-409
Glauber Brass Mfg. Co.	1040-1043
Practico	1040-1043
Practico	1040-1043
Quickool	1038

Frames and Covers, Manhole

See Covers, Frames and Plates—Manhole, Trench, Sump, Pit.

Frequency Changers

Allis-Chalmers Mfg. Co.	1114-1115
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Frequency Recorders

Bristol Co.	558-559
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Friction Clutches

See Clutches, Friction.

Frogs, Railway

See Track, Industrial.

Fronts, Boiler

See Boiler Fronts.

Frostproofing, Pipe

(See also Coverings, Pipe)

Kalamazoo Tank & Silo Co.	623
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Fuel Economizers

Green Fuel Economizer Co.	687
Sturtevant, B. F., Co.	985-1003

Fuel Oil Plants

Anthony Co.	957
Hammel Oil Burning Equipment Co., Inc.	958
Hart, B. Franklin, Jr., & Co.	803
Wayne Oil Tank & Pump Co.	598-599

Fume Hoods

See Hoods, Lavatory, Fume or Vapor.

Furnace Blocks

See Blocks, Furnace.

Furnace Cement

See Cement, Refractory.

Furnace Equipment, Arc

General Electric Co.	1050-1084
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Furnace Equipment, Water Cooled

Including:—Doors and Frames, Floors, Posts, Reversing Valves, Shields, Skewbacks, Bulkheads, etc.

Blaw-Knox Co.	102-103
Love Brothers, Inc.	604

Furnaces, Brick

American Chimney Construction Co.	632
Custodis, Alphons, Chimney Construction Co.	634
Heinicke, H. R., Inc.	638
Rust Engineering Co.	19

Furnaces, Corrugated

American Spiral Pipe Works	416-417
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Furnaces, Down-draft

See Boilers, Heating, Steam and Hot Water.

Furnaces, Drill Steel

Sullivan Machinery Co.	34-35
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Furnaces, Heat Treating

Including:—Annealing, Hardening, Tempering, Forging.

American Gas Furnace Co.	960-961
Anthony Co.	957
Hammel Oil Burning Equipment Co., Inc.	958
Koven, L. O., & Brother	603
Wayne Oil Tank & Pump Co.	598-599
Whiting Foundry Equipment Co.	1150-1151

Furnaces, Heat Treating, Electric

General Electric Co.	1050-1084
Hoskins Mfg. Co.	959

Furnaces, Lead Melting

Stuebner, G. L.	73
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Furnaces, Melting, Electric

Including:—Brass, Aluminum, Lead, Paraffin, etc.

General Electric Co.	1050-1084
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Furnaces, Metal Melting—Brass or Malleable Iron, etc.

Anthony Co.	957
Love Brothers, Inc.	604
Wayne Oil & Pump Co.	598-599
Whiting Foundry Equipment Co.	1150-1151

Furnaces, Metallurgical

See Furnaces, Metal Melting.

Furnaces, Muffle, Electrical

General Electric Co.	1050-1084
Hoskins Mfg. Co.	959

Furnaces, Oil Burning

American Gas Furnace Co.	960-961
Anthony Co.	957
Hammel Oil Burning Equipment Co., Inc.	958
Wayne Oil Tank & Pump Co.	598-599

Furnaces, Open Hearth and Continuous Heat

Wellman-Seaver-Morgan Co.	928-929
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Furnaces, Smokeless

(See also Stokers)

Automatic Furnace Co.	664-665
Model	664-665

Furnaces, Soldering Iron, Electric

General Electric Co.	1050-1084
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Furnaces, Tar Melting

Eureka Machine Co.	1170
Koven, L. O., & Brother	603
Stuebner, G. L.	73

Furniture, Drafting Room

American Drafting Furniture Co.	1
Economy Drawing Table & Mfg. Co.	2
Hamilton Mfg. Co.	3
Pease, C. F., Co.	6-7

Furniture, Hospital

Federal Steel Fixture Co.	1162-1163
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Furniture, Metal

Federal Steel Fixture Co.	1162-1163
Lyon Metallic Mfg. Co.	1166-1167

Furniture, School and College

See Furniture, Drafting Room

Furniture, Restaurant

Van, John, Range Co.	1171
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Furring, Hollow Tile

See Tile, Hollow, Clay or Terra Cotta.

Furring, Metal

Concrete Engineering Co.	170
Consolidated Expanded Metal Companies	172
General Fireproofing Co.	174-176
Youngstown Pressed Steel Co.	188-189
Ceco	170

Fuses, Blasting

(See also Blasting Supplies)

Du Pont de Nemours, E. I., & Co., Inc.	40
Hercules Powder Co.	38-39

Fuses, Electric—Cartridge, Plug or Link

Economy Fuse & Mfg. Co.	1123
Federal Electric Co.	1124
General Electric Co.	1050-1084
Johns-Manville, H. W., Co.	1024-1025
Noark	1024-1025

Fuses, Electric, Indicating

Economy Fuse & Mfg. Co.	1123
Arkless	1123

Fuses, Electric, Renewable Cartridge

Economy Fuse & Mfg. Co.	1123
Federal Electric Co.	1124
General Electric Co.	1050-1084
Johns-Manville, H. W., Co.	1024-1025
National	1124
Noark	1024-1025

Fusible Plugs

See Plugs, Fusible.

Fusion Kettles

See Kettles, Chemical Process.

G

- Gage Boards**
 American Steam Gauge & Valve Mfg. Co.....553-557
 Ashton Valve Co.....510-511
 Foxboro Co., Inc.....560-561
 Schaeffer & Budenberg Mfg. Co.... 566
- Gage Cocks**
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- Gage Frames and Tablets**
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- Gage Glasses**
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 Durabla Mfg. Co..... 586
- Gage Testers**
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- Gages, Absolute Pressure**
 Taylor Instrument Companies...570-571
 Uehling Instrument Co..... 573
 Tycos570-571
- Gages, Air**
 See Gages, Pressure.
- Gages, Altitude**
 See Gages, Liquid Level.
- Gages, Differential**
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 Gages, Draft.
- Gages, Draft**
 Bristol Co.....558-559
 Brown Instrument Co..... 564
 Hammel Oil Burning Equipment Co., Inc..... 958
 Hoffman, Charles V., Co., Inc..... 691
 McDonough Automatic Regulator Co.532-533
 Precision Instrument Co.....562-563
 Schaeffer & Budenberg Mfg. Co.... 566
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 Uehling Instrument Co..... 573
 Ellison 683
 Redline 566
 Tycos570-571
- Gages, Fire Alarm**
 Ashton Valve Co.....510-511
- Gages, Gas**
 See Gages, Pressure.
- Gages, Hook**
 Gurley, W. & L. E.....10-11
- Gages, Liquid Level**
 Bristol Co.....558-559
 Builders Iron Foundry..... 577
 Foxboro Co., Inc.....560-561
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Worthington Pump and Machinery Corp.	772-777
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Strainers, Gasoline

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Glauber Brass Mfg. Co.	1040-1043
Kissel	1040-1043

Strainers, Oil

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Strainers, Pipe

Crane Co.	440-441
Kieley & Mueller, Inc.	529

Strainers, Suction

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Dunham, C. A., Co.	518-521
Haines, William S., & Co.	525
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Plant Engineering & Equipment Co., Inc.	542
United States Cast Iron Pipe and Foundry Co.	410-412
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Gordon, Robert, Inc.	978
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Pittsburgh-Des Moines Steel Co.	625
Scaife, Wm. B., & Sons, Co.	813
Struthers-Wells Co.	608-611
Tippett & Wood	613
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Walsh's Holyoke Steam Boiler Works	614-615
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Penn Metal Co.	325
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Allis-Chalmers Mfg. Co.	1114-1115
Buffalo Foundry & Machine Co.	1138-1141
Devine, J. P., Co.	1144-1145
Hooven, Owens, Rentschler Co.	701
Love Brothers, Inc.	604
Steady-Schmidt Mfg. Co.	1149
Hamilton	701

Sugar Plantation Equipment

Chicago Bridge & Iron Works	620
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Superheaters

Badenhausen Co.	641
Eureka Machine Co.	1170
Heine Safety Boiler Co.	645
Power Specialty Co.	688-689
Foster	688-689
Simplex	641

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Pease, C. F., Co.	6-7

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Swing Hammer Pulverizers

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Switch Stands

U. S. Wind Engine & Pump Co.	627
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Bristol Co.	558-559
General Electric Co.	1050-1084
Westinghouse Electric & Mfg. Co.	1048-1049

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Cutter, George, Co.	1116-1117
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Sprague Electric Works	1086-1087
Trumbull Electric Mfg. Co.	1110-1111
Western Electric Co.	1119
Westinghouse Electric & Mfg. Co.	1048-1049
Bull Dog	1112
Circle T	1110-1111

Switches, Battery, End Cell

Crouse-Hinds Co.	1109
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Switches, Electric

Including:—Snap, Pull, Pendent, Tumbler, Push Button.

General Electric Co.	1050-1084
Trumbull Electric Mfg. Co.	1110-1111

Switches, Electric, Externally Operated

General Electric Co.	1050-1084
Johns-Manville, H. W., Co.	1024-1025
Trumbull Electric Mfg. Co.	1110-1111
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Switches, Electric, Knife

Crouse-Hinds Co.	1109
General Electric Co.	1050-1084
Mutual Electric & Machine Co.	1112
Trumbull Electric Mfg. Co.	1110-1111
Bull Dog	1112

Switches, Motor Starting

Crouse-Hinds Co.	1109
General Electric Co.	1050-1084
Trumbull Electric Mfg. Co.	1110-1111

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 United States Cast Iron Pipe and Foundry Co. 410-412

Tanks, Chemical

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 Blaw-Knox Co. 102-103

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 Corcoran, A. J., Inc. 621
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 Petroleum Iron Works Co. 605-607
 Struthers-Wells Co. 608-611
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 Simmons, John, Co. 404

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 Buffalo Foundry & Machine Co. 1138-1141
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 Farrar & Trefts, Inc. 602
 International Engineering Works, Inc. 648-649
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Tanks, Steel

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Screw Machine Products Corp. 1128
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Telephones

Screw Machine Products Corp. 1128
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 American Mason Safety Tread Co. 266-268
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 Feralun 265
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Treads and Risers, Stair, Metal
 Penn Metal Co. 325

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 Great Southern Lumber Co. 154-155
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 Brown Hoisting Machinery Co. 48-49
 Browning, Victor R., & Co. 865
 Champion Engineering Co. 866-867
 Chesapeake Iron Works 868-869
 Cleveland Crane & Engineering Co. 870-871

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Erie Steel Construction Co.....	880
Euclid Crane & Hoist Co.....	884-885
Lane Mfg. Co.....	881
Niles-Bement-Pond Co.....	872-873
Pawling & Harnischfeger Co.....	874-875
Shepard Electric Crane & Hoist Co.....	876-879
Whiting Foundry Equipment Co.....	882
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Baltimore Cooperage Co.....	616
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Gillis & Geoghegan.....	937
G & G.....	937

Trucks, Electric Storage Battery

Elwell-Parker Electric Co.....	110
Hunt, C. W., Co., Inc.....	118-120

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Standard Scale & Supply Co.....	940
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Standard Scale & Supply Co.....	940
Kalamazoo Tank & Silo Co.....	623

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Banner Iron Works.....	124-125
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American Metal Hose Co.....	591
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Tubing, Seamless—Brass and Copper.

Wheeler Condenser and Engineering Co.....	787
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Tubing, Seamless—Iron or Steel

Byers, A. M., Co.....	402
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New England Tank & Tower Co....	624

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Tunneling Shields and Equipment

Watson-Stillman Co.....	1132-1133
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Turbines, Steam

Allis-Chalmers Mfg. Co.....	1114-1115
Carling Turbine Blower Co.....	972-973

Turbines, Steam—Continued.

Coppus Engineering & Equipment Co.....	732
De Laval Steam Turbine Co.....	712
General Electric Co.....	1050-1084
Moore Steam Turbine Corp.....	714
Ridgway Dynamo & Engine Co.....	706-707
Sturtevant, B. F., Co.....	985-1003
Terry Steam Turbine Co.....	715-717
Wing, L. J., Mfg. Co.....	1004
Curtis.....	1050-1084
Rateau-Smoot.....	706-707

Turbo Alternators

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Turntables

Easton Car & Construction Co....	114-117
Hunt, C. W., Co., Inc.....	118-120
Steacy-Schmidt Mfg. Co.....	612
Tippett & Wood.....	613
Washburn & Granger, Inc.....	682
Whiting Foundry Equipment Co....	1150-1151

Turrets

See Skylights; Ventilators.

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Ultra Violet Ray Water Sterilizers

See Sterilizers, Water, Ultra Violet Ray.

Underground Construction

See Engineers or Contractors, Foundation.

Underground Steam Pipe Conduit

See Conduit, Steam Pipe, Underground; Casing, Pipe, Underground.

Unions, Double Eccentric

Josam Mfg. Co.....	1044-1045
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Unions, Pipe

See Fittings, Pipe.

Unloaders, Ballast

Lidgerwood Mfg. Co.....	59
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Unloaders, Pressure, Air Compressor

Yarnall-Waring Co.....	582-583
Yarway.....	582-583

Urinals

Simmons, John, Co.....	1039
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Urinals, Chemical

Kaustine Co., Inc.....	1032
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Vacuum Apparatus

Buffalo Foundry & Machine Co....	1138-1141
Devine, J. P., Co.....	1144-1145

Vacuum Cleaners

Spencer Turbine Co.....	984
Western Electric Co.....	1119

Vacuum Gages

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Valve Control, Electric

Cutler-Hammer Mfg. Co.....	505
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Johnson Service Co.....	526-527
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Valve Disks

See Disks, Valve.

Valve Holders, Radiator

Monash-Younger Co.....	536-538
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Valves, Acid Resistant

Cadman, A. W., Mfg. Co.....	442
Duriron Castings Co.....	1146
Lunkenheimer Co.....	470-475
Duro.....	470-475
Gato.....	442

Valves, Air, Automatic—Lever and Float or Globe

Davis, G. M., Regulator Co.....	514-515
d'Este, Julian, Co.....	516-517
Ludlow Valve Mfg. Co.....	464-469
Simplex Valve and Meter Co.....	578-579
Williams, D. T., Valve Co.....	496-498
Wright-Austin Co.....	550-552
Curtis.....	516-517
Victor.....	514-515

Valves, Air Line Return, Radiator

Dunham, C. A., Co.....	518-521
Haines, William S., & Co.....	525
Johnson Service Co.....	526-527
Monash-Younger Co.....	536-538
Sylphon.....	526-527
Vento.....	525

Valves, Air Vent, Float

See Vents, Air.

Valves, Air and Vacuum, Poppet

See Valves, Air.

Valves, Alarm or Dry Pipe, Sprinkler System

Globe Automatic Sprinkler Co.....	1047
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Valves, Altitude

Davis, G. M., Regulator Co.....	514-515
Golden-Anderson Valve Specialty Co.....	495
Kieley & Mueller, Inc.....	529
Kitts Mfg. Co.....	530
Simplex Valve and Meter Co.....	578-579

Valves, Ammonia

Automatic Refrigerating Co.....	1014
Continental Machinery Co.....	1016
Vogt, Henry, Machine Co.....	1017
York Mfg. Co.....	1020

Valves, Atmospheric Relief

See Valves, Back Pressure.

Valves, Automatic, Hot Water

See Valves, Air Line Return, Radiator.

Valves, Back Pressure

Boylston Steam Specialty Co.....	512-513
Chaplin-Fulton Mfg. Co.....	524
Davis, G. M., Regulator Co.....	514-515
Fisher Governor Co.....	522-523
Kieley & Mueller, Inc.....	529
Locke Regulator Co.....	531
McNab & Harlin Mfg. Co.....	476-481
Pittsburgh Valve, Foundry & Construction Co.....	484-486
Fulton.....	524

Valves, Balanced

Atlas Valve Co.....	507-509
Davis, G. M., Regulator Co.....	514-515
d'Este, Julian, Co.....	516-517
Fisher Governor Co.....	522-523
Locke Regulator Co.....	531
Lunkenheimer Co.....	470-475
Mason Regulator Co.....	534-535
Curtis.....	516-517

Valves, Blow-off

Ashton Valve Co.....	510-511
Cadman, A. W., Mfg. Co.....	442
Chapman Valve Mfg. Co.....	436-439
Homestead Valve Mfg. Co.....	444-445
Jenkins Bros.....	446-449
Kelly & Jones Co.....	450-459
Lunkenheimer Co.....	470-475
Pittsburgh Valve, Foundry & Construction Co.....	484-486
Pratt & Cady Co., Inc.....	487-491
Simmons, John, Co.....	404
Vance-Vetter Co.....	548
Walworth Mfg. Co.....	494
Williams, D. T., Valve Co.....	496-498
Yarnall-Waring Co.....	582-583
Hovalco.....	444-445
Yarway.....	582-583

Valves, Butterfly

Chapman Valve Mfg. Co.....	499
Coffin Valve Co.....	500-501

Products are indexed under the noun except where common usage makes it desirable to index under the adjective.

Valves, Butterfly—Continued.

Pittsburgh Valve, Foundry & Construction Co. 484-486

Valves, Check

Chapman Valve Mfg. Co. 436-439
Clow, James B., & Sons. 408-409
Coffin Valve Co. 500-501
Crane Co. 440-441
Flower Valve Mfg. Co. 503
Jenkins Bros. 446-449
Kelly & Jones Co. 450-459
Kennedy Valve Mfg. Co. 460-463
Locke Regulator Co. 531
Ludlow Valve Mfg. Co. 464-469
Lunkenheimer Co. 470-475
McNab & Harlin Mfg. Co. 476-481
Nelson Valve Co. 482-483
Pittsburgh Valve, Foundry & Construction Co. 484-486
Pratt & Cady Co., Inc. 487-491
Rumsey Pump Co., Ltd. 766-767
Simmons, John, Co. 404
Walworth Mfg. Co. 494
Williams, D. T., Valve Co. 496-498
Beckwith 450-459
Excelsior 450-459

Valves, Check, Carburetor

Lunkenheimer Co. 470-475

Valves, Check, Rotary

Smolensky, M., Mfg. Co. 492-493

Valves, Chlorine, Automatic

Wallace & Tiernan Co., Inc. 817

Valves, Chronometer

Pittsburgh Valve, Foundry & Construction Co. 484-486

Valves, Compounding

Union Water Meter Co. 580-581

Valves, Cut-off or Hopper

Brown Hoisting Machinery Co. 891
Haiss, George, Mfg. Co., Inc. 61
Hunt, C. W., Co., Inc. 118-120
Ransome Concrete Machinery Co. 96-99
Washburn & Granger, Inc. 682
Brownhoist 891
Dean 682

Valves, Diaphragm—Rubber or Metal

(See also Valves, Radiator, Return Line, Automatic; Traps, Radiator; Valves, Reducing or Regulating, Pressure)

Atlas Valve Co. 507-509
Boylston Steam Specialty Co. 512-513
Johnson Service Co. 526-527
Parks-Cramer Co. 1010-1011
Powers Regulator Co. 540-541
Tagliabue, C. J., Mfg. Co. 568-569
Victor 507-509

Valves, Differential

See Valves, Reducing or Regulating, Pressure.

Valves, Drip, Automatic

Chapman Valve Mfg. Co. 436-439
Flower Valve Mfg. Co. 503

Valves, Engine Stop, Automatic

Crane Co. 440-441
Locke Regulator Co. 531

Valves, Fan Engine

Atlas Valve Co. 507-509
Kitts Mfg. Co. 530

Valves, Flap

Chapman Valve Mfg. Co. 499
Clow, James B., & Sons. 408-409
Coffin Valve Co. 500-501
Coldwell-Wilcox Co. 502
Flower Valve Mfg. Co. 503
Ludlow Valve Mfg. Co. 504
Morris Machine Works. 754-759

Valves, Float or Tank

American Steam Gauge & Valve Mfg. Co. 553-557
Atlas Valve Co. 507-509
Boylston Steam Specialty Co. 512-513

Valves, Float or Tank—Continued.

Davis, G. M., Regulator Co. 514-515
d'Este, Julian, Co. 516-517
Fisher Governor Co. 522-523
Golden-Anderson Valve Specialty Co. 495
Kieley & Mueller, Inc. 529
Mason Regulator Co. 534-535
Ohio Body and Blower Co. 314-317
Pittsburgh Valve, Foundry & Construction Co. 484-486
Simmons, John, Co. 404
Curtis 516-517
Swarthout 314-317

Valves, Foot

American Spiral Pipe Works. 416-417
Coffin Valve Co. 500-501
Flower Valve Mfg. Co. 503
Kelly & Jones Co. 450-459
Ludlow Valve Mfg. Co. 464-469
Morris Machine Works. 754-759
Pittsburgh Valve, Foundry & Construction Co. 484-486
Rumsey Pump Co., Ltd. 766-767
Simmons, John, Co. 404

Valves, Gas

Smith Gas Engineering Co. 954-955
Wellman-Seaver-Morgan Co. 928-929
Porter 928-929

Valves, Gate

American Spiral Pipe Works. 416-417
Central Brass Mfg. Co. 1038
Chapman Valve Mfg. Co. 436-439
Coffin Valve Co. 500-501
Crane Co. 440-441
Flower Valve Mfg. Co. 503
Jenkins Bros. 446-449
Kelly & Jones Co. 450-459
Kennedy Valve Mfg. Co. 460-463
Ludlow Valve Mfg. Co. 464-469
Lunkenheimer Co. 470-475
McNab & Harlin Mfg. Co. 476-481
National Valve & Mfg. Co. 422
Nelson Valve Co. 482-483
Pittsburgh Valve, Foundry & Construction Co. 484-486
Pratt & Cady Co., Inc. 487-491
Simmons, John, Co. 404
Standard Spiral Pipe Works. 418-419
Walworth Mfg. Co. 494
Williams, D. T., Valve Co. 496-498
Lenticular 460-463
Newtype 460-463
Victor 470-475

Valves, Gate—Altitude Regulating, Device for

Simplex Valve and Meter Co. 578-579

Valves, Gate, Electrically or Hydraulically Operated

Chapman Valve Mfg. Co. 436-439
Coffin Valve Co. 500-501
Ludlow Valve Mfg. Co. 464-469
Nelson Valve Co. 482-483
Pittsburgh Valve, Foundry & Construction Co. 484-486
Pratt & Cady Co., Inc. 487-491

Valves, Gate, Pneumatically Operated

Chapman Valve Mfg. Co. 436-439

Valves, Generator

Lunkenheimer Co. 470-475

Valves—Globe, Angle, Cross

Central Brass Mfg. Co. 1038
Clow, James B., & Sons. 408-409
Crane Co. 440-441
Golden-Anderson Valve Specialty Co. 495
Jenkins Bros. 446-449
Kelly & Jones Co. 450-459
Kennedy Valve Mfg. Co. 460-463
Locke Regulator Co. 531
Ludlow Valve Mfg. Co. 464-469
Lunkenheimer Co. 470-475
McNab & Harlin Mfg. Co. 476-481
Nelson Valve Co. 482-483

Valves—Globe, Angle, Cross—Continued.

Pittsburgh Valve, Foundry & Construction Co. 484-486
Pratt & Cady Co., Inc. 487-491
Simmons, John, Co. 404
Smolensky, M., Mfg. Co. 492-493
Walworth Mfg. Co. 494
Williams, D. T., Valve Co. 496-498
Excelsior 450-459
Kewanee 494

Valves, Hose

(See also Valves, Gate)

Chapman Valve Mfg. Co. 436-439
Kennedy Valve Mfg. Co. 460-463
Ludlow Valve Mfg. Co. 464-469
Walworth Mfg. Co. 494
Williams, D. T., Valve Co. 496-498

Valves, Hydraulic

Crane Co. 440-441
McNab & Harlin Mfg. Co. 476-481
Metalwood Mfg. Co. 1129
Pittsburgh Valve, Foundry & Construction Co. 484-486
Simmons, John, Co. 404
Williams, D. T., Valve Co. 496-498
Yarnall-Waring Co. 582-583
Yarway Gaskey 582-583

Valves, Hydraulic Operating

Pittsburgh Valve, Foundry & Construction Co. 484-486
Vance-Vetter Co. 548
Aiken 484-486
Critchlow 484-486
Stuart 484-486
Tanner 484-486

Valves, Mixing, Shower

See Mixers, Shower Bath.

Valves, Needle

Lunkenheimer Co. 470-475
Walworth Mfg. Co. 494
Williams, D. T., Valve Co. 496-498

Valves, Oil Firing

Hammel Oil Burning Equipment Co., Inc. 958

Valves, Plug

Cadman, A. W., Mfg. Co. 442
Pittsburgh Valve, Foundry & Construction Co. 484-486
Gato 442

Valves, Plug Drain

Chapman Valve Mfg. Co. 499
Coldwell-Wilcox Co. 502

Valves, Pop Safety

American Steam Gauge & Valve Mfg. Co. 553-557
Ashton Valve Co. 510-511
Boylston Steam Specialty Co. 512-513
Crane Co. 440-441
Haines, William S., & Co. 525
Lunkenheimer Co. 470-475
Smolensky, M., Mfg. Co. 492-493

Valves, Pump, Asbestos

Johns-Manville, H. W., Co. 1024-1025
Vulcabeston 1024-1025

Valves, Pump, Rubber

Jenkins Bros. 446-449

Valves, Quarter-turn

Homestead Valve Mfg. Co. 444-445

Valves, Quick Closing, Electrically Operated

Golden-Anderson Valve Specialty Co. 495

Valves, Quick Opening, Lever

(See also Valves, Gate)

Jenkins Bros. 446-449
Kelly & Jones Co. 450-459
Kennedy Valve Mfg. Co. 460-463
Nelson Valve Co. 482-483

Valves, Quick Opening, Lever—Continued.

Pittsburgh Valve, Foundry & Construction Co.	484-486
Standard Spiral Pipe Works.	418-419
Walworth Mfg. Co.	494
Williams, D. T., Valve Co.	496-498

Valves, Radiator

Detroit Lubricator Co.	588
Kennedy Valve Mfg. Co.	460-463
Lunkenheimer Co.	470-475
Pratt & Cady Co., Inc.	487-491
Simmons, John, Co.	404
Williams, D. T., Valve Co.	496-498

Valves, Radiator, Graduated or Modulation

Dunham, C. A., Co.	518-521
Haines, William S., & Co.	525
Monash-Younger Co.	536-538
Webster, Warren, & Co.	546-547
<i>Vento</i> .	525

Valves, Radiator, Packless

Dunham, C. A., Co.	518-521
Monash-Younger Co.	536-538

Valves, Radiator, Return Line, Automatic

Dunham, C. A., Co.	518-521
Haines, William S., & Co.	525
Johnson Service Co.	526-527
Monash-Younger Co.	536-538
Powers Regulator Co.	540-541
Webster, Warren, & Co.	546-547
<i>Sylphon</i> .	526-527
<i>Vento</i> .	525

Valves, Reducing or Regulating, Pressure

Atlas Valve Co.	507-509
Boylston Steam Specialty Co.	512-513
Chaplin-Fulton Mfg. Co.	524
Crane Co.	440-441
Davis, G. M., Regulator Co.	514-515
d'Este, Julian, Co.	516-517
Dunham, C. A., Co.	518-521
Fisher Governor Co.	522-523
Golden-Anderson Valve Specialty Co.	495
International Oxygen Co.	951
Johnson Service Co.	526-527
Kieley & Mueller, Inc.	529
Kitts Mfg. Co.	530
Locke Regulator Co.	531
Lunkenheimer Co.	470-475
McDonough Automatic Regulator Co.	532-533
Mason Regulator Co.	534-535
Plant Engineering & Equipment Co., Inc.	542
Simmons, John, Co.	404
Tagliabue, C. J., Mfg. Co.	568-569
Union Water Meter Co.	580-581
Walworth Mfg. Co.	494
<i>Atlas</i> .	542
<i>Beats All</i> .	531
<i>Curtis</i> .	516-517
<i>Fulton</i> .	524

Valves, Regulating, Pressure

See Valves, Reducing or Regulating, Pressure.

Valves, Relief—Air, Gas or Water

American Steam Gauge & Valve Mfg. Co.	553-557
Ashton Valve Co.	510-511
Boylston Steam Specialty Co.	512-513
Chaplin-Fulton Mfg. Co.	524
Crane Co.	440-441
Davis, G. M., Regulator Co.	514-515
Fisher Governor Co.	443; 522-523
Kieley & Mueller, Inc.	529
Locke Regulator Co.	531
Lunkenheimer Co.	470-475
Pittsburgh Valve, Foundry & Construction Co.	484-486
Simmons, John, Co.	404
Stack Heater Co.	793
Walworth Mfg. Co.	494
Wheeler Condenser and Engineering Co.	787
<i>Fulton</i> .	524

Valves, Safety—Angle and Cross

See Valves—Globe, Angle, Cross.

Valves, Safety and Vacuum—Oil Still Agitator

Fisher Governor Co.	443
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Valves, Shear

See Gates, Shear.

Valves, Steam Jacketed

Devine, J. P., Co.	1144-1145
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Valves, Stop and Check, Non-return

Boylston Steam Specialty Co.	512-513
Crane Co.	440-441
Davis, G. M., Regulator Co.	514-515
Fisher Governor Co.	522-523
Golden-Anderson Valve Specialty Co.	495
Jenkins Bros.	446-449
Kelly & Jones Co.	450-459
Kieley & Mueller, Inc.	529
Locke Regulator Co.	531
Lunkenheimer Co.	470-475
McNab & Harlin Mfg. Co.	476-481
Nelson Valve Co.	482-483
Pittsburgh Valve, Foundry & Construction Co.	484-486
Pratt & Cady Co., Inc.	487-491
Williams, D. T., Valve Co.	496-498
<i>Crane-Erwood</i> .	440-441

Valves, Suction, Rotary

Smolensky, M., Mfg. Co.	492-493
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Valves, Thermostatic

See Valves, Radiator, Return Line, Automatic.

Valves, Tide

See Valves, Flap.

Valves, Vacuum Breaker

Locke Regulator Co.	531
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Valves, Water Control

See Valves, Float or Tank; Valves, Balanced.

Valves, Water Level Control

See Regulators, Feed Water.

Varnishes, Bituminous

(See also Paint, Acid Resistant; Enamels)

Carbolineum Wood Preserving Co.	233
<i>Protexol</i> .	233

Varnishes, Insulating

Biegler, E. N., Mfg. Co.	276
Sherwin-Williams Co.	216-217
<i>Ajax</i> .	216-217

Varnishes, Interior and Exterior

Billings-Chapin Co.	198
Du Pont de Nemours, E. I., & Co., Inc.	204-205
Hampden Paint & Chemical Co.	208
Lowe Brothers Co.	211
Sherwin-Williams Co.	216-217
Toch Brothers.	221
Tropical Paint & Oil Co.	222-223
<i>Little Blue Flag</i> .	211
<i>Rubefect</i> .	198

Vats

(See also Tanks)

Farrar & Trefts, Inc.	602
Kalamazoo Tank & Silo Co.	623
New England Tank & Tower Co.	624

Vault Frames and Plates

See Covers, Frames and Plates—Manhole, Trench, Sump, Pit.

Vaults, Safe Deposit and Bank

Hydrolithic Waterproofing Co., Inc.	210
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Veneer

American Hardwood Mfrs. Ass'n.	152-153
Grand Rapids Veneer Works.	1147
Long-Bell Lumber Co.	156-157

Ventilating Apparatus, Window

Bogert & Carlough Co.	348-349
Detroit Steel Products Co.	350-351
Drouvé, G., Co.	292-293
Lord & Burnham Co.	356
Lupton's, David, Sons Co.	341-347
Metallic Sash-Operator Co.	357
National Ventilating Co.	289
Payson Mfg. Co.	358-361
Truscon Steel Co.	352-354

Ventilating Sets, Portable

See Heating and Ventilating Apparatus

Ventilating Systems

(See also Ventilators, Roof; Heating and Ventilating Apparatus)

Howie Co., Inc.	294-295
Jordan, Paul R., & Co.	308
Moyer Mfg. Co.	312
<i>Moyer Vac</i> .	312

Ventilators, Car

See Ventilators, Roof.

Ventilators, Dampened

See Ventilators, Roof.

Ventilators, Glass Top

See Ventilators, Roof.

Ventilators, Mushroom

Hersh & Brother.	1012
<i>Bi-cal-ky</i> .	1012

Ventilators, Ridging

(See also Roof Trimmings)

Globe Ventilator Co.	307
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Ventilators, Roof

Acme Ventilator Corp.	302-303
Arex Co.	301
Auto Utilities Mfg. Co.	306
Burt Mfg. Co.	304-305
Globe Ventilator Co.	307
Hersh & Brother.	1012
Ilg Electric Ventilating Co.	979-981
Jordan, Paul R., & Co.	308
Kain & Aunger Co.	309
Kernchen Co.	310-311
Moyer Mfg. Co.	312
Newark Cornice & Skylight Works.	313
Ohio Body and Blower Co.	314-317
Robertson, H. H., Co.	277-279
Rohrman-Cooper Co., Inc.	318
Royal Ventilator Co.	319
Schoedinger, F. O.	320
Sturtevant, B. F., Co.	321
Van Noorden, E., & Co.	300
<i>Aeroboost</i> .	308
<i>Airout</i> .	302-303
<i>Autoforce</i> .	321
<i>Bi-cal-ky</i> .	1012
<i>Columbus</i> .	320
<i>K-S-V</i> .	310-311
<i>Moyer Vac</i> .	312
<i>Peerless</i> .	306
<i>Pyramid</i> .	318
<i>Si-Fo</i> .	309
<i>Simplex</i> .	300
<i>Storm King</i> .	300
<i>Swartwout</i> .	314-317

Ventilators, Roof, Fan

Burt Mfg. Co.	304-305
Hersh & Brother.	1012
Ilg Electric Ventilating Co.	979-981
<i>Bi-cal-ky</i> .	1012

Ventilators, Roof, Revolving

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CHECKING-LIST

COVERING

ENGINEERING CONSTRUCTION

AND

POWER PLANT DESIGN

FOR USE WITH THE
ENGINEERING EDITION OF SWEET'S CATALOGUE

The function of this Checking-List is to serve as a guide and reminder in connection with the preparation of specifications and contracts, and for making estimates.

For convenience it is arranged in two parts: the first, dealing in general with methods of construction, and the second, especially with the design, construction and equipment of steam and hydro-electric power plants.

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PART I—ENGINEERING CONSTRUCTION

1—MATTERS PRELIMINARY TO CONTRACTS

1-1 INVITATION TO BIDDERS

- (a) Authority
 - Official title
 - Address
- (b) Work Required
 - Location
 - General statement of scope of work
 - General method of construction
- (c) Proposal
 - Time and place for delivery
 - Form of proposal
 - Accompanied with certified check
- (d) Bond
 - Required from successful bidder
- (e) Address for Further Information, Drawings, etc.
- (f) Rejection of Bids

1-2 INFORMATION FOR BIDDERS

- (a) General
 - Blanks for bids or proposals
 - Date for opening bids
 - Printed form of bid to be used
 - Blank bidding sheet to be filled in with both words and figures for each item
 - No alterations or restrictions to be made in bidding sheet or specifications
 - Copy of advertisement must be attached to bidding sheet
 - Amount per day added to bids for purposes of comparison
 - Each bidder must sign full name and address given
 - if firm name, names of members must be given
 - if corporation, names of officers
 - When signing for another person power of attorney must be filed
 - Withdrawal of bids
 - Informal bids
 - No recapitulation of work
 - One man interested in two bids cause for their rejection
 - Member of firm not accepted as bondsman for firm
 - Contract signed and bond given in [....] days after notice to successful bidder
 - Bidder present at opening of bids
 - Proposal accompanied by certified check
 - return of check of unsuccessful bidders
 - return of check of successful bidder
 - forfeited if chosen bidder does not commence work on time
 - Bids must be balanced—no prices unnecessarily high or low
 - State organization, facilities and experience for work
 - State credit or means of credit available
 - Proposals in sealed envelope
 - time and place for delivery
 - Bidder to visit site of work before estimating
 - Bidder to give number of days in which he will complete the work
 - Bidder to submit with bid full description of proposed methods of work
 - List of proposed Sub-contractors

Loan of drawings
 deposit to insure their return
 Owner not responsible for information except that given by Engineer
 Provision for submitting a modified form in addition to regular bid

- (b) Conditions of Site
 - Location and accessibility
 - Geographical features
 - Railroad connections
 - Tidewater connections
 - Soundings
 - Borings
 - Test pits
 - Character of rock formation
 - Lines and grades
 - Construction materials available
 - sand and gravel deposits
 - stone
 - timber
 - water supply
 - Difficulty in obtaining labor and materials or delivery of material to property
 - Severity of weather
- (c) Labor Laws
 - State labor laws—working hours defined
 - Rate of wage to be paid on work—for public work
 - Bidders referred to local laws in regard to work
- (d) Approximate Statement of Quantities
 - Basis for comparing bids
 - Bidders to satisfy themselves as to accuracy of approximate quantities
 - Prices not changed by change of quantity
- (e) Samples
 - Of work already completed for inspection by Contractor

1-3 PROPOSAL

Bidder's name and address
 name and address of every member of firm
 if corporation, information desirable
 Agreement to furnish work for price included
 Amount of estimate
 Declaration that bidder is only party interested
 No government official or employee a partner
 Enclosed check for a percentage of bid
 Agreement to give bond
 Liquidated damage, or other damage clause
 Proposal made with full understanding as to nature and quality of work
 Alternate proposals
 Organization of bidder
 Financial information concerning bidder
 Facilities for doing work
 Statement of similar work performed by bidder
 references
 Bidder to have examined site
 Bidder to execute contract within [....] days after notice of award
 forfeiture of deposit in case of neglect
 Schedule of unit prices
 what the prices are to cover

Right to increase or diminish quantities
 Bidders' signatures
 sworn statement before notary
 Sureties' consent
 form
 sworn before notary

2—CONTRACT

2-1 AUTHORITIES

Parties
 Covenants
 Engineer to make explanations and give orders
 provision in case of disability of Engineer
 Engineer to adjust differences
 Engineer to give orders in Contractor's absence

2-2 DRAWINGS

Specifications and drawings a part of contract
 right to amplify drawings
 right to modify drawings
 supplementary drawings
 examination by Contractor
 conditions encountered not indicated on supplementary drawings

2-3 TIME AND ORDER OF DOING WORK

Time is the essence of the agreement
 Work to begin [....] days after letting of contract
 Schedule of progress
 Penalty for non-completion
 Bonus for completion in advance
 Extension of time

- strikes
- stoppage by Engineer
- weather
- other causes

 Extension of time not to release bondsmen
 Conditions of final acceptance
 Right to suspend work

- no claim for damage in consequence of suspension
- damages to Contractor due to suspension of work by owner

2-4 CLAIMS

No claim because actual quantities differ from preliminary statement
 Contract and specifications may be modified by written agreement
 Contractor's claim for damage
 statement filed with Engineer

2-5 EXAMINATION OF WORK

Access to work
 persons or parties included

2-6 SUB-CONTRACTORS

Interference of work under adjacent contracts

2-7 ADDITIONAL WORK OR MATERIALS

2-8 RIGHT OF PROPERTY IN MATERIALS

2-9 EMPLOYEES, ETC.

Competent men to be employed
 Dismissal of workmen
 Compliance with labor laws required

Compliance with local laws and regulations
Payment of employees of Contractor
Bond to indemnify municipalities against paupers, etc.
Work on Sundays, legal holidays, or at night permitted?

2-10 DUTIES OF CONTRACTOR

(a) General

Personal attention given to work
Furnish representative who can act upon special orders
Maintenance of office at the work
Keep plans and specifications on work
Co-operation with other contractors

(b) To Furnish the Following:

Laborers to assist Engineer in setting stakes, sounding, etc.
Laborers to assist Inspector in handling materials
Materials for stakes
Boats for conveyance of Engineers
Scales for weighing materials
Offices for Engineers
Quarters for workmen

(c) Lines and Grades

Preservation of stakes, bench marks and monuments
Advance notice given of need of lines and grades

(d) Rules and Regulations

Study and obey rules and regulations of fire, water, park and police departments with special attention regarding hydrants, steam boilers, explosives, protection of trees and shrubbery
To secure permits and licenses

(e) Sanitary Provisions and Conveniences for Employees

Water supply
Garbage destruction
Sewage disposal
Medical attendance and inspection
Hospital

(f) Records

Furnish bills of lading to Engineer on request
Show time books for work done on force account

2-11 CONTRACTOR'S LIABILITIES

Accidents to persons and property
Examination of abutting property before beginning work
Injury to work by the elements
Insurance against fire
Unforeseen difficulties in performance of work
Preservation and protection of materials and finished work until final acceptance
Verification of borings and soundings
Verification of plans
Checking and verifying of bills of materials furnished by Engineer
Assumption of all liabilities for patent royalties
Payment of demurrage on freight
Disposal of all surplus excavation, old materials, etc., not claimed by owner or abutting property owners
Liability for plant and methods
Providing of means for public travel
Contractor's liabilities not affected by Sub-contractor

Expense caused by strikes, riots, etc.

2-12 MATERIALS TO CONFORM TO SPECIFICATIONS

2-13 MAINTENANCE OF WORK

Definition
Required for stated time
Procedure in case of failure to repair
Maintenance bond or cash deposit
Provision for disturbance of completed work by others than Contractor

2-14 DEFECTIVE WORK AND MATERIALS

2-15 COMPLETION OR ABANDONMENT OF WORK

Cancellation of contract by default
Completion of work after abandonment
Damages for failure to complete on time
Sworn statement required on completion of work
Provision for use of work before completion of contract
Receipted bills, satisfactory liens and other evidences of non-indebtedness for materials and labor to be filed with Engineer
Permission to complete contract not a waiver

2-16 PAYMENT FOR WORK

Partial payments
small percentages retained
method of estimating
Final estimate and payments
Vouchers
Interest on delayed payments
No estoppel
Final payment to terminate liability of owner
Lien laws
Money due Contractor may be retained to meet claims
Prices for extras

2-17 ARBITRATION

Damages for submitting to arbitration
Bond for fulfillment of arbitration

2-18 CHANGE AND INTERPRETATION OF PLANS

Change of plans, grades, etc., may be made by Engineer
Change of plans will not release bondsmen
Quantities may be increased or diminished
Written matter to prevail over printed matter in specifications
Engineer (or Board of Arbitration) to interpret plans and specifications
Omissions not to be used as an excuse for non-performance or extra price
Complete workmanlike job required
Borings and soundings not guaranteed

3-SPECIFICATIONS (General Sections)

3-1 WORK REQUIRED

Limits of contract
Nature and quality of finished work
Rapidly and safety of construction
Work to begin at places designated by Engineer

3-2 DEFINITIONS

Measurements made of actual

lengths, areas and volumes within "neat lines"
Units of measurement as cubic yard, ton, day, rock, earth, etc.
Owner
Chief Engineer
Contractor
Board of Arbitration
Datum of levels
Legal address of Contractor
provision for change
Approved and directed
Contract
Extra and additional work
Unit prices
Materials delivered

3-3 INSPECTION

Duties of Inspector
Work done in Inspector's absence subject to rejection
Contractor to provide facilities for inspection
Contractor to provide laborers to assist Inspectors
Culled material to be removed at once
Contractor to make openings or tear out work for inspection
condition of payment
Acceptance by Inspector not final

4-SUBWAYS AND TUNNELS

4-1 MAINTENANCE OF TRAFFIC, PROTECTION OF PROPERTY, ETC.

(a) Street Maintenance

Access to buildings
Decking of streets
material
quality
surface drainage
Decking of sidewalks
Bridges across open trenches
Maintenance of street intersections
Maintenance of sidewalk crossings

(b) Number and Sizes of Openings of Shafts

Location

(c) Storage of Materials

Location
Amounts

(d) Fire Protection

Access to fire hydrants
Access to fire alarm boxes

(e) Cancelments, Etc.

Procedure in case of necessary cancellation
Procedure in case of necessary disturbance

(f) Maintenance of Street Lighting

(g) Maintenance of Street and Elevated Railway Tracks, Mains, etc.

Notice given to interested parties of start of work
Plans of rearrangement
Reconstruction or relaying
reasonable dispatch
Support of
Protection from injury
Necessary permanent changes of piping, electric conduits and ducts
Payment for new pipes
Payment for excavation outside of net lines
Changes of service connections
Measurement of conduit and duct excavation
Payment for additional necessary construction
Provision for owners of railway to make extensions or improvements

Support of column foundations of elevated roads
 Support and restoration of buildings
 Methods used
 Procedure in case of damage
 Buildings requiring special attention
 Test pits
 Responsibility in case of damage
 Repairs and measures necessary for tenantable conditions of buildings at all times
 Dispatch with which work is done
 Measurement of work done
 Payment for

(h) Maintenance of and Restoration of Pipes, etc.

Protection of
 sewers
 pipes
 ducts
 mains
 conduits
 wires
 cables

4-2 TEMPORARY REMOVAL

Consent of owner
 Approval of Engineer
 Restoration
 Permanent change of location

4-3 BY-PASSING OF PIPES IN CONSTANT USE

Quality of pipe used
 Ventilation in case of gas pipes
 Location of all gates and valves
 Posting drawings in field offices for emergency use

4-4 SEWERS

Change of location
 Claims for damages
 Size of trenches
 freedom from water
 Limit of length of trench opening
 Trenches for manholes and receiving basins
 Foundations
 Testing of grades
 Gutters and passageways kept open
 Under other structures
 Protection of fresh work
 Procedure in freezing weather

(a) Concrete

Profiles and inverted centers for inverts
 protection of invert
 forms, moulds, etc.
 Defective work
 Spur pipes
 how built in
 Risers
 Dimensions
 Ventilation

(b) Pipe Sewers

Vitrified pipe
 Iron pipe
 How laid
 Joining hub and spigot pipes
 Special castings
 Connections
 Ventilation
 Protection of exposed ends of pipes
 Cleanliness of interior of pipes

(c) Manholes

Foundations
 Pipe connections
 Vitrified bricks or granite blocks
 Bluestone
 Use of bats
 Steps or ladders
 Manhole heads and cover
 perforations
 weights

noiseless head and cover for asphalt or wooden block streets
 emergency manholes
 joints
 sealed heads in vault

(d) Catch Basins

Foundations
 Stone flooring
 Headstone and gutter stone
 Grate-bar cast-iron cover
 Cast-iron trap
 Iron steps

(e) Culvert Pipes

Flush tanks
 Waterproofing
 Quality of material
 Flow to be uninterrupted
 Brick or stone inverts
 Brick arches
 Permits for connections
 Cleaning

(f) Backfilling

Material used
 Method of tamping
 Sheeting withdrawn

(g) Payments for

Sewers
 Excavation
 Steel beams and reinforcing rods
 Automatic flush tanks
 Waterproofing
 Cast-iron sewer pipe
 House and drainage connections

(h) Sewers Under Station Platforms

4-5 RESTORATION OF SURFACE

Temporary
 material
 quality
 duration allowed
 Permanent
 area
 type of surface
 quality
 Payment for

4-6 SIDEWALKS

Adjacent to ventilating openings, vault lights, entrances
 Material
 Provisions for other types of pavements
 Measurement
 Curbing
 lines for
 Park surfaces
 trees
 shrubbery
 grass plots

4-7 EXCAVATION

(a) Definitions

Of earth excavation
 Of rock excavation

(b) Dimensions

Width of excavation
 Depth of trenches

(c) Securing of Sides

Sheeting
 Shores
 Walling timbers
 Provision for excess pressure
 Payment for sheeting, etc.

(d) Underpinning of Adjacent Buildings

Definition of underpinning
 Securing other than underpinning
 Payment

(e) Payment for Permanent Sheeting

(f) Timber for Temporary Purposes

Quality
 Workmanship in placing

(g) Vaults of Abutting Property

Disturbance of vaults
 Temporary partitions in case of disturbance of vaults

(h) Blasting

Precautions
 minimum distance from buildings
 type of explosives allowed
 storage of explosives
 state laws

(i) Drainage (Temporary)

Method of pumping
 Discharge piping
 Material in discharge water

(j) Carting

Dumping regulations
 Expeditious removal of material
 Tightness of carts, buckets, etc.

(k) Method of Measurement of Trenches

(l) Changes of Street Grade

Payments for

(m) Cross Sectioning of Rock Encountered

(n) Backfilling

Quality of material
 Method of placing
 around subsurface structures
 Removal of sheeting

(o) Measurements and Payments

Governed by what?
 Allowance for excess excavation outside tunnel lines
 Provision for slips, slides, timbering
 Rates for
 tunneling above mean high water
 tunneling below mean high water
 tunneling in rock
 removal of water

4-8 SHAFTS

(a) General

Location
 Contour of surface
 Proximity to railways or canals
 Character of strata
 Proposed method of making tunnel

(b) Method of Sinking

By hand
 Piling
 Haase's System
 Sinking Drum Method
 Sack-Bour Process
 Pneumatic System
 Honigman System
 Pattberg System
 Cementation Process
 Kind-Chaudron Process
 Hydraulic-Ram Boring Process
 Freezing Process

(c) Uses of Shafts

Extraction of excavated material
 Lowering and raising of workmen
 Ventilation
 down cast
 up cast
 Extraction of water
 Transmission of power from the surface to the underground workings

(d) Cross Section

(e) Lining

Concrete (see Section 6—, Concrete)
 Steel caisson
 double walls filled with concrete
 rivet spacing
 Sandstone
 Corrugated
 Suspended
 Water rings

Exterior caulked
Water tightness
Cribbing
Punch props
Backing deals
Stringing
Sills
Walling
Walling curb
Walling platform
Tubbing
wood
kind
metal
cast iron
wrought iron
brickwork
cement

Alignment boxes
Contraction joints
Limits of excavation
Timbering (see Section 4—12, Timbering and Piling)
Allowable variation in final position of shaft
Floor construction
Roof construction
Opening of shaft
protection by gates
trap door cover
grillage

(f) Drainage

Piping
Method used
Pumps
pulsometers
reciprocating steam pumps
beam engines
sinking pumps
deep well pumps
centrifugal pumps
vertical direct drive

(g) Stairway

Covered
Width
Material
Length

(h) Refilling of Temporary Shafts

Material immediately over tunnel
rock for drainage
careful lowering of material
Distribution to prevent subsequent settling
Refilling around permanent shaft lining
Replacing of drains to prevent leakage into tunnel
Removal of timber

4-9 TUNNELING**(a) Shields**

Type
Design
strength
length of overhang or tail
Provision for safety of workmen
Jacks or rams
pressure used
number
power
locating of operating pumps
Submission of drawings for approval
Platforms
Water trap
Ejectors
Method of starting shield from shaft
Thrust from shield
Cradle for shield
Accuracy required in driving
Blasting ahead of shield
kind of explosive used
size of charge
Support of soft ground ahead of shield
Erection of
Size of enlarged chambers
Track or skids for shield

(b) Plant

Buildings
blacksmith shop
boiler house
carpenter shop
foundry
freight house
ice house
locomotive shop
machine shop
oil house
pattern shop
planing mill
pump house
sand house
store house

(c) Power Plant (see also Part II, Power Plant Design, page 29)

Construction of buildings
location (shaft)
material
fireproof
precautions for extinguishing fires
water supply
duplicate
extinguishers
hose
location of valves

Equipment

boilers
condensers
electrical machinery
lighting
hydraulic machinery
hoists
pumps
air compressors
number
capacity
pressure
for locks
for drills, hammers, etc.

Maintenance provisions

excess capacity for emergency
coal used for heating, etc.
kind
air supply
cooling apparatus for air supply
air supply taken where?
air supply pipes
size
maximum allowable velocity through them
provision for by-pass
pressure regulating valve
quality of pipe
device for deadening noise of escaping air
spare air supply plant
capacity
provision for water supply to boilers
Records of operator
revolutions per minute of compressors
pressures in air receivers, locks, headings, etc.
pressures in hydraulic machinery
instruments used
electrical records

(d) Hoisting Plant

Elevators
Cage
safety
safety catches
bronze bearings
landing dogs
devices to prevent overwinding
Cables
Brakes
Guides
Fastenings
Service cage
Engines
Rope
Pulleys
Skips

Tests of safety devices
before use
at intervals throughout use

(e) Compressed Air Requirements

Quality of air supplied
maximum amount of CO₂ allowed
volume required
Supply taken from where?
Washed
Cooled
Extraction of cylinder oil
Foul air vent pipes from shield
regulating valve
Special means for removal of blasting fumes

(f) Bulkheads

Maximum allowable distance apart
Minimum number in continuous operation
Material
brick
concrete
metal
Piping through
Provision for removal

(g) Air Locks

Minimum number of metal air locks per bulkhead
Strength
to withstand what pressure?
Dimensions
Cross-section
Heating
Ventilation
Operation of doors
Provision for looking through door
Attendance at doors
Regulation of pressure in
Number of locks
Lock tender
Emergency
Material
Inside control of air valves
Fittings for locks
pressure gauge
recording air gauge
location
provision for locking
Who keeps the key?
Maintenance of working conditions

(h) Safety Screens

Where used
Number used
Material
Bracing
Maximum allowable distance from shield

(i) Quarters for Workmen

Light
Heat
Sanitary provisions
Bathing facilities
hot and cold showers
Lockers
Facilities for resting
Facilities for drying clothing
Provisions for supplying of hot drinks

(j) Medical Attendance

Qualified medical and surgical practitioners
hours of duty
substitute in case of absence
Hospital room
attendants
number of
location
hospital locks
number
cots
telephone
air gauge
ventilation
heating
maintenance in a sanitary condition

- compartments for locking doctor in and out
- arrangement for treatment or removal of ill employees
- facilities for treatment or removal of ill employees
- facilities for investigation of physiological effects of compressed air
- collection of records
- employment of help for work under compressed air
- examination
- re-examination in case of absence from work
- sanitary conditions of tunnel
- (k) Runways
 - Width
 - Location
 - shield platform to emergency lock
 - Handrails
 - Steps
 - Ladder to track level
 - Provisions for keeping clean
- (l) Telephone Connection
 - From each lock to power house and office of engineer and main network
 - From heading to power house and main network
- (m) Lighting
 - Temporary equipment
 - maximum spacing of lights in tunnel
 - especial lighting of heading
 - electric lighting
 - candles
 - lanterns
 - insulation
 - current separate from power circuit
 - Permanent equipment
 - system used
 - direct current
 - voltage
 - alternating
 - voltage
 - phase
 - frequency
 - two-wire or three-wire
 - switchboard
 - lamps
 - arc
 - incandescent
 - supports
- (n) Haulage
 - Manual
 - Animal
 - use of animals under compressed air
 - Mechanical
 - type of locomotive used
 - electrical
 - compressed air
 - steam
 - not allowable under compressed air
 - provisions for safety
 - operators
 - cars for tunnel use
 - design
 - tightness
 - brake
 - tracks
 - grade
 - alignment
 - flooring
- (o) Lining
 - Material used
 - concrete
 - masonry
 - cast-iron
 - ordinary or standard weight
 - heavy weight
 - cast steel
 - used where
 - Length of segments

diameter
caulking pockets
caulking
treatment of joints before
caulking
air jet
water jet under high pressure
scraping
method of caulking
use of rust mixture

Details
taper rings
care used in erection
sump segments
spacing
bolts
specifications for
washers
fillets
nuts
grouting hole
leakage around bolts
grommets
metallic lead
hemp with paste of red lead
in boiled linseed oil
Provision for change in method of making joints
Sliding rings
Movable bolting platform

- (p) Screw Piles (Cast Steel)
- Bore segments
 - Plugs
 - material
 - Driving
 - loading
 - Testing
 - Bedding of piles on rock
 - Borings at site during tunnel erection
 - Delivery of sections
 - Screw pile sleeves
 - collar of sleeve
 - Dowels
 - Watertight head of screw pile
 - Concrete within screw pile
 - Measurement
 - Driving machinery
 - Voids outside of tunnel lining
 - grouting
 - drystone packing and grout
 - rubble masonry
 - provision for removing air pressure for test of tunnel
 - manholes in lining
 - Operations to prevent excessive escape of air
 - poling
 - breast boards
 - clay close to interstices
 - materials for packing space between tail of shield and lining
 - deposit of a blanket of clay on the river bed
 - law regulations

4-10 CONCRETE (see Section 6—, Concrete)

4-11 STEEL AND IRON WORK

4-12 TIMBERING AND PILING

Material
quality
Sizing
Fastenings
Water logged timber
treatment
peeling
seasoning
testing
brush treatment
open-tank treatment
cylinder treatment
Cable mat for protection
Treenails
wood
holes for
painting of
how paid for

Character of piles
manner of driving
Concrete piles
where used
Grillage foundation timber
measurement and payment
Hoistway timbering
bolting
bolt specifications
washers
countersinking
Posts
Guides
Splice plates
material
channel shops
minimum length
Splicing joints
method
Additional bracing
Alignment boxes
Ladders
Platforms
Wedging
Blocking
Cord-wood
Legging
Wall plates

4-13 VENTILATION

- (a) Who is Responsible For?
- (b) Location of Shafts or Openings
 - Down cast
 - Up cast
- (c) Method Used
 - Natural
 - Furnace
 - Steam jet
 - Waterfall
 - Mechanical
 - blowers
 - fans
 - motors
- (d) Instruments Used
 - Anemometers
 - Barometers
 - Blowers
 - Centrifugal fans
 - Dry and wet bulb thermometers
 - Fans
 - Hygrometers
 - Pitot tubes
 - Rotary ventilators
 - Steam jet
 - Thermometers
- (e) Standard of Ventilation

4-14 WATERPROOFING

- (a) Materials Used, and Quality
 - Brick mastic
 - Asphalt
 - Coal tar
 - Felt
 - Pitch
- (b) Application
 - Limits of waterproofing
 - At stations
 - Method of joining side walls, roof and floor
 - Finish of surfaces before applying
 - dryness of concrete
 - Quality of labor
 - Methods and care in applying
 - Number of piles used
 - definition of
 - Precautions after laying
 - Procedure in case of leaks
 - Precautions in regard to fire during process of applying

4-15 DRAINAGE

- (a) System Used
 - Floor of tunnel as conduit
 - Wall and arch drains
 - Subdrains
 - Cross drains
 - connections
 - Broken stone

- (b) Sumps
 - Capacity
 - Tightness
- (c) Pumps
 - Capacity
 - Discharge
 - Approval of pattern
 - Duplicate installation for emergency
- (d) Station Drainage
 - Soil pipes
 - Shaft pumps and pump chambers
 - Grades used
 - Quality of drain pipes
 - cast-iron
 - specification
 - size
 - weight
 - joints
 - tests
 - coating
 - inspection
 - valves
 - handholes
 - gratings
 - bends
- (e) Vitrified Drains
 - Definition
 - Size
 - Shape
 - Lengths
 - Joints
 - Curved pipe
 - maximum length
 - Matching
 - Burning and glazing
 - Making joints
 - Measurements

(f) Payment for Drains

4-16 PIPING, CONDUITS, ETC.

- (a) Piping
 - Use
 - water
 - high or low pressure
 - fire mains
 - gas
 - steam
 - air
 - mail tubes
 - Description
 - hub and spigot joints
 - standard dimensions
 - length exclusive of socket
 - outside diameter
 - inside diameter
 - allowable variation in thickness
 - Special castings
 - marking
 - allowable percentage variation in weight
 - quality of iron
 - tests of materials
 - casting of pipes
 - method
 - type of mould
 - length of time allowed to remain in mould
 - vertical casting
 - which end up in casting
 - quality of castings
 - cleaning and inspection
 - coating
 - inspection before coating
 - hydrostatic test
 - weighing
 - power of engineer to inspect
 - report of inspector
 - delivery of castings
 - blocking
 - wedges
 - injury of coating
 - placing of materials inside pipe
 - Laying of pipe
 - method of jointing

- packing
 - jute
 - lead
 - quality
- caulking

- (b) Conduits
 - Who places wiring?
 - Material used
 - quality
 - Tests
 - Bedding
 - Cleaning
 - Watertight joints
 - Bends and offsets
 - Maximum number of bends between outlet boxes
 - Support and protection
 - Lengths (regular)
 - Special lengths
 - Finish and cut ends
 - Single or multiple duct diameter
 - Outlet or pull boxes
 - material
 - jointing
 - covers
 - measurement for payment
 - Closures
 - Paraffined plugs
 - Fish wire
 - left in duct?

- (c) Ducts
 - Form of
 - Location of duct line
 - Dimensions
 - Combining
 - Vitrified ducts
 - quality
 - glazing
 - interior finish
 - holes
 - shape
 - size
 - how laid
 - dowel pins
 - unbleached muslin
 - mandrels
 - rodded
 - Duct manholes
 - Laying of ducts
 - line
 - grade
 - surrounding material
 - mortar
 - on curves
 - Plugging of unused ducts

4-17 GRATINGS, HAND RAILS, VAULT LIGHTS

- (a) Steel Gratings
 - Fan and ventilating chambers
 - At stations
 - Measurement
 - Payment
- (b) Hand Rails
 - Material
 - Finish
 - Fastening
 - Measurement
 - Payment
- (c) Vault Lights
 - Material
 - Where used
 - Setting
 - Joints
 - tightness
 - provision for expansion
 - packing used
 - Non-slipping treads
 - Strength
 - Minimum limit load required
 - Tests
 - expense borne by whom?
 - Measurement
 - Payment

4-18 VENTILATING SHAFTS AND FAN CHAMBERS

- Steel doors
- Ladders
- Stairways
- Landings
- Provision for use as an emergency exit

4-19 PAINTING

- Workmanship
 - weather
 - no painting in wet or freezing weather
 - painting on dry surfaces
 - brushes to be used
- Cleaning
 - scales, grease, dirt, rust, etc.
 - by wire brush
 - by sandblast
 - by pickling
- Number of coats
 - for tunnel or run
 - for stations
- Quality of paint
 - proportions
 - formulae
 - color
 - inspection
 - preparation
 - allowable variation
 - raw linseed oil
 - specifications
 - boiled linseed oil
 - requirements
 - drier
 - turpentine
 - red lead
 - mixing
 - fineness
 - composition
 - lampblack
 - magnesium silicate
 - silica
 - red iron oxide
 - sublimed white lead
 - white zinc
 - rosin
 - fineness
 - drying
 - working quality
 - standard samples
- Shop coat
 - renewal if damaged
- Special treatment
 - treatment of steel bedded in concrete
 - treatment of recesses, which could hold water
 - treatment of surfaces in contact or inaccessible
 - treatment of turned or faced surfaces
- Payments

5-ROADS AND PAVEMENTS

- GENERAL SECTIONS. (See also Section 1—, Matters Preliminary to Contracts, and Section 3—, Specifications)
- Public convenience
 - protection of fire hydrants, driveways, houses, crossings, sidewalks, etc.
 - maintenance of barriers, lights, watchmen, etc.
 - Order and progress of doing work
 - Grade and contour of pavement
 - Preservation of Engineer's stakes
 - Preservation of monuments, etc.
 - Treatment of old material
 - Storage of new material
 - Rebuilding and adjusting street structures
 - catch basins, sewer and water frames and covers, sewer inlets, water pipes and conduits

Care in setting street structures exactly to grade
 Maintenance of clean sidewalks
 Connection with existing pavement and streets
 Curbing to be completed in advance
 Final cleaning up
 No pavement to be laid in poor weather
 engineer judge as to weather conditions
 Rejection of work not in compliance with specifications
 Measurement and payment
 Incidental work at Contractor's expense
 Extra work
 Payment
 Guaranty

5-1 PREPARATION OF SUBGRADES FOR ROADS

(a) Clearing and Grubbing

Treatment of all vegetable growth
 Width of clearing
 Engineer to be notified when complete

(b) Excavating and Embanking

Conformity to lines and grades
 Earth must not be disturbed below sub-grade
 Treatment of soft spots below sub-grade
 Disposal of excess material
 Use of spoil banks
 Appearance of finished surface
 Drainage ditches

(c) Rolling the Roadbed

Type of roller
 Weight of roller
 Duration of rolling
 Method of rolling old roadbed
 Treatment of soft spots
 Treatment of areas inaccessible to roller
 Optional treatment in case of sandy soil

5-2 BROKEN STONE ROAD

(a) Subbase Course (see Section 5-1.)

First, second and third courses
 sizes of stone used
 thickness of each course after rolling

(b) Rolling

Weight and type of roller used
 Method of duration of rolling
 Each course to be true to grade and cross-section tests

(c) Screenings

Care used in spreading
 Excess of screenings to be avoided
 Rolling
 Measurement and payment

(d) Broken Stone

Quality—trap rock, granite, hard limestone, etc.
 Tests for abrasion
 toughness
 Samples furnished to be representative
 Definition of sizes
 dust
 screenings
 Nos. 1, 2, 3 and 4
 tailings
 Crusher plant
 stationary
 portable
 supervision
 Measurement and payment

5-3 CONCRETE PAVEMENT

One or Two Course
 (clauses necessary for two course work enclosed in [....])

(a) Materials

Cement (see Section 6-1a, Cement)
 Coarse aggregate for lower course (see Section 6-1c, Stone)
 Fine aggregation for lower course (see Section 6-1c, Stone)
 [Aggregate for wearing course]
 Use of run of pit gravel
 prohibit or limit its use
 Water (see Section 6-1d, Water)
 Bituminous filler for expansion joints
 quality
 Bituminous material for surface coating
 quality
 Protection plates for expansion joints
 size and character
 Reinforcing metal (see Section 6-7, Reinforcing Steel)
 Gravel or chips for bituminous surfacing

(b) Machinery

Concrete mixer
 type
 approval of Engineer
 Roller
 design
 weight

(c) Earthwork

Excavation
 accurate to lines and grades
 disposal of material
 embankments
 method of placing and compacting
 facing
 Roadbed
 method of preparation before placing concrete
 Shoulders and side roads
 Under drains and lateral drains
 Side forms

(d) Placing Concrete

Thickness of concrete in each course
 Crown given to surface
 Proportions for concrete
 [Proportions of concrete for lower course]
 [Proportion of concrete for upper course]
 Placing of reinforcing materials
 Placing expansion joints
 Mixing and placing concrete (see Section 6-2, Mixing; and Section 6-4, Placing)
 [Placing concrete for lower course]
 [Placing concrete for upper course]
 Finishing the surface
 Beveled edges
 extent
 Curing the concrete
 protection against too rapid drying
 protection against too early traffic
 Placing macadam or gravel shoulders
 Cleaning up

(e) Bituminous Coating

Preparing surface for bituminous coating
 Composition of coating
 specifications
 Initial protection by screenings

5-4 ASPHALT PAVEMENT

(a) Sub-grade (see Section 5-1.)

(b) Foundation

Hydraulic cement concrete (see Section 5-3, Concrete Pavement)

Stone blocks relaid (see Section 5-6, Granite Block Pavement)
 defective areas to be replaced before applying wearing course

(c) Pavement to be Constructed in Two Courses

Base course
 thickness
 Surface course
 thickness

(d) Preparation of Cementing Element

From crude, native, solid asphalts
 From proper distillation of crude asphaltic oils
 Rejection of low grade asphalt
 Refined asphalt
 composition
 properties
 tests
 heat test
 water test
 Use of suitable apparatus for distilling
 Full information of source and character of crude asphalt to be furnished to Engineer

(e) Bitumens Excluded

(f) Softening or Tempering Agent

Properties
 Composition

(g) Sand

Silicious
 Free from organic matter, mica, soft grains, etc.
 Maximum allowable percentage of foreign substances
 Sharp assorted sizes
 Maximum percentage of voids
 Sieve test

(h) Pulverized Stone

Material
 Percentage of various sizes
 Substitution of Portland cement for pulverized stone
 Stone must be dry when used

(i) Asphaltic Paving Cement

Preparation
 Composition
 refined asphalt
 tempering agent
 limiting percentage of ingredients
 Agitation
 Test with standard Dow penetration apparatus
 Viscosity

(j) Wearing Course

Composition
 Mixing
 Sand separately heated
 placed in mixer first
 limiting temperatures on placing
 Pulverized stone heated second
 mixed with sand before adding asphalt cement
 no flame allowed in contact with stone
 temperature limits
 Heating asphalt cement
 temperature limits
 rejection of cement heated above limit
 thermometers
 suitable and accurate
 furnished by Contractor
 Care to accurately weigh and proportion materials charged

(k) Application

Mixing
 type of mixer
 capacity
 approval of design
 temperature limits of mixture at discharge

weighing and measuring devices accurate
 Laying asphalt pavement
 surface of base must be dry and clean
 adjacent surfaces sprinkled to prevent dust
 temperature of air and climatic conditions
 temperature of mixture on unloading
 prevention of heat loss in transportation from mixer to work
 method of placing
 dumped in piles outside of work and raked
 Laying base course
 voids must be completely filled
 average thickness after rolling
 freedom from depressions and irregularities
 joints between hot and cold materials reduced to a minimum
 rolling
 design and weight of rollers
 method of rolling
 testing contour of surface
 templates, straight edges
 maximum allowable deviation
 no hauling over course until surface course is applied
 Laying surface course
 breaks in lower course repaired
 surface must be clean
 painting of exposed surfaces of curbs, manholes, etc., with hot pitch before laying
 removal and replacing of wearing course for inspection
 hand rolling, smoothing irons
 heavy rolling as soon as possible
 method and duration
 contour and grade accurate
 test of grade by template
 maximum allowable deviation from true grade
 Treatment around street R. R. tracks
 sub-grade and pavement foundation under tracks
 special mixture in contact with rails
 tamping of concrete around rail
 treatment of contact
 heating of rails in cool weather before placing asphalt
 use of paving blocks or bricks
 method of setting
 filler

(l) Measurement and Payment

(m) Delivery of Materials

Suitable containers for asphalt
 Container to be labeled
 Each shipment to be kept separate
 Bills of lading accessible to Engineer
 Samples furnished from each carload

5-5 ASPHALT BLOCK PAVEMENT

(a) Sub-grade (see Section 5-1.)

(b) Foundation

Hydraulic concrete
 Broken stone

(c) Asphalt Blocks

Dimensions
 same for blocks on same street
 Defective blocks to be rejected
 Material and composition
 trap rock or limestone
 sand
 pulverized stone
 asphaltic cement
 Manufacture
 materials to be thoroughly mixed
 temperatures of ingredients and mixture
 minimum pressure used

blocks cooled in air or water?
 specific gravity of blocks
 maximum percentage of water absorbed when immersed
 rattler test
 maximum allowable loss in percentage

(d) Laying Blocks

Foundation clean and dry
 Small blocks set on mortar base
 Large blocks set on sand cushion
 Mortar composition wet
 thickness of layer
 leveled by templates
 Blocks set with longest dimension across the street
 set as close together as possible
 Blocks to break joints
 Only whole blocks to be used except at edges of pavement
 Each course laid continuously
 Method of compacting ends of course
 Tamping
 Poorly set blocks replaced
 Test by template or straight edge
 Layer of sand placed on top
 Treatment around R. R. tracks (see Sections 5-4k and 5-6e, Application)
 Street not opened to travel until Engineer allows

5-6 GRANITE BLOCK PAVEMENT

(a) Preparation of Sub-grade (see Section 5-1)

(b) Foundation

Hydraulic cement (see Section 5-3, Concrete Pavement)

(c) Granite Blocks

Quality
 Properties
 No rock outcrop or seamy stone allowed
 Blocks from different quarries kept separate and laid together
 Blocks to be properly culled
 Dimensions
 Test of blocks
 for toughness
 for abrasion

(d) Sand Cushion

Depth after ramming blocks

(e) Application

Setting blocks
 perpendicular to street surface
 length at right angles to street
 method at street intersections
 Ramming
 each block to be rammed
 rammers
 weight
 material
 Filling of joints
 use of gravel
 limiting sizes
 freedom from foreign matter
 mixture with bituminous paving cement
 joints first filled with dry gravel
 heated to defined limits
 paving cement poured thereon
 alternative filled—Portland cement grout
 composition of grout
 mixing
 care and timing of work
 Fitting paving around other structures
 street R. R. tracks
 sub-grade to extend under rail uninterrupted
 mortar for filling
 composition
 arrangement of courses close to rail

Bridge stone crossings
 same material as blocks
 limiting dimensions
 angle of ends
 set in advance of paving blocks

(f) Measurement and Payment

5-7 BRICK PAVEMENT

(a) Sub-grade (see Section 5-1)

(b) Foundation

Hydraulic concrete (see Section 5-3, Concrete Pavement)
 thickness
 surface true to cross-section

(c) Sand Cushion

Depth after rolling
 Quality of sand
 Shaped to specified cross-section
 Template and guide timbers
 Rolling
 hand roller
 weight and diameter
 minimum length of handle
 Cushion not to be disturbed before laying brick

(d) Paving Brick

Dimensions
 Brand
 Shape
 No distorted bricks allowed
 Lugs or raised letters permitted?
 Manufactured especially for paving purposes
 Changes in brand and color allowed?
 Uniform burn
 Color
 Annealed
 Special brick for steep grades
 Free from flaws, cracks, etc.
 Tests
 number of bricks
 rattler test
 allowable average and maximum losses
 water test
 rejected bricks kept separate and labeled conspicuously
 samples submitted to be representative
 delivery of brick
 Inspection
 Storage
 Care used in handling
 Method of transportation from piles to work

(e) Application

Setting brick
 method of arranging courses
 on straight stretches
 on curves
 on street intersections
 beside curbs, tracks, manholes, etc.
 lugs to be laid in one direction
 Rolling and ramming brick
 method pursued
 type and weight of roller
 test of surface after rolling
 use of straight edge and template
 length
 maximum allowable distortion
 Filling joints
 material used
 asphalt filler
 pitch and bituminous cement
 hydraulic cement grout
 method of filling
 type of distributor used
 grout to be kept in constant motion until in place
 bricks to be wet before filling
 treatment of expansion joints
 Travel excluded from pavement

5-8 WOOD BLOCK PAVEMENT

- (a) Sub-grade (see Section 5-1)
- (b) Foundation
 - Portland cement concrete
- (c) Wood Blocks
 - Material
 - One kind only on a job
 - Sizes
 - Only wood from live, sound trees to be used
 - Blocks to have square corners
 - Chamfered blocks for grades
- (d) Preservative
 - Creosote oil
 - composition
 - method of manufacture
 - kinds of oil rejected
 - Treatment
 - kind
 - all parts of block to be impregnated
 - maximum allowable dilution of oil by water during process
 - determination of quantity of oil injected
 - test
 - only seasoned blocks to be treated
- (e) Laying Blocks
 - Foundation clean
 - Use of sand cushion
 - Blocks to be kept wet by sprinkling before laying
 - Layer of mortar
 - blocks set in mortar to be rolled before it has set
 - Method of coursing
 - at street intersections, manholes, tracks, etc.
 - Grain of blocks set perpendicular to base
 - One row parallel to curb
 - Blocks set close together as possible
 - Blocks to be rammed
 - method
 - Finished surface true to grade and cross section
 - Are joints to be filled?
 - material
 - sand
 - bituminous filler
 - specifications
 - Inspection
 - Expansion joints
 - maximum spacing
 - method of construction
 - Street not open to travel until Engineer directs

5-9 BITUMINOUS CONCRETE PAVEMENT

- (a) Sub-grade (see Section 5-1)
- (b) Foundation
 - Old Macadam pavement
 - leveling or dressing down
 - care to prevent undue disturbance of original pavement
 - treatment of newly dug or filled trenches
 - use of hydraulic cement in leveling roadway
 - Old stone or brick pavement
 - use if in good condition
 - if reset, grout to be used for joints
 - treatment of holes or depressions
 - Hydraulic cement foundations (see Section 5-3, Concrete Pavement)
 - Broken stone foundations (see Section 5-2, Broken Stone Road)
 - No travel permitted on foundation until surface is placed

- (c) Bituminous Concrete
 - Composition
 - crushed stone (see Section 5-2c)
 - sand (see Section 5-4g)
 - pulverized stone (see Section 5-4h)
 - substitution of hydraulic cement
 - asphaltic cement
 - percentage, by weight, of ingredients
 - Mixing
 - Placing
 - temperature at unloading mixture
 - spreading
 - Test

5-10 GROUTED PAVEMENT**5-20 GENERAL SPECIFICATIONS FOR EXPERIMENTAL OR UNTRIED PAVEMENTS**

- (a) Contractors Submitting Proposals for Construction of New Pavements Must Submit Specifications
- (b) Special Guaranty
 - Minimum duration of pavement in good condition
 - Contractor to maintain pavement in good condition for specified time at his own expense
 - Engineer or successor the judge as to condition
 - Procedure on failure of Contractor to repair or replace
- (c) Bond Given by Contractor
 - Amount
 - Surety

5-30 HYDRAULIC CEMENT CONCRETE COMBINED CURB AND GUTTER

- (a) Design
 - Made in accordance with plans
 - Provision for variation in cross-section at special places
- (b) Excavation
 - Drainage trench
 - limiting dimensions
 - filling
 - broken stone
 - coarse gravel
 - method of filling
 - drain connected to sewer at suitable intervals
- (c) Concrete (see Section 6—, Concrete; also Section 5-3, Concrete Pavement)
 - Single rich mixture or core with facing
- (d) Application
 - Expansion joints
 - length between joints
 - widths of joint
 - Circular corners at street intersections
 - Corner protection
 - Finishing of surface
 - Forms
 - Protection during work
 - Replacing injured work
- (e) Measurement and Payment

5-40 HYDRAULIC CONCRETE SIDEWALKS

- (a) Design
 - Number of courses
 - Width
 - Distance from outer curbing
- (b) Excavation and Grading
 - Preparation of sub-grade
 - Drainage course
 - broken stone
 - gravel

boiler-room cinders
use preceded by thorough wetting
rolling or ramming
connection to street drains

- (c) Concrete Lower Course (see Section 5-3, Concrete Pavement)
 - Maximum size of crushed stone used
 - Grade
- (d) Surface or Finishing Course
 - Thickness
 - Composition
 - Wet mixture
 - Care to obtain uniform consistency throughout
 - Finishing surface
 - Rounding corners
- (e) Application
 - Forms
 - Expansion joints
 - spacing
 - method of construction
 - transverse joints
 - joints between curb and walk
 - Protection during and immediately following construction
 - Regarding after removal of forms
 - use of rich surface soil
- (f) Defects Repaired for Specified Time by Contractor
- (g) Measurement and Payment

6-CONCRETE**6-1 COMPOSITON**

Give proportions for various classes of work

- (a) Cement
 - Grades
 - specify grades for various classes of work
 - portland
 - natural
 - puzzolan, slag, or tufa
 - silica or sand
 - mixtures
 - conformation of grade to local building ordinances
 - Form of proposal for furnishing cement
 - Brand
 - list of brands used given to Engineer by Contractor
 - brand chosen to have been in use on work of equal importance
 - reputation of Manufacturer
 - requirements in case of use of unknown brand
 - change of brand for work undesirable
 - maximum number of brands allowed on work
 - mixing of brands not allowed
 - color of brands to be uniform
 - brand to receive approval of Engineer
 - well known brand may be approved on short time tests
 - failure of brand to prohibit further use on work
 - Shipment of cement
 - sealing of each package
 - responsibility for damage
 - prevention of substitutions in transit
 - contractor responsible for demurrage
 - box cars not allowed for storage purposes
 - notice sent to Engineer of arrival
 - contractor to provide for unloading, hauling and storage of cement
 - procedure in case of shortage

method of packing and shipping
barrels
bags
stout paper
cloth
bulk canvas
trade-mark on each package
capacity of packages
condition at delivery
treatment of broken barrels or sacks
protection of cement during shipment from rain and moisture
marking of gross weight on packages
maximum allowable percentage for leakage
barrels properly lined
prompt unloading of cars
delay of delivery may prohibit use on work
size of shipment
bills of lading accessible to Engineer

Storing of cement
storehouses
location near work
precautions when located near sea or in a damp place
size
weathertight
protection against moisture and drafts
floors raised from ground
provided with scales for weighing

method of storing
each shipment kept separate
aisles for access of inspectors
system for location of any package
stored so that older cement will be used first
identification marks on each package
disturbance of

storekeepers
competency
keeping of records
minimum allowable amount of accepted cement kept in store
disposition of empty sacks
storage of cement in the open
maximum allowable amount
protection from weather

Tests

sampling of cement for testing
method used, from
carload lots
barrels
bags
storehouse
sample representative of what quantity?
mixing of samples (allowable or not?)
no extension of time granted Contractor due to delay caused by tests
performance by competent persons
re-testing of cement stored beyond a certain time
mill inspection and tests
certificate of manufacture
date of manufacture
tests and analyses
statement that cement is not adulterated
contractor to furnish copies of mill tests
inspection of raw materials and methods of manufacture
tests made in presence of Engineer or representative
contractor to furnish acceptable inspectors
records of inspection at disposal of Engineer

facilities for mill inspection
manufacturer to furnish necessary tools, labor, etc., for inspection
expense included in bid
provision for inspection en route
provision for inspection at delivery
provision for inspection in storage
field inspection and tests
contractor to furnish suitable house
equipment
heating
simple field tests
mortar box tests
laboratory inspection and tests
selection by approval of Engineer
expense borne by whom
protection of samples shipped to laboratory
sample accompanied by manifest giving complete data of same
quantity of sample
marking of sample
time of sending
charges prepaid
identity of maker given or withheld?
visiting of laboratory by interested parties
tests made in accordance with methods suggested by the committee on Uniform Tests of Cement of the American Society of Civil Engineers
records of tests
limits of accuracy desired in per cent

Requirements for use of cement
no cement used on work that has not been accepted by the Engineer
cement that has been exposed to moisture rejected
lumpy cement
rejected or pulverized?
right of Engineer to make extended tests
papers and all rubbish to be removed from cement
unnecessary use and waste of cement
deduction for excess
where finished work contains more than is specified
abandoned concrete (mixed but not placed)
loss in transmission to work
loss by spilling
allowable percentage lost
use of less cement
manufacturer must guarantee recent aeration of cement

Acceptance of cement
requirements
uniformity
fineness
specific gravity
time of setting
tensile strength
constancy of volume
boiling water test
chemical composition
color
microscopic test
tagging of accepted cement
Rejection of cement
removal of rejected cement by Contractor
expense borne by Contractor
time limit
freight on rejected cement
removing work due to defective cement
expense borne by Contractor

caked cement to be rejected
prompt removal of acceptance seal from rejected cement
adulterated cement to be rejected
decision of Engineer to reject cement to be final

Measurement
unit of measure
Payment

(b) Sand

Where obtainable
Coarse
Sharp
Silicious
Maximum percentage of mica, loam, dirt or clay allowed therein
Use of local sands
Fineness
Submission of samples to Engineer
size of samples
name of collector
Measurement
Payment

(c) Stone

Kinds of rock permitted
Gravel
Limestone
Igneous rock
Mixture
Limiting sizes of crushed stone
"Run" of crusher permitted?
Use of local stone
permitted under what conditions?
Submission of samples to Engineer
size of sample
name of collector
Screening
Washing
Use of large stones for rubble concrete or cyclopean masonry
method of placing
Measurement
Payment

(d) Water

Composition
Means for measuring

6-2 MIXING

(a) By Hand

Method used
Size of batches

(b) By Machine

Type of mixer used
Approval of Engineer
Provision for inspection of mixing

(c) Methods of Determining Proportions

Measures used
Mechanical analyses
Allowances for moisture

(d) Details

Cleanliness of ingredients before mixing
Location of mixing apparatus
Retempering
Remixing of concrete compacted in transportation
Mixture used for steep slopes

6-3 TRANSPORTATION FROM MIXER TO WORK

Cars, wagons, buckets, etc.
tightness
approval of design
Rapidity of transportation
Maximum allowable time between mixing and placing

6-4 PLACING

(a) Methods Used

Hand
Chutes
Spouting plants
Buckets

(b) Application

Size of batches
Order used in placing
Thickness of layers
Length of sections
Compacting
"joggled" to expel air
ramming
spading

(c) Details

Imperfections in placing
Maximum drop allowed
Keeping concrete moist after placing length of time
Care used in placing around pipes, ducts, etc.
Time allowed for setting
Finish of surfaces that will set before adjoining concrete is placed

(d) Placing Concrete Under Water

Chutes
Bags
Buckets

(e) Placing Concrete in Compressed Air**(f) Procedure When Placing on**

Rock
cleaning
Earth
ramming
Old concrete
dovetails or grooves
cleaning
wetting
coating of cement or mortar
Cast-iron or steel lining

(g) Precautions During Freezing Weather

Placed on approval of Engineer
Apparatus for heating materials used
Salt hay
Canvas
Tarpaulin
Method for keeping air warm under covering

(h) Precautions in Hot Weather

Covering to prevent rapid drying
Wetting of concrete

(i) Protection of Fresh Concrete from Injury**(j) Expansion Joints****6-5 FORMS AND MOULDS**

Design
Material used
wood
metal
How set
Precautions in placing
Strength to withstand ramming
Tightness
Caulking
Cleaning and wetting
Soaping or oiling to prevent adhesion of concrete
Material to give smooth finish to concrete
Provision for rejection of unsatisfactory forms
Supports for forms
rods
removal
plugging of resulting voids

Removal of forms
Replacing of old forms
Invert forms for tunnels
built for flowing concrete beneath, not screeding
Panels for weepers

6-6 SURFACE FINISH

Rough surface for plastering
Surfacing for waterproofing
Brush coat of grout
Granolithic finish
Surfacing with mortar
Preparation for surfacing
scrubbing
washing with acid
tool dressing

6-7 REINFORCING STEEL

Classes
plain
deformed
cold twisted
Basis of purchase
Manufacture
bessemer
open hearth
no rerolled material
twisting
Chemical properties and tests
maximum allowable percentage of phosphorus
Physical properties and tests
tension tests
modifications in elongation
bend tests
Permissible variations in weight
Finish
Inspection
Rejection
Placing
Fastening
Protection

6-8 GROUT**(a) Time for Grouting****(b) Steel Pipe for**

Where used
Standard weight
Placing

(c) Plant and Equipment for Grouting

Compressors
capacity
pressure used
cooling
gauges
portability
valves and connections
maximum allowable weight
submission of designs
Grouting machines
design
strength
hydraulic pipe and fittings
making connections to piping
sizes
tests

(d) Sand for Grout

Fineness
Storing
Protection from moisture

(e) Mixing and Placing of Grout

Consistency
Freedom from lumps when put in mixer

Continuous feeding of section
Uniform delivery
Grout not be forced long distances
Order of grouting sections
Regrouting and blowing water

(f) Grouting Pads

Number
Material
Strength
Gaskets
Material and workmanship
Setting grouting pads
method
tightness
leaks

(g) Sulphate of Alumina for Waterproofing Grout**6-9 MASS CONCRETE**

Materials
Proportions

6-10 CYCLOPEAN MASONRY

Proportions of concrete used
Placed wet
Method and care in placing
Bonding of stones used
Size and shape of stones
Racking
Trowel work
Expansion joints
Intervals
Type
Cold water paint to prevent adhesion
Facing
Finishing

6-11 CONCRETE BLOCKS

Where used
Cement (see Section 6-1a)
Sand
Aggregates
Methods of manufacture
Unit of measure
Proportions
Mixing
Moulding
Steel rods
Curing
protection
Minimum age before using
Marking
Mortar for joints
Maximum unit load to be placed on blocks
Size and dimensions
Setting blocks
Bonding
Pointing and repointing joints
Care in storage and handling
Protecting and sprinkling
Preliminary tests
Additional tests
Test requirements
Representative sample
Marking of samples
Transverse test
Compression test
Ultimate test
Condemned blocks to be destroyed

7-DAMS

(See Dams under Hydro-Electric Construction in Power Plant Digest, page 46.)

PART II—POWER PLANT DESIGN

1—GENERAL CLAUSES

This section is intended to cover the questions that must be answered in the General Clauses which should accompany every set or section of specifications sent out for bids.

1-1 CONTRACT MEANING OF TERMS USED

- (a) Owner
- (b) Architect
- (c) Purchaser's Representative
- (d) Or Equal Approved

1-2 STANDARD APPARATUS

- (a) Is Standard Apparatus to be Estimated on Even if it Does not Strictly Comply with Specifications?
- (b) How Shall Deviations from Specifications or Plans be Noted by Bidder?
- (c) How Shall Deviations from Specifications or Plans be Controlled?

1-3 CONTRACT BASIS

- (a) On Purchaser's Specification
- (b) On Bidder's Proposal
- (c) On Combination of Above

1-4 DRAWINGS

- (a) Are Any Items not Shown on Drawings Required?
- (b) Are Any Items Required if Shown on Drawings, but not Specified?
- (c) Are Drawings Approximate or Definite?
Scale or figured dimensions have preference?
Centering of electric outlets in panels and ceilings
- (d) Will Copies of Drawings be Given to Bidders?
Time allowed for taking off quantities
Penalty for failure to return in specified time
Keeping clean and free from marks
Supply of copies after award of contract by whom?
Whose property are drawings given to Contractor?
- (e) Measurements on Buildings
Made by whom?

1-5 MATERIALS

- (a) Quality of Materials
- (b) Small Details Required for Complete Finish, if not Specified or Shown, Supplied by Contractor without Extra Charge?
- (c) Completion to Satisfy Reasonable Requirements of Whom?
- (d) Pending Completion Has Purchaser Right to Operate Apparatus or Shall Contractor Control until Acceptance?
- (e) Samples of Materials
- (f) Who Supplies Tools, Derricks, Scaffolding, Hoists, etc.?
- (g) Who Pays Freight Charges?
- (h) Any Penalty on Contractor for Failure to Pay Freight and Other Charges?

1-6 WORKMANSHIP

- (a) Quality of Work Demanded
- (b) Who Condemns Defective Work?

- (c) Are Inspections on Contractor's or Client's Behalf?
- (d) How Shall Contractor Check the Quality of Work?

1-7 LABOR

- (a) Shall Labor be Union Labor?
- (b) Who Decides Which Union if Two Exist in Same Trade?
- (c) Procedure with Intoxicated or Troublesome Workmen

1-8 DELIVERY AND STORAGE

- (a) Where Is Date of Delivery Noted?
- (b) Can Premises be Used for Storage Pending Construction?
- (c) Who Pays for Storage of Material, if Required, at Manufacturer's Plant or Elsewhere Away from Premises?

1-9 WORK OF OTHER CONTRACTORS

- (a) Co-operation
- (b) No Interference with Work of Others
- (c) No Damage to Work of Others

1-10 SUB-CONTRACTORS

- (a) Allowed or Not?
- (b) Names to be Submitted to Whom?
- (c) Names to be Approved by Whom?
- (d) No Relief from Responsibility?

1-11 DAMAGE TO WORK

- (a) Who Takes Risk of Damage After Delivery?
- (b) Who Provides Protection during Construction?
- (c) If It Is Impossible to Prevent Damage, What Notices Must be Sent and to Whom?

1-12 INSURANCE

- (a) Who Supplies Fire Insurance?
- (b) Who Supplies Liability Insurance?
- (c) Who Supplies Boiler Insurance?

1-13 PATENTS

- (a) No Unlawful Use
- (b) Defense of Suits
- (c) Payments of Judgments
- (d) Payments of Royalties

1-14 EXCAVATION AND CUTTING

- (a) Who Does Excavation?
- (b) Who Does Cutting?
- (c) Who Cleans Up?
- (d) Who Carts Away Debris?

1-15 CHANGES

- (a) Changes not Involving Extra Cost to Contractor?
- (b) Changes Involving Extra Cost to Contractor?
- (c) Changes Reducing Cost to Contractor?
How will these be charged for?
Any allowance to be made for omissions?
- (d) How Ordered?

1-16 EXTRA WORK

- (a) Extra Work Subject to Specifications?
- (b) Additions and Omissions (see Section 1-15, Changes)
- (c) How Ordered?
- (d) How Checked?

- (e) Percentage to be Charged above Cost:

What shall "Cost" include?
Any allowance for office expenses, superintendence, tools, insurance, etc.?

- (f) Any Estimates Required?
How detailed?
- (g) In Event of Dispute as to Value, Who Shall Decide?
- (h) Pending Settlement of Dispute What Action Shall be Taken?

1-17 OVERTIME

- (a) Rate for Overtime
- (b) Who Pays for Overtime Work?
- (c) Is Full Cost of Overtime Work to be Paid, or Only Additional Cost?
- (d) Where Overtime Is Necessitated Through Failure of Contractor, Who Pays?
- (e) How Ordered?
- (f) How Checked?

1-18 TESTS AT FACTORY

- (a) Required with What Apparatus?
- (b) Who Makes Test?
Who supplies load?
Who supplies instruments?
- (c) Witnessed by Whom?
- (d) What Expenses of Inspector Are to be Paid by Contractor?
Traveling
Hotel
Inspection charge
- (e) Where Are Test Requirements Detailed?
In section of specification or in contract
- (f) Any Preliminary Test to be Made Before Making Witness Test?
- (g) Is Test at Factory an Acceptance Test?

1-19 TESTS OF BUILDING

- What Tests Will be Made?
- (a) Electric-Wiring Installation
Insulation
Voltage drop under load
- (b) Engines and Turbines
Capacity
Valve setting
Efficiencies at what loads? (Mechanical efficiency and steam consumption per horse-power hour)
Regulation
Noiseless operation and freedom from vibration
For internal-combustion engines and compressors, amount of water used for cooling
Other contract requirements
- (c) Dynamos
Capacity
Efficiencies
Temperature rise
Compounding
Voltage regulation
Commutator
Balance (electrical and mechanical)
Noiseless operation
Other contract requirements
- (d) Refrigeration Machinery
Capacity of machine
Ice-making capacity

Room and box temperature
Water cooling
Efficiencies
Amount of cooling water required
Absence of leaks
Noiseless operation and freedom from vibration
Other contract requirements

(e) Boilers and Producers

Capacity
Quality of steam and gas
Freedom from leaks
Other contract requirements

(f) Piping Systems

Freedom from leaks
Pressure drop (if this is specified)

(g) Storage Battery

Capacity
Absence of buckling
Regulation
Other contract requirements

(h) Heating and Cooling Systems

Freedom from noise
Freedom from water hammer
Freedom from trapped pipes
Circulation
Meeting contract requirements of temperature and humidities
Regulation of temperatures
Absence of leaks
Other contract requirements

1-20 GUARANTEES

(a) Against What Defects?

Design
Workmanship
Material
Delays
Insufficiency

(b) Term of Guarantee

Starts with what date?

(c) Bond Required

For what amount?
Extends until what time?
Character of sureties required

(d) Repair of Defects

Who makes?
Are repairs to be f. o. b. shop, or are repairs to be made on the job?
Time allowed?
Notice sent by whom—client, architect, consulting engineer, contractor, bonding company—and to whom?

(e) In Event of Failure to Make Good Procedure

How will cost of making good be charged?
What charge for supervision of repairs?
Privilege of rejection
Right to recall payments?
Right to use installation and deduct fair value of repair of defects?

1-21 PERMITS AND CERTIFICATES

(a) Who Applies for Permits and Certificates?

From insurance authorities
From State and municipal authorities

(b) Who Pays for Permits, Certificates and Inspections?

1-22 PAYMENTS

(a) Made by Whom?

(b) On Whose Approval, How Evidenced?

(c) First Payment When?

(d) Other Payments When?

(e) Final Payment When?

(f) If Delivery or Final Acceptance Is Delayed on Purchaser's Account, When Will Payments be Made?

2-BOILERS AND STACKS

NOTE: Under this section are grouped matters belonging strictly to the steam-generating plant: Boilers, Setting, Superheaters, Stokers, Fuel Supply and Ash Removal, Oil-Burning and Gas-Burning Equipment, Smoke Stack. Following established custom, Smoke Breeching will be found under the steam-fitting section (No. 4-1 *et seq.*), where also the auxiliaries of the boiler plant appear.

Items marked with an asterisk (*) may be specified or, preferably, left for the boiler maker to specify. They are noted here to call attention to the necessity for definite knowledge and understanding on these points before the contract is placed.

2-1 TYPE OF BOILER

- (a) Horizontal Fire-tube
- (b) Vertical Fire-tube
- (c) Horizontal Water-tube
- (d) Vertical Water-tube
- (e) Enclosed Fire-box Types
 - Marine
 - Sectional
 - Locomotive

2-2 GENERAL DESCRIPTION

- (a) Number
- (b) Horse Power Required
 - Number of sq. ft. heating surface per horse power
 - Even load or varying load?
- (c) Character of Fuel
 - Coal
 - Oil
 - Gas
- (d) Diameter of Shell (Horizontal Fire-tube), Steam Drum (Water-tube)
 - Number of courses
- (e) Number and Length of Tubes
- (f) Diameter of Tubes
- (g) Arrangement of Setting
 - Single or in battery
- (h) Height and Diameter of Stack. (See also Section 2-27, Smoke Stack)

2-3 DIRECTIONS AS TO DELIVERY AND ERECTION

- (a) Who Supplies Boilers, Castings and Trimmings, f. o. b. Cars?
- (b) Who Takes Boilers, etc., from Cars and Erects? Cribbing Furnished by Whom? Horizontal Fire-tube, Water-tube
- (c) Who Sets up Castings?
- (d) Who Does Mason Work?
- (e) Who Makes Smoke Connections?
- (f) Date of Delivery Desired?
- (g) Provision for Expansion in Boilers
- (h) Provision for Expansion in Fronts
- (i) Provision for Expansion in Grates
- (j) Who Furnishes Water for Erection and Test?

2-4 METHOD OF SUPPORT

- (a) By Lugs (Horizontal Fire-tube, Water-tube)

(b) From Beams (Horizontal Fire-tube, Water-tube)

(c) Saddles (Enclosed Fire-box)

2-5 WORKING PRESSURE

- (a) Working Pressure
- (b) How Test Is to Be Applied
- (c) Inspection by Whom?
- (d) Safety Valves Set at What Pressure?

2-6 THICKNESS

- (a) Heads
- (b) Shell or Steam Drum
- (c) Front
- (d) Furnace (Enclosed Fire-box)
- (e) Mud Drum (Water-tube)

2-7 GRATES

- (a) Length
- (b) Width
- (c) Type
 - Stationary, shaking, dumping, horizontal or inclined
- (d) Air Space and Percentage of Air Space
- (e) Height above Floor
- (f) Pitch
- (g) Method of Support
- (h) Furnished by Whom?
- (i) Installed by Whom?
- (j) Weight per Square Foot
- (k) Any Mechanical Stoker?
- (l) Any Fuel Conveyor?

2-8 MANHOLES AND HANDHOLES

- (a) Number
- (b) Size
- (c) Location
- (d) Type of Covers
- (e) Reinforcing of Openings
- (f) Material of Covers
- (g) Gaskets
- (h) Wrench

2-9 STEAM OUTLETS

- (a) Number
- (b) Size
- (c) Construction
 - Flanged or screwed
 - Forged, pressed or cast steel, cast-iron. Standard or extra-heavy
 - Length of nozzle
- (d) Water Separator
 - Construction
 - How connected to steam outlet?

2-10 ANY DOME (HORIZONTAL FIRE-TUBE)

- (a) Diameter
- (b) Height
- (c) Detail

2-11 OTHER OUTLETS

- (a) Water Column, Sizes
- (b) Feed, Sizes
- (c) Blow-off, Sizes
- (d) Surface Blow-off, Sizes
- (e) Safety Plug, Sizes

2-12 OUTLETS IN FRONTS

- (a) Water Column, Sizes
- (b) Feed, Sizes
- (c) Blow-off from Column, Sizes
- (d) Tube Doors, Sizes

- (e) Fire Doors, Sizes
- (f) Ash Doors, Sizes
- (g) Return Flue Door, Sizes
(Horizontal Fire-tube)

2-13 OPENINGS IN SETTINGS

- (a) Manholes
- (b) Steam Pipes
- (c) Clean-out
- (d) Blow-offs
- (e) Water-leg Clean-outs (Enclosed Fire-box)
- (f) Soot Doors (Water-tube)

2-14 ITEMS TO BE FURNISHED

- (a) Water Separator
Type
Size
Allowed makes
- (b) Plates and Rollers for Lugs (Horizontal Fire-tube)
Size and construction
- (c) Internal Feed Pipe
How supported?
Size, diameter and length of pipe
- (d) Fusible Plug
- (e) Water Column
Type
Size
Kind of gage cocks
Kind of gage glass
Allowed makes
High- and low-water alarm
Feed-water level regulator
- (f) Steam Gage
Size
Finish
Pressure range
Allowed makes
Who connects?
Method of support
- (g) Blow-off Cock
Type and size
Allowed makes
- (h) Blow-off Valves
Type and size
Allowed makes
- (i) Feed Valves
Type and sizes
Allowed makes
- (j) Check Valves
Trimnings
Method of support
Allowed makes
- (k) Water-column Valves
Trimnings
Method of support
Allowed makes
- (l) Safety Valve
Type
Trimnings
Method of support
Allowed makes
Discharge carried where?
- (m) Stack Plate (Horizontal Fire-tube)
- (n) Dead Plate
- (o) Arches and Jambs and Rear Arches, Baffle Tiles
- (p) Manhole Frames
- (q) Clean-out Frames and Doors
- (r) Buckstays
Number, length and type
- (s) Tie Rods
Where required?
How fastened?

- (t) Superheater
- (u) Tube Cleaners
Number
Type
Allowed makes
- (v) Special Systems of Draft-control
With or without mechanical draft?
Allowed makes

2-15 MATERIAL

- (a) Shell
- (b) Head
- (c) Tubes
- (d) Fronts
- (e) Rivets
- (f) Braces
- (g) Buckstays
- (h) Furnaces (Internally Fired Boilers)
- (i) Baffle Tiles (Water-tube Boiler)
- (j) Mud Drum (Water-tube Boiler)

2-16 DETAILS OF CONSTRUCTION

- (a) Fronts
Flush, or over-hanging
Full or half front
Double or single tube-doors
Double or single fire-doors
Double or single ash-pit doors
Any return flue
Construction of doors
Any special construction, for shaking or dumping grates or forced draft or mechanical stokers or extended furnace?
- (b) Tubes
Spacing
Beaded or flared ends?
How expanded?
Height of top row of tubes
How are tube holes to be made?
Any specially heavy tubes or stays?
Material and construction of headers, water-tube
Space behind boilers for withdrawing tubes
- (c) Shell and Heads
Convex or concave heads?
Curtain sheet?
How are supports to be fastened?
Scarfig, lap over rivets, assembling of joints
Planing of girth seams of horizontal boilers when plates are over $\frac{5}{8}$ inch thick
Straps
shaping
finish of edges
scarfig
- (d) Seams
Lap or butt joints? If butt joints, triple or quadruple riveted? If lap seams, single or double riveted? Minimum distance allowed between rivet hole and edge of plate
Longitudinal seams
single or double riveted?
- (e) Riveting
Holes punched? Drilled or punched and reamed?
Method should be described
Unfair holes?
Use of drift pin?
Calking
- (f) Bracing
Size and type of braces
Any through braces?
Number of braces
Bracing below tubes of horizontal boilers
- (g) Stays
Minimum diameter

Type of thread and number of threads per inch
Method of fastening to sheets
Material

- (h) Bolts and Studs
Material
Diameter
Allowable stresses

- (i) Standards of Construction
Massachusetts laws?
U. S. naval practice?
What insurance company's requirements to be met?

2-17 SPECIAL NOTES FOR MARINE-TYPE BOILERS OR OTHER INTERNALLY FIRED BOILERS

- (a) Furnaces
Type
wet back
dry back
Number in each boiler
Diameter
Length
Thickness
Material
Method of support
Any special design for stokers?
Diameter opening front head
Diameter opening rear head
- (b) Front Connection
Material
Thickness
Area
Doors
Damper
Covering
Liner
- (c) Back Connection
Material
Thickness
Method of support
Lining
Roofing
Clean-out
Covering
- (d) Covering of Whole Boiler
Covering of heads

2-18 INSURANCE

- (a) Amount of Insurance?
- (b) What Company?
- (c) Any Report Required of Inspection?

2-19 TEST AT WORKS

- (a) Any Tests by Purchaser's Inspector at Works?
- (b) Expenses to be Included?

2-20 SUPERHEATERS

- (a) Location?
- (b) Type
- (c) Material
- (d) Method of Support
- (e) Steam Pressure Carried
- (f) Degree of Superheat Required
- (g) Probable Load Conditions
- (h) Fuel Used
- (i) Capacity
Pounds of steam per hour
Percentage of moisture in original steam
- (j)* Number of Square Feet of Heating Surface
- (k)* Prevention of Burning Out
- (l) Delivery and Erection
Who delivers, erects and connects?

- (m) Cleaning
Means for cleaning outside surface
Means for inspection of inside surface
- (n) Mason Work
Any required?
Done by whom?
Material supplied by whom?
- (o) Allowed Makes

2-21 BOILER SETTING

- (a) See Boilers for Details of Sizes, Conditions of Delivery at Building and on Cribbing, Setting of Castings. Whether Boilers Are Set Single or in Battery and Method of Support; also kind of Grates, Number of Clean-Outs, Number of Manholes, Buckstays, Type of Furnace, etc.
- (b) Materials for
Furnace lining
Combustion chamber
Return flue (if any)
Baffle arches
Front arches and jambs
Bearing walls
Curtain walls
Bridge walls
Top of setting
Top of walls
Ash pit
Floor of combustion chamber
Firing pit
Outside walls
- (c) Workmanship
- (d) Fire and Common Brick
How laid?
header courses where?
In what material are fire bricks to be set?
In what material are common bricks to be set?
Joints how made in fire brick courses?
Joints how made in common brick courses?
- (e) Cap Stones
Length and thickness
How set?
- (f) Special Brick
How supported?
- (g) If Return Flue Is Used
Method of support
Thickness of arch or roof
- (h) Framing for Steam Outlets
Manholes
Blow-off connections
Clean-outs
- (i) Foundations
- (j) Drainage of Boiler Pit
- (k) Waterproofing; Any Iron Pan?
- (l) Plan Elevation and Section

2-22 MECHANICAL STOKERS

- (a) Location of Plant
- (b) Number of Boilers
Type of boilers
- (c) Rated Capacity of Boilers
- (d) Overload Capacity Required
- (e) Fuel Analysis
- (f) Load Conditions
- (g) Type of Stoker
Chain-grate
Inclined-grate
front-feed
side-feed
side-feed self-cleaning

- Underfeed
Shovel stoker
- (h) Motive Power
Apparatus by whom?
Connection by whom?
- (i) Mason Work
By whom?
Details (see Section 2-21, Boiler Setting)
- (j) Forced Draft
Apparatus furnished by whom?
Connections by whom?
Duct work by whom?
Motors, fans and blowers, see Index
Power required to operate fans and blowers, in percentage of rated capacity of boilers
- (k) Natural Draft Obtainable in Furnace
- (l) Supply of Fuel
Any crusher required?
Whence is supply derived?
How controlled?
How weighed?
- (m) Removal of Ash
How discharged from fire?
How removed?
(See also Section 2-23, Coal and Ash Handling)
- (n) Renewal of Parts
- (o) Special Furnace Construction
Is any required?
Space needed, length, width and height
Excavation required
- (p) Foundation
- (q) Guarantees
Life of stoker and refractory arch (if any)
Efficiencies at various capacities
What grade of fuel may be burned?
Maximum percentage of overload?
How long can fire be left inactive (banked)?
Smokelessness up to what rating?
- (r) Allowed Makes

2-23 COAL AND ASH HANDLING

- (a) Storage and Delivery
Kind of material to be handled?
How and where received?
How and where stored?
How and where delivered?
Is storage pile separate from storage for daily use?
Is fuel to be weighed on delivery and ashes on removal?
Is fuel to be weighed as used?
Maximum quantity fuel delivered or ashes removed at one time
How fast must fuel be removed from point of delivery?
Maximum quantity per day
Maximum quantity per hour
- (b) Material and Details of Construction
Kind and weight of material used and details of:
car
track
conveyor
crusher
piping
hopper
scales
- (c) Erection
Who erects apparatus?
Who builds foundation?
Who furnishes steel, wood, or concrete supports?

- Who does wiring?
Who supplies plans?
Who supplies skilled labor?
Who supplies common labor?
- (d) Crusher
Must fuel be crushed?
If so, who supplies and installs crusher?
How will crusher be driven? (See Section 7, Steam Engine; and Section 11-24, Electric Motors)
- (e) Type of Apparatus
Industrial railway (car and track)
Moving conveyor
Chute
Pressure or suction pipe
- (f) Car
Car arranged for dumping?
Car arranged so that one side may be let down?
Car arranged for hoisting?
Car arranged for overhead track?
Capacity of car—dimensions?
How propelled?
- (g) Track
On floor
Flush
Overhead
Switches
Turntables
Scales—recording or indicating
Safety guards
- (h) Conveyors
Type
belt
chain
flight
bucket
spiral
suction or pneumatic
steam exhausters
rotary pressure exhausters
sluicing by water
- (i) Cranes and Hoists
Traveling crane
Jib cranes
Derrick
Self-contained electric
Elevator
Compressed air
(See also Section 20-38, Cranes)
- (j) Hopper or Bunker
Capacity
Dimensions
Gates and spouts
Openings
How supported?
- (k) Scales
Overhead
On floor
On conveyor
Flush
Capacity
Method of cleaning
Method of adjustment
Recording or indicating

2-24 POWDERED OR PULVERIZED COAL

- (a) Unloading Station (see Sections 2-23a and 2-23j).
- (b) Crusher (see Section 2-23d).
- (c) Elevator or Conveyor (see Section 2-23h).
- (d) Drier
Type
Location
Method of firing
- (e) Magnetic Separator
Type

- Location
- Voltage required
- (f) Pulverizer
 - Type
 - Location
 - Foundation
 - Provision for motor on same or other foundation
- (g) Heating Units
 - Boilers or furnaces
 - size
 - number
 - number fires in each
 - Location of units
 - Space in front of and above each fireplace
 (See also Section 2—21b).

2—25 OIL-BURNING EQUIPMENT

- (a) Tank
 - Shape
 - Width, length and height
 - Slope of bottom
 - Manholes
 - Coil in tank
 - length of pipe coil
 - diameter of pipe
 - material of pipe
 - Outlets
 - filtering
 - vent
 - emptying
 - water removal
 - pump suction
 - Tell-tale
 - Painting
 - Foundation
- (b) Method of Feeding
 - Pumps (see Sections 4—18, 4—19 and 4—20, Pumps)
 - Meter
 - size of oil meter
 - by-passing
 - make
- (c) Oil Heater
 - Construction
 - Material
 - Covering
 - Painting
- (d) Burners
 - Make
 - Type
 - Location in furnace
 - Valving
 - regulating valve or cock
 - Where does atomization take place?
 - What provision for cleaning?
 - Any auxiliary burner for hot water heater for house?
- (e) Furnace Construction
 - Any grates to be provided for possible coal burning?
 - Construction of checkerwork
 - Any baffle arches?
 - Where is construction shown?
 - Auxiliary air supply brought in where?

2—26 NATURAL GAS

- (a) Location of Plant
- (b) Pressure at Which Gas Is Delivered
- (c) Kind of Boiler Under Which Gas Is Burned
- (d) Is Gas to be Burned in a Boiler Installation Already Complete or in a New Installation?
- (e) Burners for Natural Gas
 - Type
 - Who erects?
 - Location in furnace
 - Size and location of heater
 - Valving
 - valving of gas supply

- valving of supply from header to burners
- valving of burners for varying load
- will steam or compressed air be used?
- (f) Furnace Construction for Natural Gas
 - Any Dutch oven?
 - Are grates to be provided for possible coal burning? If so, how are they to be protected?
 - Construction of checkerwork
 - Who supplies plans?
- (g) Piping
 - Material
 - Who supplies?
 - Limits of contractor's work
- (h) Guarantee
- (i) Allowable Makes

2—27 SAWDUST AND OTHER LOW-GRADE FUELS

- (a) Quality of Fuel Available
- (b) Character of Fuel
 - B. t. u. dry
 - B. t. u. as received
 - Percentage of moisture
 - Other constituents
- (c) Will Fuel be Dried or Otherwise Treated before Use?
- (d) Method of Conveying Fuel from Storage or Point of Manufacture to Furnace
- (e) How will Combustion be Regulated?
- (f) How will Back Fire be Prevented?
- (g) Will Grates be Supplied?
 - V. bars.
 - Conical hole pin-hole grates
 - Slotted grates
- (h) Will Coal be Used to Aid Combustion?
- (i) Details of Construction
 - Collector
 - Chute or conveyor
 - Measuring or weighing device
- (j) Furnace Construction
 - Dutch oven
 - Special baffling
 - Checkerwork
 - Any auxiliary openings into furnace?
- (k) Natural Draft
- (l) Forced Draft
 - Fan, steam or electric drive?
 - Blower, steam-jet or turbine?
 - Pressure obtained
 - Percentage of steam required at full load
- (m) Ashpit Pressure Necessary

2—28 SMOKE STACK

- (a) Number of Stacks
- (b) Diameter and Height
 - How high will stack project above surroundings?
- (c) Material
- (d) Thickness
- (e) Metal
- (f) Regular Brick
- (g) Fire Brick
- (h) Concrete
- (i) Method of Support
- (j) Foundation: How Made? Of What Material? Any Special Facing? Supplied by Whom?
- (k) Painting

- (l) Clean-out
 - Location
 - Size
 - Detail
 (Items from m to u apply to steel or iron stacks only)
- (m) Lining
 - Method of support
 - Material
 - Carried up how far?
 - Carried down how far below breeching?
 - Thickness of lining
- (n) Riveting
 - Spacing
 - Diameter
- (o) Lap of Sections (If Lap Joint is Used)
 - Length of lap
 - Inside or outside
- (p) Flanged Joints
 - Flange dimensions
 - Bolting
 - Pitch and diameter of bolts
- (q) Base Plate
- (r) Anchoring
 - How anchored?
 - How are anchoring guys kept taut?
 - How is expansion provided for?
- (s) Breeching Entrance
- (t) Protecting Umbrella
- (u) Provision for Re-painting and Inspection
- (v) Ladders
- (w) If of Masonry or Concrete
 - Method of construction
 - Method of making joints
 - Any separate lining?
 - Provision for re-painting and inspection

3—GAS PRODUCER EQUIPMENT

3—1 NUMBER

3—2 TYPE

- (a) Pressure
- (b) Suction
- (c) Pressure and Suction
- (d) Water-gas

3—3 KIND OF FUEL

- (a) Anthracite
- (b) Bituminous
- (c) Lignites
- (d) Oil

3—4 FUEL QUALITIES

- (a) Size
- (b) B. T. U. Per Pound
- (c) Analysis (If so, Bituminous or Lignite)
- (d) Approximate Percentage of Ash
- (e) Approximate Percentage of Sulphur

3—5 CAPACITY REQUIRED

- (a) In Pounds of Coal Gasified per Hour
- (b) B. T. U. Delivered per Hour

3—6 QUALITY OF GAS REQUIRED

- (a) Average B. T. U. (Effective) Heat Value per Cubic Foot
- (b) Minimum B. T. U. (Effective) Heat Value per Cubic Foot
- (c) Allowable Percentages of Hydrogen

(d) Allowable Percentages of Dust

(e) Allowable Percentages of Other Gases, or Impurities

3-7 HEAD ROOM AND SPACE AVAILABLE**3-8 INSTALLATION**

(a) Who Installs and Furnishes Producer, Scrubber and Regulator?

(b) Who Installs and Furnishes Piping?

(c) Who Takes from Cars and Places on Foundations?

(d) Who Installs Gas Holder?

3-9 WHERE IS EQUIPMENT TO BE INSTALLED?**3-10 HOW CAN EQUIPMENT BE GOTTEN INTO PLACE?****3-11 EQUIPMENT INCLUDES:**

(a) Producer

Vaporizer or saturator?

Lining

Charging, interlocking hopper?

Grates?

Blower—hand, motor or engine driven?

Blast regulator?

Cone bottom ash pit or water seal?

Railing, ladder and platform?

Standover pipe (material and where terminated)?

Water supply

where obtained?

where discharged?

how regulated?

Two-way valve

Poke holes and covers

Poke holes and covers

Coal hoist (see Section 2-23, Coal and Ash Handling)

Foundation: How made? Of what material? Any special facing? Supplied by whom?

Painting

Covering

Dimensions

Tools

(b) Scrubber

Stationary

material

dimensions

filling

explosion relief

gas tester

ladder and rail

water supply

where obtained?

where discharged?

how regulated?

temperature and pressure

Rotary

material

how driven?

size

water supply

where discharged?

where obtained?

how regulated?

Foundation: How made? Of what material? Any special facing? Supplied by whom?

(c) Moisture Regulators

Who supplies?

How drained?

Where drained?

(d) Exhaust and Blower

How is discharge pressure regulated?

Any special material for gas handling?

Any special construction for gas handling?

Any by-pass connections?

Foundation

Painting

(e) Piping

Material: Lap-welded, cast-iron spiral riveted, straight riveted

Gas line

Connections between producer and scrubber

Scrubber and engine

Standover pipe

Purge pipe

Engine exhaust

Drip piping

Gage piping

Water, supply and discharge

Drain

Weights of piping required

Will piping be flanged or screwed?

Kind of gaskets to be used

How will joints be made up?

How will piping be supported?

Details of standards

Any insulating covering for gas, water, air or drip piping

Painting

(f) Valves

For standover pipes

For purge pipes

For by-pass on gas lines

For by-pass on exhaust gas line

For water

For steam

(g) Muffler or Heater

Material

Type

Size

Foundation: How made? Of what material? Any special facing? Supplied by whom?

Painting

Covering

If muffler is also a heater, will hot water or steam be generated?

What trimmings and fittings required?

How is water supply regulated?

Relief valve?

Any by-pass?

(h) Limits of Work

Excavation by whom?

Foundation by whom?

How far does gas producer Contractor do piping for gas, exhaust and drip?

Water piping

Air piping

Steam piping

Drain piping

Electric wiring

Any special ventilation required?

What valves are supplied by Contractor?

(i) Gages and Recording Appliances

Gages

number

type

where mounted?

how mounted?

how connected?

Any recording calorimeter?

Any water meters?

Any thermometers?

Any testing burners?

Any gas-analysis apparatus?

(j) Test and Inspections

Factory inspection

expenses by whom?

object of inspection?

(k) Performance Tests

What purpose?

Duration

How carried on?

Who supplies load?

How is load measured?

How is gas quality to be determined?

How is gas quantity to be determined?

Any standard regulations for test?

Who will conduct test?

Who will supply fuel and water?

Who will supply operating labor?

Who makes fuel analysis?

For other matters connected with the installation, operation and use of gas producers see Section 15—, Fuel; Section 2—25, Natural Gas; and Section 2—23, Coal and Ash Handling.

4—STEAMFITTING

The steamfitting section includes such a wide range of apparatus and work that it is the most voluminous in the CHECKING LIST. On account of the magnitude and special character of the items, Boilers (including setting and smokestacks) and Refrigeration, separate sections have been devoted to these contracts (see Sections 2— and 14—), and only their co-ordination with the rest of the steamfitting work is taken up in Section 4—1.

NOTE—It will be noted that several items in this as in other sections of the CHECKING LIST have been starred, or prefaced by an asterisk. These starred items may be specified, or preferably may be left for the Machinery Builder to specify. They are noted here to call attention to the necessity of definite knowledge on these points before placing a contract.

The items to be considered generally in the steamfitting section of an isolated power-plant specification are as follows:

4-1 GENERAL OUTLINE OF THE WORK

(a) Furnishing, Delivering and Erecting of Boilers (see Section 2—1, Type of Boiler)

(b) Steam, Water, Blow-off and Smoke Connections to Boilers

(c) High- and Low-pressure Steam and Drip Connections to Engines, Pumps, Compressors, Hot-water Heaters, Etc.

(d) Blow-off Tank

(e) House-heating System

(f) Refrigerating Plant (see Section 14—, Refrigeration)

(g) Drying Apparatus

(h) Kitchen Apparatus

(i) Injectors

(j) Ejectors

(k) Indirect Heating System

(l) Direct Heating System

(m) Ventilating Equipment, Including

Fresh-air supply

Tempering coils

Air washers and humidifiers

Fans

Heating coils

Vent ducts

Hot-air ducts

Temperature control

Humidifying control

Air cooling by refrigeration

(n) Pumps

(o) Air Compressors
Tanks

(p) Hot-water Heaters

Hot-water tanks

(q) Muffler Tank

(r) Exchanger Tank

(s) Air-separating Tank

- (t) Water Weighers
- (u) Steam Meter
- (v) CO₂ Recorder
- (w) Condensing Apparatus
- (x) Cooling Tower
- (y) Fuel Economizers
- (z) Smoke Breeching
- (aa) Smoke Stack
- (bb) Insulating Covering of Steam, Water, Brine and Ammonia Piping
Insulating covering of smoke breeching
Ducts
Pumps and engine cylinders
Tanks, heaters and traps
Tempering coil castings
Re-heater casing, etc.
Exposed shells or drums of boilers
- (cc) Central Oiling System
- (dd) Railing
- (ee) Wrench Board
- (ff) Gages and Gage Board
- (gg) Automatic, Temperature-regulating System
- (hh) Painting
- (ii) Pump Governors
- (jj) Thermostatic Control of the Hot-water Heating
- (kk) Vacuum Heating System
One-pipe
Two-pipe
Air lines and air valves
- (ll) Radiators
- (mm) Coils
- (nn) Temporary Heat, Including Connection and Disconnection of Radiators
- (oo) Temporary Pumping
- (pp) Labor for Operating the Heating Plant
- (qq) Fuel for Operating the Heating Plant
- (rr) Do Specifications Include Engines, Dynamos, Electric Equipment, Motors, etc.?
- (ss) Description of General Arrangement of Main Piping
- (tt) Auxiliary Main for Emergency Use
- (uu) Does Piping Run Above or Below Floor?
- (vv) Exhaust Steam Will or Will Not be Used for Heating?
- (ww) Exhaust Steam from Pumps Will or Will Not be Collected into a Separate Main, Carrying a Higher Back Pressure than the Engine Main?
- (xx) Relief from Exhaust Pipe Run to What Point?
- (yy) Heating System is Up-Feed or Down-Feed?
- (zz) Return Main Sealed or Dry?
- (aaa) Return Main Connected to Pump Governor and Discharge Where?
- (bbb) Any Exchanger on Return to Cool Returns and Heat Water?
- (ccc) Make-up Water Supplied Where?
- (ddd) Boiler-Feed Pump and Injectors Have Suctions Where?
- (eee) Compressed-Air Piping
- (fff) Cold-Storage Piping
- (ggg) Compressed-Air to be Supplied For dampers of thermostatic control system
Elevator-door operation
Cleaning-out purposes
Manufacturing purposes
Any other purposes?
- (hhh) Blow-off Main Will Run Where?
- (iii) Blow-off Tank Cooled How?

- (jjj) Blow-off Tank Below Sewer Level or Above Sewer Level? If Below, What Kind of Pumps and How Controlled?
- (kkk) Description of the Heating System
- (lll) What Part of Building Indirectly Heated?
- (mmm) What Part of Building Directly Heated?
- (nnn) At What Height and Where Will Registers be Located?
- (ooo) Special Heating of Vestibules
- (ppp) Special Ventilation of
Toilet rooms
Pump room
Engine room
Kitchen, if any
Laundry room
- (qqq) Floor Heights

4-2 SPECIFICATIONS OF MATERIALS AND APPARATUS IN THE STEAMFITTING

(a) Pipe

Where piping is not to be erected under a steamfitting contract, but is to be purchased fabricated only, reference should be made to Sections under General Clauses:—Drawings (1-4), Materials (1-5), Delivery and Storage (1-8), Insurance (1-12), Excavation and Cutting (1-14), Tests at Factory (1-18 and 1-19f), Guarantees (1-20)

State who furnishes and who erects Steam Exhaust, Blow-off and other Valves; Steam and Oil Separators and other auxiliary apparatus; Throttle Valves on Engines, Pumps and Compressors; Companion Flanges for such Valves, Manifolds or Fittings as may be furnished by other contractors; Piping between high- and low-pressure Cylinders and Receivers and Condensers

Also see following Sections: Pipe Supports (4-2-1), Steam Traps (4-2o), Insulating Covering (4-2p), Plates and Collars (4-2q), Feed-Water Heaters (4-21), Blow-off Tank (4-23), Combination Heater, Grease Extractor, etc. (4-24), Back-pressure Valves (4-27), Reducing Valve (4-28), Grease Extractor (4-29), Steam Separators (4-30), Pump Regulators (4-31), Water-weigher or Meter (4-32), Damper Regulators (4-33), Exhaust Heads (4-34), High-pressure Steam Connections (4-40), Drip Piping (4-42), Condensers (4-44), Economizer (4-45), Work by other Contractors (4-53).

Pipe will be used for what purpose?
high-pressure steam over 150 pounds per square inch
medium-pressure steam from 50 to 150 pounds
low-pressure steam up to 50 pounds
condenser steam (below atmospheric pressure)
boiler feed
drips
blow-off
compressed air
air not under pressure
lubricating oil
fuel oil
water
gas
vent
hydraulic

- (b) Materials
Wrought iron, wrought steel, cast-iron, spelterized
black or galvanized or otherwise treated?
Brass
rough or polished?
standard of size?
Copper
standard of size?
- (c) Construction and Weight
Iron and Steel Pipe
seamless
lap weld
butt weld
spiral riveted
merchant pipe
standard weight
extra heavy
double extra heavy
Brass and Copper Pipe
weight per foot
will wrought-iron lap-welded pipe table be used as standard?
- (d) Pressure and Temperature
Steam
high, low, exhaust
saturated or superheated?
superheated to what degree?
Water
pressure and temperature
static and working head
Air, Oil and Gas
pressure
To what pressure shall several kinds of pipe be tested, at mill or after being erected? (See Sections 1-18 and 1-19f, Tests).
- (e) Diameters up to 14 Inches Internal Diameters. Above this, External Diameters?
- (f) Fittings and Flanges
- (g) High-Pressure Mains and Branches to be Made With Standard Weight or Extra Heavy Flanges? Iron, Semi-Steel, Cast Steel, Forged Steel or Malleable Iron?
- (h) Joints How Made? Flanges How Attached?
- (i) Gaskets, What Material and How Made?
Gum, fibre, metallic
Trade names or marks allowed
- (j) Flanges
Standard dimensions of flanges, for standard weight and extra-heavy, are how fixed?
Type of flanges
plain faced?
recessed?
pipes peened over?
screwed?
welded?
Vanstone, Walmanco, Cranelap, Cornellweld, etc.?
Low-pressure mains and connections
flanges used where?
couplings used where?
Small piping
brass unions
malleable-iron unions with brass to iron seats
- (k) Bolts
Square head and hexagon nut
Hexagon head and hexagon nut
Number of bolts to be as per standard of
- (l) Pipe Supports
Types of hangers
Provision for expansion of piping
Any special supports for boiler headers or engine room headers?
Piping to engines on standards or hangers?

Size of pipe for standards and spacing and adjustment
 Supports for risers
 Supports for ducts
 Supports for breeching
 Supports for exhaust to roof
 Supports for coils on side walls

(m) Packing of Valve Stems

Packing of pumps and valves

(n) Valves

Boiler valves
 working pressure
 any automatic self-closing non-return valve?
 angle valves, gate valves
 are these to have a rising stem?
 are they to operate by any special method (hydraulic, compressed air, steam or electric motor?)
 any by-pass in valve?
 safety valves
 pop or lever type, size, one or two, type of seat (see Index)
 check valves
 float valves
 automatic boiler stop valves
 valves for top and bottom of water column
 draw-off valve for bottom of water column
 feed valve on branch from main and at hand height
 blow-off valve
 blow-off cocks
 Gates, globe or angle valves on connections to engines
 valves located below the floor?
 any floor stand?
 Relief valves on hot-water tank and feed line; size, type, pressure at which they are to relieve
 Radiator valves
 angle, corner, gate, self-packing or packless?
 weights of radiator valves. Type of wheels, how finished?
 How are bodies to be finished? Shall valves be supplied with unions for connecting radiator?
 return valves on radiator connections: thermostatic, motor, impulse, check, globe, gate.
 if radiators are concealed in boxings, are valves to have extension stems horizontal or vertical?
 Will graduated supply valves be used? If of adjustable type, by whom adjusted?
 Air valves: size of opening in radiators, type of valve, valves for air line or valves for discharge into room
 Preference valves for insuring supply of exhaust steam to open feed-water heaters
 Stems
 stationary
 rising stem with elongated bonnet
 outside screw and yoke. (O. S. & Y)
 steel, brass, nickel-steel or nickel-bronze mountings?
 Material
 brass; rough, polished or nickel-plated?
 bronze
 all iron
 iron body with brass mounting
 steel, semi-steel, cast-steel, with monel or nickel trimmings
 Pressure and superheat and test pressure
 Screwed or flanged?
 flange drilling

Type and size
 horizontal, vertical or angle?
 size of inlet and outlet
 Allowed makes

(o) Steam Traps

Size of inlet and discharge and pipe area of discharge valve
 Capacity in pounds of water to be handled or in square feet of radiating surface or linear feet of pipe
 Type of trap
 high, medium or low pressure?
 return or non-return?
 intermittent or continuous discharge?
 If direct return, give height above water line of boiler
 If trap discharge is to be raised, does drawing or specification show how much?
 If oil trap, is special provision necessary to discharge steam when pressure is below atmosphere?
 Traps to be by-passed by three-valve by-pass?
 Gauge glass and self-contained by-pass valve?
 Maximum and minimum pressure under which trap is to operate
 Types of traps to be submitted for the various purposes
 Steam piping

(p) Insulating Covering

Steam piping
 Drip piping
 Water piping
 cold water, hot water
 Blow-off piping
 Feed piping
 Fresh-air piping
 High-pressure main flanges
 Low-pressure main flanges
 Flanges on piping above inches in diameter
 Covering of flanges to be moulded or plastered on?
 Feed-water heater
 Muffler tank
 Grease extractor
 Reducing valve
 Back pressure valve
 Pump governor
 Valve bodies
 Fittings to have moulded covering or plastered covering?
 Hot-water tank
 Blow-off tank
 Air-separating tank
 Drip tank
 Smoke connections and up-take from boilers
 Boilers, if not brick-set; if brick-set, top of boilers to be covered
 Boiler dome
 Boiler shells, for water-tube boilers, and vertical boilers
 Engine cylinders
 Pump cylinders
 Compressor cylinders
 Generators of absorption type of refrigerating plant
 Cold-air ducts leading to tempering chambers
 Tempering chambers
 Hot-air ducts leading from tempering chambers to re-heaters
 Re-heater casing
 Ducts from re-heaters to registers
 Fan casings
 Return mains and return risers
 Steam risers, where concealed
 Connections from risers to radiators, where concealed
 Exhaust riser to roof; should this be covered?
 Thickness of pipe covering
 high-pressure pipe over inches

high-pressure pipe under inches
 high-pressure pipe over inches
 high-pressure pipe under inches

Material of covering in each case approved manufacturers
 Covering of auxiliary apparatus and tank, material, thickness and finish
 Shall pipe covering be re-canvased and sewed?
 Painting of covering
 Method of covering smoke connections
 shall this be canvased and painted? Thickness of canvas, color and painting
 Blow-off pipe where exposed to fire, how protected?
 Covering of pumps and other cylinders: How finished? Material of covering and thickness?
 Covering of air ducts, etc.: thickness and finish, color of paint
 Brine-pipe covering: thickness of material, finish, color of paint
 Ice-water pipe covering: thickness of material, finish and painting
 Covering of fittings, moulded, plastered

(q) Plates and Collars

Pipes passing through walls, floors, partitions and ceilings
 Material of collars and thickness
 how finished at the bottom
 how finished at the top
 how supported during construction?
 Are collars to be furnished where risers are boxed?
 Where risers are in chases are collars to extend above floor?
 Filling of collars during construction to prevent filling with concrete
 Plates
 are plates to be screwed to the collars?
 split plates, cast or galvanized-iron, or bronze?
 separate plate for each pipe, or single plates for pipes close together?
 Smoke breeching and ducts; material and thickness of collars for these, where they pass through walls
 Protection of radiator branches in concrete
 Collars for pipe going through roofs. Method of flashing, material and thickness

(r) Painting and Bronzing

What material is to have shop coats?
 What material is to have paint after erection?
 Schedule of colors of paint
 What material is to be bronzed?
 Schedule of bronzing
 Is steel piping to be painted?
 Painting of boiler fronts, pumps, engines, ducts and covering
 Suggested standard schedule of painting follows:
 live-steam pipes, white
 exhaust-steam pipes, yellow
 cold-water pipes, blue
 brine pipes, green
 hot-water pipes, white with red bands
 return pipes, yellow with red bands
 fire-line pipes, red
 sprinkler, black, or white where against white plaster

- (s) Radiators
Material and type
Schedule of sizes, if any, or reference to plans for sizes
Cleaning of radiators before delivery
Are bushings allowed?
Method of joining sections of radiators, with a screw nipple or push nipple?
Radiator legs to be standard height or extra height?
Tapping low enough to drain
If radiators are without legs, specify brackets for hanging on wall
Radiators to be prepared for use with gravity steam, vacuum air-line system, gravity hot water, or mechanical circulation hot water system

- (t) Pipe Coils
Size of pipe
Standard or extra-heavy?
Iron, steel or brass?
Black or galvanized on outside?
Continuous welded or made up with screwed or flanged fittings?
Style of coil? (Oval, zigzag, cylindrical or special)
Details of construction?
Return-bend or header type?
How supported?
Method to determine that iron or steel has been used as specified?
Test?

4-3 STEAM RISERS

- Sizes, Where Shown?
- Anchoring
- Provision for Expansion and Contraction
- How Are Connections to be Taken Off?
- Following Breaks in Walls
- Dripping
- Cleaning Out
- Are Risers Concealed or Exposed?
- Connections from Mains to Risers
How pitched?
How valved?
- Material
- Covering
- Method of Support

4-4 RADIATOR CONNECTIONS

- Over or Under Floor
- Whence will First Story Radiator Connections be Taken
- Direction or Pitch
- Method of Caring for Expansion of Risers
- Sizes of Supply Connections
- Sizes of Return Connections
- Connections Made Into Top or Bottom of Radiators?
- Connections to First Floor Radiators

Following are sizes of standard connections for two-pipe and for single-pipe work

4-5 COIL CONNECTIONS

- Sizes, Where Shown?
- Anchoring
- Provision for Expansion and Contraction
- How Are Connections to be Taken Off?
- Following Breaks in Walls
- Dripping
- Cleaning Out
- Are Coils Concealed or Exposed?

- Connections from Mains to Risers
How pitched?
How valved?
- Where Coils are Under Skylights, Where and How Shall Connections be Run?
- Shall Certain Coils, Such as Those in Sprinkler-Tank Room, Have Direct Connections to Boiler Room?

4-6 TEMPERING COILS

- Number of Square Feet of Heating Surface
- Size of Pipe or Numbers of Cast-Iron Sections
- Divided Into How Many Sections?
- Type of Coil or Stack
- How Is Supply of Steam to be Controlled: Hand-Valved Alone, or Hand-Valved and Automatic?
- Is All or Only Part to be Supplied by Steam From Boilers?
- Is Boiler Steam to be Supplied at Reduced Pressure? If so, What Reducing Valve?
- Is Coil to be By-Passed?
- Where Does Drip Return to? How Trapped?
- Is Steam Supply to be Controlled by Temperature of Entering Air or Temperature of Leaving Air?
- Painting Coils or Stacks
- Painting of Casing
- Casing, Material, Thickness of Metal. Any Removable Sections?
- Is Coil on Inlet or Discharge of Fan
- Covering
- What Means, If Any, Are to be Used to Shut Off Air From Coil When It is Not in Use?
- Support
- Maximum Allowable Friction of Air Passing Through Cast-Iron Blast Heaters or Pipe-Coil Heaters
- Temperature of Air Entering Coils and Desired Temperature of Air Leaving Coils Under Extreme Conditions

4-7 INDIRECT HEATERS AND RE-HEATERS

- Number of Square Feet of Heating Surface
- Size of Pipe or Number of Cast Iron Sections
- Divided Into How Many Sections?
- Type of Stack
- How Is Supply of Steam to be Controlled: Hand Valved Alone, or Hand Valved and Automatic?
- Is All or Only Part to be Supplied by Steam from Boilers?
- Is Boiler Steam to be Supplied at Reduced Pressure? If so, What Reducing Valve?
- Where Does Drip Return to? How Trapped?
- Painting of Coils or Stacks
- Painting of Casing
- Casing, Material, Thickness of Metal. Any Removable Sections?
- Covering
- What Means, If Any, Are to be Used to Shut Off Air from Coil When Not in Use?
- What Means, If Any, to Deflect Air Through or Around Coil?
- With Thermostatic Control. Is Supply of Steam Controlled or

Is Mixture of Cold and Hot Air Controlled?
If latter, who supplies and installs mixing dampers?

(p) Support

4-8 REGISTERS

- Material
- Finish
- Any Special Shapes?
- Any Special Material and Finish for Main Hall Registers? Directors' Room Registers? Other Special Registers? Registers Exposed to Acid Fumes? Toilet Rooms?
- Which Registers Are to be Provided with Adjustable Shutters?
- How Are Shutters to be Operated?
- How Are Sizes to be Ascertained by Bidder from Plans? From List?
- Any Curved Registers?
- Painting
- How Will Registers be Set?
- How Will Joints between Registers and Surroundings be Made Dust-tight?
Co-operation with other trades
- How Will Registers be Connected to Flues?

4-9 TEMPERATURE AND HUMIDITY REGULATIONS

- Scope of Temperance Regulation
Radiators and coils, automatically controlled?
Tempering coils
Indirect stacks
Re-heater stacks
Dampers in fresh-air supply ducts? hot or cold?
Dampers in vent ducts?
Hot water heating?
Refrigerating stacks?
Fan supplying air for cold storage
Refrigerating compressor motor
Humidifying and air-washing apparatus
Control of hot-water tanks
- System of Regulation
Temperature
Humidity
sprays in humidifier automatically operated
dampers in supply ducts automatically operated
dew-point control
- Who Supplies
Pump or compressor
Connecting piping
Thermostats
Automatic valves
Diaphragm valves operated by thermostats
Dampers operated by thermostats or by air from heat-regulating system
- Who Places These Dampers and Valves in Position
- Maintenance of System After Completion
- Thermostats
Location of thermostats
Range of thermostats
Finish of thermostats
- Any Duplicate Apparatus?
- Adjustment and Testing
- Foundation
- Guarantee
- Allowed Makes

4-10 DUCTS AND FLUES

- Material Inside and Outside Building

- (b) Method of Support
- (c) Covering
- (d) Painting of Ducts
- (e) Painting of Covering
- (f) Thickness of Different Size Ducts
- (g) Construction
 - Method of making seams
 - Method of making joints between sections
- (h) Deflectors
 - Material
 - How operated?
 - How adjusted?
 - How secured?
- (i) Doors in Ducts and Flues
 - Material
 - How constructed and size?
 - Number and location. Shown on plans or listed?
- (j) Sizes of Ducts
- (k) Any Special Construction for Acid-impregnated air? Moist air? Avoiding transmission of noise?
- (l) Any Flashing of Ducts or Flues?
- (m) Any Thimbles Required for Passage of Ducts or Flues Through Walls, Etc.
- (n) Any Special Provision for Pipes or Hangers Passing Through Ducts, Etc.

4-11 SMOKE BREECHING

- (a) Material
- (b) Method of Support
- (c) Covering
- (d) Painting
- (e) Painting of Covering
- (f) Thickness of Metal
- (g) Construction
 - Size and pitch of riveting
 - Method of joining sections
 - Method of reinforcing sections
- (h) Clean-outs
 - Size and construction
 - Number and location
- (i) Dampers
 - Number
 - Construction
 - Arrangement for connection to automatic regulator
 - How made tight?
- (j) Plan and Elevation Are Required
- (k) How Connected to Boilers, and How to stack?

4-12 AIR WASHERS AND HUMIDIFIERS

- (a) Capacity and Velocity
 - Maximum cubic feet air per minute
 - Minimum cubic feet air per minute
 - Velocity of air through washer and eliminator
 - What resistance will be added to flow at maximum capacity by complete apparatus?
- (b) Construction Details
 - Materials used in construction of different parts
 - Spray. How obtained, number and kind of nozzles and spacing?
 - Filtering strainers
 - number used
 - mesh of screen
 - area of screen surface
 - Eliminators
 - vertical or horizontal
 - spacing
 - angle of air deflection
 - square feet exposed washing surface
 - method of flooding

- gage of metal
- how cleaned?
- Casing
 - bracing
 - inspection doors
 - number and size
 - construction
- gage of metal
- Tank
 - size
 - height
 - accessories
 - float valve
 - overflow
 - drain valve
 - flanges for pump connections
- gage of metal
- Pumps (see Sections 4-18, 4-19 and 4-20)
- Fans (see Section 4-13)

- (c) Type of Washer
 - Fan discharging through spray or mist chamber and eliminator
 - Fan discharging through body of water and eliminator
 - Fan and washer combined
- (d) Steam and Water Supply
 - Whence received?
 - At what pressure?
 - Where discharged?
 - At what pressures?
 - Who makes piping connections?
 - Who supplies valves?
 - Any automatic flushing device?
- (e) Humidity and Temperature Control
 - How is humidity controlled?
 - by raising or lowering water temperature?
 - by adding moisture to air?
 - Instruments used
 - humidostat
 - hygrostat
 - Accessories
 - angle air-duct thermometer
 - strainers
 - water heaters
 - diaphragm valves
 - air pumps
 - air tanks
 - air lines
 - thermometers
 - steam pressure gage
 - any special device to prevent excessive humidity in event of apparatus getting out of order?
- (f) Foundation
- (g) Covering
- (h) Painting
- (i) Guarantee
- (j) Trimmings

4-13 FANS AND BLOWERS

- (a) Approved Makes
- (b) List of Fans Giving
 - Capacities in cubic feet per minute at maximum and minimum desired speeds at standard pressures for these speeds
 - Maximum speed and minimum speed
 - Types of fans or blowers
 - centrifugal paddle wheel
 - sirocco or multi-vane
 - cone
 - disc
 - positive-pressure rotary blower
 - turbine blower
 - centrifugal blower
 - reciprocating (see Air Compressors)
 - allowed makes
 - Horse power desired of motors, or cylinder sizes of engines
- (c) Speed Control
 - What part of control is to be by

- field regulation and what part by armature resistance?
- Is maximum speed to be obtained with weakened field and no resistance in circuit?

- (d) Motor or Engine Driven
- (e) If Motor Driven
 - Voltage
 - Direct or alternating-current? If latter, single, two- or three-phase, and number of cycles per second? If direct-current, shunt or compound-wound?
 - Is motor to be directly coupled, or mounted on shaft?
 - Is motor to be belted? If so, maximum and minimum speeds of motor? Who supplies belt? Any idler equipment; belt tightener; chain drive? (For further details of Belt see Section 7-23d)
 - Types and makes of controllers any automatic control?
 - If motor is directly coupled or mounted on shaft, is support of motor to be part of fan housing or frame, or is a separate base to be built?
 - Lubrication of motors
 - oil, grease, dry or liquid graphite?
 - Allowable temperature rise of motors under maximum operating conditions
 - Are motors open or enclosed or semi-enclosed type?
 - Approved makes of motors
 - If chain drive is used, allowed make and size
- (f) If Engine Driven
 - Steam pressure
 - Speed control
 - Lubrication
 - Construction
 - Approved makes
- (g) Any Special Fans Required for Acid or Moist Air or Gases?
- (h) Any Shut-off Dampers Required to Close Off Fans When Not Operating
 - *Construction and material of such dampers
 - How controlled?
- (i) Specification and Plans to be Required from Builder Before Approved, Showing Details of Construction, Length of Bearings
- (j) Who Makes Electric Connections?
- (k) Who Makes Steam Connections?
- (l) Material
- (m) Foundation of Fans, Motors, Engines and Controllers: How Made? Of What Material? Any Special Facing? Supplied by Whom? Any noise or vibration? Insulating material?
- (n) Painting
- (o) Covering
- (p) Guarantee

4-14 FOUNDATIONS

- (a) Who Supplies?
- (b) Material
 - Above floor
 - Below floor
- (c) Outside Finish Above Floor, Sides and Corners
- (d) Top Finish, Material and Thickness
- (e) Bolt Drillings
- (f) Painting
- (g) Sheet Piling
- (h) Piling
- (i) Waterproofing
- (j) Shoring

4-15 GAGES

- (a) List Giving
 - Size of face for indicating and timing of chart for recording gage Range of pressures
 - Use (brine, steam, water, air, ammonia, etc.)
 - Locations of separated gages
- (b) Material and Finish
- (c) Method of Support, Including Material of Gage Board and Its Location
- (d) Who Makes Connections?
 - Discharges for blow-off from gages lead where? How controlled?

4-16 RAILINGS

- (a) Size of Pipe for Railings and Number of Pipes in Height
- (b) Any Gates?
- (c) Material and Finish
- (d) Method of Support
- (e) Painting
- (f) Height
- (g) Where Shown

4-17 MATS

- (a) Material
- (b) Length, Width and Thickness
- (c) Approved Makes

4-18 STEAM PUMPS (RECIPROCATING)

- (a) Number of Boiler-feed Pumps, Sizes and Types
- (b) Number of Drain Pumps, Sizes and Types
- (c) Number of House Pumps, Sizes and Types
- (d) Number of Fire Pumps, Sizes and Types
- (e) Number of Elevator Pumps, Sizes and Types
- (f) Number of Oil Pumps, Sizes and Types
- (g) Number of Circulating Pumps, Sizes and Types
- (h) Number of Brine Pumps, Sizes and Types
- (i) Number of Ammonia Pumps, Sizes and Types
- (j) Number of Vacuum Pumps, Sizes and Types
- (k) Number of Air Pumps, Sizes and Types
- (l) Pressures Against Which Pumps Must Work
- (m) Suction Lift
- (n) Sizes
 - Steam cylinders
 - Water, air or oil cylinders
- (o) Types
 - Simplex or duplex
 - Single-cylinder, or compound, or triplex
 - Direct, or crank and fly-wheel type?
 - Triplex driven by steam engine, belted, or directly coupled?
- (p) Inside or Outside Packed Plungers or Piston Pumps?
- (q) Stuffing Boxes, Flanged or Screwed?
- (r) Valves, Exterior or Interior?
 - Material of valves
- (s) Allowable Piston Speeds
- (t) Initial Steam Pressure
- (u) Back Pressure
- (v) Air Chambers. Size and Number and Location of Pet Cocks

- (w) Material of
 - Linings
 - Rods
 - Pistons and plungers
- (x) Lubricators, Types and Sizes
- (y) Foundation: How Made? Of what Material? Any Special Facing? Supplied by Whom? Any Drip Plans? Plans to Be Submitted?
- (z) Painting
- (aa) Governing
- (bb) How Are Governing Devices Lubricated?
- (cc) Covering of Steam Cylinders. Covering of Other Cylinders
- (dd) Pump Packing
- (ee) Allowed Makes

4-19 ELECTRIC PUMPS (TRIPLEX)

- (a) Number of Boiler-feed Pumps, Sizes and Types
- (b) Number of Drain Pumps, Sizes and Types
- (c) Number of House Pumps, Sizes and Types
- (d) Number of Fire Pumps, Sizes and Types
- (e) Number of Elevator Pumps, Sizes and Types
- (f) Number of Oil Pumps, Sizes and Types
- (g) Number of Circulating Pumps, Sizes and Types
- (h) Number of Brine Pumps, Sizes and Types
- (i) Number of Ammonia Pumps, Sizes and Types
- (j) Number of Vacuum Pumps, Sizes and Types
- (k) Number of Air Pumps, Sizes and Types
- (l) Sizes, Diameter and Stroke of Cylinders
- (m) Speeds Allowed
- (n) Pressures Against Which Pumps Must Work
- (o) Suction Lift
- (p) Types, Single or Double-Acting
- (q) Drive
 - Maximum speed and minimum speed
 - Horse power desired of motors
- (r) Speed Control
 - What part of control is to be by field regulation and what part by armature resistance?
 - Is maximum speed to be obtained with weakened field and no resistance in circuit?
- (s) Motor
 - Voltage
 - Direct or alternating-current? If latter, single, two- or three-phase and number of cycles per second? If direct-current, shunt or compound-wound?
 - Is motor to be directly coupled or mounted on shaft?
 - Is motor to be belted? If so, maximum speeds of motor? Who supplies belt? Any idler equipment; belt tightener; chain drive?
 - (For further details of Belt specification see Section 7-23d)
 - Types and makes of controllers
 - Any automatic control? Remote control?
 - If motor is directly coupled or mounted on shaft, is support of motor to be part of pump housing or frame, or is a separate base to be built?

- Lubrication of motors
 - oil, grease, dry or liquid graphite?
- Allowable temperature rise of motors under maximum operating conditions
- Are motors open or enclosed or semi-enclosed types?
- Approved makes of motors

- (t) Conditions with Cross-Head or Trunk Pistons

- (u) Materials
 - Linings
 - Rods
 - Pistons or plungers
 - Valves

- (v) Air Chambers, Size and Number and Location of Pet Cocks

- (w) Relief Valves

- (x) Self-oiling Bearings

- (y) Foundation: How Made? Of What Material? Any Special Facing? Supplied by Whom?

- (z) Painting

- (aa) Guarantee

4-20 CENTRIFUGAL, ROTARY OR TURBINE PUMPS

- (a) Number and Type
 - Horizontal or vertical?
 - If vertical, is pump submerged? Is it supported on feet or between framework?
- (b) Purposes for Which They Are to be Used
- (c) Pressure Against Which Pumps Must Work
 - Vertical discharge lift
 - Is discharge head steady or variable?
- (d) Suction Lift
 - Vertical suction lift
 - Is suction head steady or variable?
- (e) Number of Stages, if More Than One
- (f) Pipe Inlet and Outlet Sizes
 - Direction of suction and discharge openings
- (g) Speeds Allowed
- (h) Material to be Pumped
 - Temperature
 - Capacity in gallons per minute
- (i) If Motor Driven
 - Voltage
 - Direct or alternating-current? If latter, single-, two- or three-phase and number of cycles per second? If direct-current, shunt or compound-wound?
 - Is motor to be directly coupled, or mounted on shaft?
 - Is motor to be belted? If so, maximum and minimum speeds of motor? Who supplies belt? Any idler equipment; belt tightener; chain drive?
 - (For further details of Belt specification see Section 7-23d)
 - Types and makes of controllers.
 - Any automatic control? Remote control?
 - If motor is directly coupled or mounted on shaft, is support of motor to be part of pump housing or frame, or is a separate base to be built?
 - Lubrication of motors
 - oil, grease, dry or liquid graphite?
 - Allowable temperature rise of motors under maximum operating conditions

Are motors open or enclosed or semi-enclosed type?

Approved makes of motors

(j) If Steam Driven (Engine)

Steam pressure

Speed control

Lubrication

Construction (see Sections 7—; and 9—)

Approved makes

(k) Air Chamber? Size and Number and Location of Pet Cocks

(l) Material of

Casing

Impeller

Vanes

Shafts

Suction pipe

(m) Is Foot Valve Included?

(n) Lubrication

(o) Foundation: How Made? Of What Material? Any Special Facing? Supplied by Whom?

(p) Painting

(q) Covering

(r) Guarantee

4—21 FEED-WATER HEATERS

(a) Open or Closed Type?

(b) Capacity in Pounds of Water Per Hour From..... Degrees to..... Degrees

(c) Pressure of Exhaust Steam

(d) Required Feed-Water Temperature

(e) Shall Heater be Arranged to Allow Steam to Pass Through It (Through Heater) or Shall the Heating be Done by Induction (Dead-End Heater)? If Latter, Where Shall Vent be Carried?

(f) Material of Shell or Casing Cast-Iron or Steel

(g) Trimmings, Thermometer, Water Gages

(h) Foundation: How Made? Of What Material? Any Special Facing? Supplied by Whom?

(i) Covering

(j) Painting of Heater

(k) Painting of Covering

(l) Guarantee

(m) Allowed Makes

(n) Size and Location of Steam Inlet and Outlet

(o) Size of Overflow or Drain

(p) If Open Type of Heater

Is governor to control steam to pumps or make-up water?

Is overflow to be float-controlled or sealed?

Is heater to be equipped with grease extractor?

capacity of grease extractor

Are returns from heating system to come back to heater?

Are high-pressure drips to return to heater? If so, how controlled?

Float construction?

Any filtering chamber required? If so, filled with what material?

Whence is suction line for pumps taken and what is its size?

Shape of heater: rectangular or cylindrical?

Is heater to be of metering type?

Is heater to be of softening type?

Is heater to exhaust free to atmosphere or to carry back pressure? If the latter, how much?

Area of heating and lime-catching surface (pan or tray surface) in square feet

Head or pressure of water supply at heater

Time of settlement to be allowed in softening heater

(q) If Closed Type

Is water or steam to pass through coils?

What number of square feet of heating surface per rated horse power is required with:

corrugated copper or brass tubes

smooth copper or brass tubes

Where will drip from heater be carried?

Horizontal or vertical type of heater?

(r) Does Water Require Softening?

(See Section 4—46, Water Softening)

4—22 FEED-WATER FILTER AND GREASE EXTRACTOR

(a) Number and Sizes of Pipe Connections

(b) Simple or Multiple Type?

(c) Material and Details of Construction

(d) Number and Style of Filtering Cartridges

(e) Trimmings

(f) Foundation: How Made? Of What Material?

(g) Covering

(h) Guarantees

(i) Allowed Makes

4—23 BLOW-OFF TANK

(a) Diameter and Length

(b) Built for What Working Pressure? Tested to what pressure?

(c) How Are Contents of Tanks to be Cooled?

If with a coil, length and diameter of pipe

(d) Any Pump Governor?

If so, kind and size

(e) Manholes Where?

(f) Size and Location of

Inlet from boilers

Outlet to sewer or drain pump

Other drain pipes

Vapor pipe

(g) Size of Vapor Pipe

Where valved?

How finished at top?

(h) Check Valves on What Pipes?

(i) Material

(j) Trimmings

(k) Foundation: How Made? Of What Material? Any Special Facing? Supplied by Whom?

(l) Covering

(m) Painting of Tank and Covering

(n) Who Makes Cooling Connections, if Any, to and from Tank?

4—24 COMBINATION HEATER, GREASE EXTRACTOR, MUFFLER TANK, RETURN TANK AND PUMP GOVERNOR

(a) Size, Diameter and Length

(b) Outlets

(c) Open Type Heater

Is governor to control steam to pumps or make-up water?

Is overflow to be float-controlled or water-sealed?

Are returns from heating system to come back to heater tank?

Are high-pressure drips to return to heater tank? If so, how controlled?

Float construction?

Any filtering chamber required? If so, filled with what material?

(d) Pressure of Exhaust Steam

(e) Required Feed-water Temperature Quantity of feed water per hour

(f) Shall Tank Have a Manhole?

(g) Where Shall Drip from Oil-separating Chamber Run?

(h) Vapor Line from Tank to be of What Size?

Vapor line runs where?

(i) What Other Drip Outlets Are Required?

(j) Whence is Suction Line for Boiler Feed Pumps Taken?

What is size of suction pipe?

(k) Material

(l) Trimmings

(m) Foundation: How Made? Of What Material? Any Special Facing? Supplied by Whom?

(n) Covering

(o) Painting of Tank

(p) Painting of Covering

(q) Guarantee

(r) Allowed Makes

4—25 HOT-WATER TANK

(a) Number of Tanks

(b) Diameter and Length

(c) Built for What Working Pressure? Tested to what pressure?

(d) Heating Element to be How Constructed?

Header of return-bend coil?

Brass, copper, iron or other pipe? Diameter of pipe and length of coil?

Where will drip be discharged?

(e) Manholes Where?

(f) Size and Location of

Plumbers' connections

Draw-off connections

Steam and drip connections

How is coil to be connected through head of tank to steam supply?

(g) Thermometer Inserted Where?

Kind of thermometer and range?

(h) How Will Temperature of Water be Regulated and Through What Range?

If automatically, will each tank have a power-operated valve with its own thermostat, or will one thermostat be used for both?

(i) What Pressure of Steam is to be Used for Heating?

(j) Material

(k) Trimmings

(l) Method of Support

(m) Covering

(n) Painting Tank and Covering

4—26 SEPARATE HOT-WATER HEATERS (NOT TANKS)

(a) Number

(b) Diameter and Length

(c) Built for What Working Pressure? Tested to what pressure?

(d) Amount of Heating Surface and Character of Surface

- (e) Allowable Drop of Pressure of Water in Passing Through Heater
- (f) Means of Access to Interior
- (g) Size and Location of Plumbers' connections
Draw-off connections
Steam, drip and vent connections
- (h) How Will Temperature of Water Be Regulated, and Through What Range?
If automatically, will each tank have a power-operated valve with its own thermostat, or will one thermostat be used for both?
- (i) Thermometer Inserted Where?
Kind of thermometer and range?
- (j) What Pressure of Steam is to be Used for Heating?
- (k) Material
- (l) Trimmings
- (m) Foundation: How Made? Of What Material? Any Special Facing? Supplied by Whom?
- (n) Covering
- (o) Painting
- (p) Allowed Makes

4-27 BACK PRESSURE VALVES

- (a) Number and Pipe Sizes
- (b) Horizontal, Vertical or Angle?
- (c) Screwed or Flanged
- (d) Set for What Pressure?
Adjustable?
Remote control?
- (e) Noise
- (f) Covering
- (g) Guarantee
- (h) Allowed Makes
- (i) *Construction

4-28 REDUCING VALVES

- (a) Type
- (b) Number and Location or Uses
- (c) Sizes of Pipe, Inlet and Outlet
- (d) Screwed or Flanged?
- (e) Initial and Final Pressures Required
Saturated or superheated steam?
If reducing valve discharges into closed space, is relief valve to be separate or integral with reducing valve?
- (f) Noiseless Operation
- (g) Leaks
- (h) Method of By-pass, if Any
- (i) Covering
- (j) Guarantee
- (k) Allowed Makes

4-29 GREASE EXTRACTOR. (OIL SEPARATOR)

- (a) Size of Pipe on Which They Are to Go?
- (b) Horizontal or Vertical?
- (c) Drain Discharged Where?
How trapped or sealed?
Any tank required?
Provision for draining separator under vacuum
- (d) Construction
- (e) Trimmings; Any Gage Glass?
- (f) Material
- (g) Covering
- (h) Painting
- (i) Guarantee
- (j) Allowed Makes

4-30 STEAM SEPARATORS

- (a) Pressure for Which Designed?
- (b) Type; Horizontal or Vertical?
- (c) If Receiver Type is Used, Size of Receiver Required
Any gage glass?
- (d) Size of Drip and Where Discharged?
How is drip tapped?
- (e) Material
- (f) Trimmings
- (g) Covering
- (h) Painting
- (i) Guarantee
- (j) Allowed Makes, Types of Each Make to be Stipulated

4-31 PUMP REGULATORS (OR GOVERNOR)

- (a) For What Purpose Required?
House pumps
Boiler-feed pumps, when pumping returns
Vacuum pump
Air compressors
- (b) Type of Regulators
Globe or angle pattern?
- (c) Construction of Floats, if of Float Type
- (d) Adjustment of Regulators, if of Spring Type
- (e) By-passing
- (f) Size of Steam Pipes Which They Control
- (g) For Float Type or Pump Governors
Trimmings
Painting
Covering
Foundation, how made? Of what material? Any special facing? Supplied by whom?
Guarantee
Allowed makes
- (h) For Spring Type
Guarantee
Allowed makes
- (i) Pressures
Steam
Vacuum
Air
Water

4-32 WATER WEIGHER OR METER

- (a) Maximum, Minimum, and Average Quantities of Water to be Measured
- (b) Temperature
- (c) Pressures Under Which Apparatus Must Work
- (d) Size Inlet, Outlet, and Overflow or Drain
- (e) By-passing
- (f) Type
Recording or Indicating
- (g) Where it is to be Located
- (h) Material
- (i) Trimmings
- (j) Foundation: How Made? Of What Material? Any Special Facing? Supplied by Whom?
- (k) Painting
- (l) Covering
- (m) Guarantee
- (n) Allowed Makes
- (o) *Construction

4-33 DAMPER REGULATORS

- (a) Number
- (b) Size of Dampers to be Controlled
- (c) Available Water Pressure
- (d) Regulator to Operate Under What Variations of Pressure?
- (e) Is Regulator to Control Anything But Damper?
- (f) All Chain Pulleys and Erection to be Furnished by Whom?
- (g) Who Makes Water Connections?
- (h) Method of Support
- (i) Guarantee
- (j) Allowed Makes

4-34 EXHAUST HEADS

- (a) Sizes of Pipe to Which They Are to be Attached
- (b) Heads to be Flanged or Screwed?
- (c) Size of Drains
Where is drain discharged?
- (d) Material
- (e) Method of Support
- (f) Guarantee
- (g) Allowed Makes

4-35 OIL CABINETS

- (a) Number of Oil Tanks to be Held
- (b) Capacity of Tanks
- (c) Material
- (d) Trimmings
- (e) Painting
- (f) Allowed Makes

4-36 TRENCH PLATES

- (a) Material
- (b) Method of Support
- (c) Approximate Length and Square Feet of Trench Plates
- (d) Allowable Weight per Section

4-37 TRENCHES

- (a) Material
- (b) Built by Whom?
- (c) Cleaned Out by Whom?
- (d) Sizes Shown Where?
- (e) Depth

4-38 BOILER NUMBERS

- (a) Material
- (b) Who Supplies and Installs These?

4-39 INJECTORS AND EJECTORS

- (a) Purpose
- (b) Size of Inlet and Discharge
- (c) Suction and Discharge Pressures
- (d) Steam Pressure
- (e) Location
- (f) Type of Apparatus
Single or double-tube?
- (g) How is Drip Carried Away?
- (h) Material
- (i) Method of Support
- (j) Guarantee
- (k) Allowed Makes

4-40 HIGH-PRESSURE STEAM CONNECTIONS

This section describes high-pressure steam connections. The following matters should be covered:

- (a) Method of Taking Steam from Boilers
- (b) Valving or Main Boiler Connections
Bridge along boiler main

- (c) Connections to Auxiliary Steam Main and Valving of Same
- (d) Construction of Steam Mains Expansion loops and bends
- (e) Installation of Steam Separators
- (f) Installation of Steam Meter
- (g) Connections to Engine Header Expansion bends
- (h) Construction of Engine Header
- (i) Valving of Engine Connections Emergency stop valves
- (j) Dripping of Main and Connections
- (k) Trapping of Drips and Discharging Where?
- (l) Pump Connections from Main and Auxiliary Steam Lines
- (m) Injector Connections to Boilers
- (n) Connections to Other Apparatus Which May be Steam-driven
- (o) Connection to Heating System
- (p) Live Steam for Manufacturing
- (q) Material
- (r) Painting
- (s) Covering
- (t) Method of Support of Piping and Flanges

If a particular method of making joints (Vanstone) is wanted, it should be fully described here.

4-41 EXHAUST STEAM CONNECTIONS

This section describes low-pressure steam connections from engines, pumps, etc., to heating main and to outside air, as well as to other apparatus in which it is to be utilized, and under this heading should be noted:

- (a) Method of Connecting from Engines to Main
- (b) Valving of Connections
- (c) Dripping of Connections
- (d) Connection of Main to Grease Extractor, Heater, or Combination Tank
- (e) By-passing of These Pieces of Apparatus Where Desired
- (f) Connection to Atmospheric Exhaust
- (g) Connection to Heating System
- (h) Connection to Hot-water Heater
- (i) Connection to Driving Apparatus
- (j) Connection to Other Apparatus Using Low-pressure Steam
- (k) The Method of Connecting Pump Exhausts
Whether into the same main as engines, or separate main
- (l) Back Pressure to be Carried on Pump Exhausts
- (m) Is Any Separate Grease Extractor to be Used?
- (n) How Will Exhaust to Outside Air be Run, and How Supported?

In connection with this description, note should be made further as to what size pipe is to be flanged and what screwed, also of suitable specifications for:

- (o) Material. (Spiral riveted, lap-welded, cast-iron, etc.)
- (p) Painting
- (q) Covering
- (r) Method of Support

4-42 DRIP PIPING

Here is described draining of high and low-pressure lines and apparatus:

- (a) Where Shall Steam Drips be Delivered?
- (b) Where Shall Dirty or Greasy Drips be Delivered?
- (c) How Shall Drips be Trapped or Sealed?
- (d) How Shall Following Apparatus be Drained and Where Shall Drain Go?
Steam Separator
Exhaust heads
Exhaust riser to atmosphere
Exhausts from separate engines and separate pumps
Engine cylinders
Connection to throttle valves of engines
Hot water tank or heater coils
Feed water heater overflow (open type)
Feed water drain (closed type)
Blow-off tank
Pump pans
Fly-wheel or dynamo pits
Indirect heating stacks below engine-room level

The following questions should also be covered:

- (e) Material
- (f) Painting
- (g) Covering
- (h) Method of Support
- (i) Location of Drip Piping, Whether Under or Over Floor, Should be Described
Method of protection desired

4-43 HEATING SYSTEM

- (a) In This Section the Kind of Heating System Desired Is to be Described, Whether
Single-pipe, up-feed, with or without air lines
Single-pipe, down-feed, with or without air lines
Two-pipe up or down feed, with or without air lines
Vacuum heating system, single or double-pipe
(For type of Return Valves see Section 4-2n)
Thermostatically controlled or not?
Modulation of heating desired or not?
Hot-water systems, natural or forced circulation?
Vapor systems
- (b) Following Questions Should be Answered:
Who pays royalty, if any is required?
What pressure is to be carried on heating main, and where shall this pressure be measured?
Who furnishes such special apparatus and appliances as may be required by special heating system chosen?
Where shall vacuum pump, air separating tank, vacuum governors, and other special apparatus be located?
Where shall vent be run from air separating tank if any is installed?
Where will reduced pressure live steam be introduced into system?
- (c) Material
- (d) Painting

- (e) Covering
- (f) Method of Support of Mains

4-44 CONDENSERS

- (a) Number
- (b) Type
Surface
Barometric
Evaporative
Jet
Rotary Jet
distance from circulating water inlet to center line of condenser
- (c) Material of
Shell
Tubes
Tube plates
- (d) Capacity
Vacuum required at full rated capacity
Temperature of circulating or injection water
Quantity and kind of water supplied per hour
Number of pounds of steam to be condensed per hour
- (e) Connections
Steam connections by whom?
Water connections by whom?
Electric connections by whom?
Size of steam-supply pipe
Size of water-supply pipe
Size of drain pipe
Whence is water obtained?
Where is water discharged?
- (f) Cooling Surface
Material
Gage of tubes
Square feet of cooling surface
Allowances for expansion and contraction of tubes
- (g) Air and Circulating Pump (see Sections 4-18, 4-19 and 4-20, Pumps and Motors)
- (h) Relief Valve
- (i) Thermometer
- (j) Gages
- (k) What Work of Other Contractors Is Required?
- (l) Cleaning
Inside of tubes
Outside of tubes
- (m) Foundation: How Made? What Material? Any Special Facing? Supplied by Whom?
- (n) Painting
- (o) Covering
- (p) Method of Support
- (q) Allowed Makes
- (r) Re-cooling of Circulating Water
Method of re-cooling
cooling tower
type of cooling tower
spray nozzles
air blast
Location of apparatus
Capacity
quantity of water to be circulated and cooled
required range of cooling
extreme weather conditions
usual weather conditions
mean barometric conditions
Connections
water connections by whom?
power connections by whom?
duct connections by whom?
dampers
Enclosure of tower

Delivery and erection
who delivers and erects?
(For Fans and Blowers see Section 4—13; for Circulating Pumps and Motors see Sections 4—18, 4—19 and 4—20)
Foundation: How made? What material? Any special facing? Supplied by whom?
Painting
Covering
Allowed makes
What work of other contractors is required?

4—45 ECONOMIZER

- (a) Location
- (b) Type
- (c) Method of Support
- (d) Foundation: How Made? What Material? Any Special Facing? Supplied by Whom?
- (e) Steam Pressure Carried
- (f) Height and Diameter of Stack
- (g) Grate Surface in Boilers
- (h) Fuel Used
- (i) Probable Load Conditions
Boiler horse power of plant
- (j) Capacity
Quantity of water circulated per hour
Probable inlet temperature
Required increase in temperature
*Number of square feet of heating surface
- (k) Arrangement of Flue-gas Connections
Connection to and from smoke breeching
Shut-off dampers
Enclosure of economizer
- (l) Water Connections
Size
By whom made?
Material
Relief valve
Discharge from relief valve
Valving
- (m) Mason Work
Any mason work?
Done by whom?
Material supplied by whom?
- (n) Heating Surface
*Material
*Test
- (o) Cleaning
*Method of cleaning outside surface
*Method of cleaning inside surface
*What supplies power?
*Who makes steam, electric, water or air connections?
*Means for removal of soot
*Means for removal of scale
- (p) Details
*Tubes, material, diameter and length
*Headers, material, diameter, and length
*Joints, how made?
*Provision for expansion
*Scrapers; material. How renewed? How operated?
*Blowing-off
- (q) Allowed Makes

4—46 WATER SOFTENING

- (a) Quantity and Quality
Maximum amount of water used in 24 hours
Maximum amount of water used in one hour

Analysis of water
Analysis of water to be purified
Purpose for which water is to be used
boiler, drinking, manufacturing, toilets, chemical processes, dyeing, etc.
Whence is water obtained?
Height in feet above foundations at which water will be delivered to softener
Where is water to be delivered?
Height at which purified water must be delivered to flow by gravity to heater or other point of use
Any settling chamber required?

- (b) Delivery and Erection
Housing for softener if erected outside of power-plant
Who builds foundations?
Who erects apparatus?
Who furnishes steel, wood, or concrete supports?
Who does wiring?
Who does piping?
Who supplies housing?
Who supplies plans for foundations?
Who supplies structure and piping?
Who supplies skilled labor?
Who supplies common labor?
Limits of contractor's work
- (c) Material and Details of Construction
Filter (see Section 4—47)
Heater
Storage tanks
Filtering material
Precipitating material
Other chemicals
Space required
Headroom required
Height of delivery of treated water
Rate of flow in sedimentation tank
Elevation of storage tanks, if elevated
Pumps (see Sections 4—18, 4—19 and 4—20)
Motors
Shafting
Character of electric current available
- (d) Metering
How will chemicals be measured?
How will water be measured?
- (e) Accessories
Thermometers
Water gages
Scales
Filters
Elevated storage tanks

4—47 WATER FILTERS

- (a) General Information
Maximum amount of water required per day of 24 hours
Maximum amount per hour
Source of water supply
General condition of the water
Purposes for which filtered water to be used
Maximum pressure on supply pipe
Size of main supply pipe
Maximum rate of filtration which will be permitted
- (b) Construction Details
Internal diameter of filter shell
material of shell
Total height over all
Thickness of shell
Thickness of heads
Test pressure required
Location of manhole
Form of supports
who builds foundations?
details of foundations

Filtering material
kind
sizes
depth
Strainer system
number of strainers
description of strainers
Exterior of valves and fittings
size of each
materials
description
shall provision be made for by-passing filters?
what are the limits of Filter Contractor's work?
Coagulating apparatus
size
pounds of coagulant contained
description of

- (c) Requirements
Methods of washing
description
time required
pressure and quantity required
where shall water be discharged?
Rate of filtration
net filtering area
capacity 2½ gallons per square foot per minute
- (d) Guarantees
Appearance of filtered water
No excess of coagulant
Maximum resistance of clean filter at 2½ gallons per square foot per minute
Time of shipment of completed filter

4—48 ELEVATED STORAGE TANK

- (a) Capacity in Gallons
- (b) Foundation
How made?
Of what material?
Supplied by whom?
- (c) Tank Construction
Material and thicknesses
Bottom flat or bumped?
Top held cylindrical
Surrounding balcony
- (d) Dimensions of Tank
Diameter
Height
- (e) Roof
Material
Pitch
- (f) Elevation from Foundation to Bottom of Tank
- (g) Tower
Material
Number and size of supports or posts
Pitch of posts
Number of panels
Size and construction of struts
Size and shape of bracing
Anchorage. Size?
- (h) Ladders
Tank. Inside and outside?
From column to balcony or from ground to balcony?
- (i) Piping
Inlet and outlet. Size?
Pipe covering
kind
number plies
Who supplies piping?
- (j) Painting
- (k) What are Limits of Tank Contractor's Work?

4-49 STEAM DURING CONSTRUCTION

- (a) What Temporary Heat Will Be Required and Where?
- (b) How Shall Change be Made for Connection and Disconnection of Radiators?
- (c) What Other Steam Will be Required?
For pumping
For hot water
- (d) Who Will Operate Boilers?
- (e) Who Will Remove Ashes?
- (f) Who Will Keep Piping in Repair?
- (g) Who Will Supply Fuel?
- (h) Who Shall Decide Whether Steam Is to be Kept on All Night or Not?
- (i) What Rate of Wages Shall be Paid for Engineer, Fireman and How Long Will a Regular Day's Work be?

4-50 INSTRUMENTS, TOOLS AND SUPPLIES

What part of the following will be required? Details should accompany list.

- (a) Firing Tools
Length, thickness of handles and tools required
- (b) Ash Cans
- (c) Engine Indicators
- (d) Anemometers
- (e) Flue-gas Thermometers
- (f) Test Gages
- (g) Draft Gage
- (h) Steam-Flow Meter
- (i) CO₂ Recorder
- (j) Recording Low-pressure Steam Gage
- (k) Recording High-pressure Steam Gage
- (l) Oil Filter Capacity
- (m) Tachometers
- (n) Allowed Makes of Each of the Above

4-51 CENTRAL OILING SYSTEM

- (a) What It Is Intended to Perform
What journal systems will be connected to?
Cylinder-oil systems connected to?
What separate cylinder-oil systems are required?
- (b) Limits of This System
Who supplies pump; filter; reservoir; feeds?
Gravity or pressure supply tank?
Filters in basement, engine-room floor, or overhead?
Shall automatic water-separator be furnished?
Steam, motor or air-driven pumps?
Allowed makes
(See also Sections 4-18, 4-19 and 4-20, Pumps)
- (c) Who Supplies Lubricators and Sight Feeds?
Shall force-feed lubricators be used?
Shall lubricators be all metal case?
Shall lubricator sights be on suction side of plungers?
Capacity of lubricators?
Shall oil cups have pipe-feed attachment?
Shall cup sights be removable without disturbing pipe connections?
Size of glass cup bodies?

(d) Where Is Reservoir to be Located?

If pressure tank be used, who furnishes air compressor?
Shall wall float indicator be furnished with gravity tank?

(e) How Are System Parts Cleaned?

*Construction parts to be submitted for approval

(f) Run of Piping and Means of Cleaning

Who furnishes plans?
Who approves plans?
Who supplies and installs piping?

(g) Materials

Shall oil mains on engines be brass, polished and nickel plated, or iron pipe painted?
Shall drip lines be of black steel or galvanized steel pipe?
Shall tanks be of heavy galvanized plate with closely riveted seams, or can they be light galvanized iron with lock-seam joints?

(h) Accessories

Shall the devices be furnished to permit emptying barrels on engine-room floor?
Shall arrangements be provided for taking oil by suction direct from barrels?
Shall heating arrangements be provided so cold cylinder oil can be pumped?
Shall a cooler be provided for cooling journal oil?
Shall draw-off stands be provided for the different oils in gravity or pressure tanks?
Shall the drips of different oils from draw-off stands be kept separated?
Shall draw-off stands have oil and drip lines concealed?
Shall a pedestal and hand wheel with extension to valve below floor be provided for shutting off oil to the two branches to each unit?
Shall journal oil be carried to rocker arms, governor, and other small bearings?

(i) Method of Support

Who furnishes gravity tank support?
Who furnishes raised concrete platform to set basement tanks upon?
Who furnishes pipe hangers?
Who cuts masonry and repairs same?

(j) Allowed Makes

*Square feet of filtering surface
*Capacity of different tanks
*Thickness of plate; riveted or lock-seam work?
*Soldered or caulked joints?

(k) Painting**4-52 FORCED-DRAFT BLOWERS**

- (a) Horse Power of Boilers Required and Rated
- (b) Grate Surface, Size and Openings
- (c) Quality of Fuel to be Burned
- (d) Type and Speed of Blowers
- (e) Steam Pressure or Electric Voltage, etc. (see Section 4-13, Fans and Blowers)
- (f) Possible Location of Blowers
- (g) Whence Is Air to be Drawn?
- (h) Are Blowers to Operate in Conjunction with Damper Regulator?
- (i) Material

- (j) Painting
- (k) Method of Support
- (l) Guarantee
- (m) Allowed Makes

4-53 WORK BY OTHER CONTRACTORS

- (a) What Plumbing Work Is Required by Steamfitter for
Damper regulator
Blow-off tank coils
Drains from pumps
Outlet in sewer for blow-off
- (b) What Electrical Connections Are Needed by Steamfitter?
Motor connections for ventilating fans
pumps
blowers
thermostat alarms
- (c) Mason Work
Cutting of holes
Trench building
Patching
Foundations

5-CENTRAL STATION STEAM HEATING**5-1 LOCATION****5-2 DISTRIBUTION SYSTEM (UNDERGROUND)**

- (a) Mains and Piping. (For other details see Section 4-Steamfitting)

General plan
Survey
Permit to dig up streets
Nature of soil
Depth of mains below street level
Sizes and lengths
Kind of pipe
flanges and couplings
valves
expansion joints
slip type
diaphragm type (packingless)
anchors
distance between anchors and expansion joints
Special fittings
angle and crosses.
oil and water separators
provision for additional connections
provision for measuring condensation
provision for dripping of pipes
traps and by-passes
how shall service connections be made?
sleeves
rollers
painting
tests

(b) Tunnel, Conduit or Trench

Combined conduit and insulator
Height and width
Material of sides
Material of bottom
Material of top
Footings
Gradings
Water of dampproofing
Under drainage
field tile
broken stone
how laid?
Supports for piping
Lighting
Any special cut-off walls where entrance is made into buildings?

(c) Pipe Insulation

Tin-lined kiln dried wood casing
Vitrified tile

Magnesia and asbestos
Asbestos air cell
Asbestos sponge
Cork, sheet or granulated
Hair felt
Waterproofing
Thickness of waterproofing
Insulation of valves, flanges and fittings
Any different insulation in man-holes?

(d) Manholes

Locations
street
valve
expansion joints

Sizes

Material

Covers (single or double) and curbs
material of structure
frames
lettering
provision for lifting
watertightness

Drains

(e) Meters, Traps, Screens, Separators

Supplied by whom?

Sizes

Approved makes and types.

(f) Special Details

Plans supplied by whom?

profiles — measurements — elevations

Inspection supplied by whom?

any special conditions as to supervision or skill of workmen and superintendence?

Tests made by whom?

test conditions

Guarantee

Any promise for protection of or against patent claims?

Liability insurance

Watchman's service

Lights

Protection

Prices for extra work

unit price per foot measurement, over all, including only expansion devices and anchors

unit price for valves set complete in manholes

unit price for street traps complete in manholes

unit price for angle fittings street crosses, etc.

5-3 BUILDING DETAILS**(a) Dimensions**

Height, width and length, and number of stories

(b) Square Feet of Direct Radiating Surface**(c) Square Feet Indirect Radiating Surface****(d) Square Feet Cast-iron Economy****(e) Square Feet Glass****(f) Square Feet Wall****(g) Cubic Contents****(h) Kind of Heating System****(i) Hours of Regular Operation of Building****(j) Where Shall Supply of Steam be Delivered?****(k) Where Shall Condensation be Taken Away?****(l) Will Supply be Metered?****(m) Will Condensation (Returns) be Metered?**

Will condensation be drained into sewer or returned to power house?

(n) Time of Starting and Completion**(o) Any Special Provisions to be Made for Expansion****(p) Permits****(q) Patented Appliances****6-POWER PLANT PIPING**

NOTE: When specifications are to be written for piping for a power plant, it is usual to make this a separate contract and the material may either be purchased separately and a separate erection contract given or the whole contract may be let as one. It seems advisable to make a separate section distinct from the general steamfitting specification.

6-1 CONDITIONS OF SERVICE**(a) Pressures**

High pressure carried
Low pressure carried
Condensing vacuum carried
Water pressure

(b) Steam Characteristics

Percentage of saturation
Superheated
amount of superheat. Maximum, minimum and average

(c) Water

Boiler feed
temperature entering economizer or feed-water heater
temperature entering boilers
Condenser
kind of water
source of supply
available head-tidal variation, etc.
analysis
temperature

6-2 HIGH PRESSURE PIPING**(a) Material**

Steel
Wrought Iron

(b) Weights

What standards of weights shall be used?

Up to what size will internal diameter be used? Above 14 inches outside diameter?

In what sizes will Merchant weight pipe be used?

In what sizes will Standard weight pipe be used?

In what sizes will extra heavy pipe be used?

In what sizes will double extra heavy pipe be used?

Will pipes over 14 inches outside diameter have extra thick walls; and if so, what thicknesses?

Any general requirements as to cracks, blisters, imperfect walls or obstructions to bore

(c) Tests

What hydrostatic pressure will be applied to test these pipes?

6-3 BONDS**(a) Material**

Steel
Wrought iron
Brass
Copper

(b) Design

Shall bonds not used to take up expansion be built to finished dimensions?

Shall bonds used to take up ex-

pansion be built to less than finished dimensions?

Who furnishes drawings?

Any minimum radius compared to diameter of pipe?

What tests are to be applied?

6-4 FLANGES**(a) Above What Diameter Shall Flanges be Used?****(b) What Standard is Used for Dimensions, Bolt Sizes and Number of Holes?****(c) Material**

Cast iron
Semi-steel
Steel

(d) Weights

Standard
Extra heavy
Hydraulic

(e) Type

Vanstone
Welded
Standard

(f) Finish

Rough
Smooth
Raise face or other joint than flat face

6-5 FITTINGS**(a) Cast-iron****(b) Semi-steel****(c) Cast-steel****(d) Weight****(e) Flanged or Screwed?****(f) Any Cast Fittings of Special Design?****(g) Any Welded Nozzles?****6-6 VALVES****(a) Material of Body and Yoke**

Cast-iron
Cast-steel
Bronze
Steam metal

(b) Above What Size Pipe Will Gate Valves be Used?**(c) Gate Valves**

Outside screw and yoke type?

Stationary or rising stem?

Screwed or flanged?

Double-wedged disc or taper seat?

Above what size shall valves be by-passed?

Shall valves be designed for re-packing under full pressure when wide open?

What size hand wheel required?

Any of these valves to be remote control? If so, by what force are they to be controlled, hydraulic or electric?

Stems

steel
bronze
nickel steel
monel metal

Seats

brass
nickel
monel metal

Gaskets

approved makes

(d) Non-return Valves.

Type

globe
angle
gate

Special details

any external or internal dashpot?
any handwheel?

Approved makes?
automatic throttle and emergency
valves

6-7 SUPPORTS

(a) Type

Hangers
roller
pipe
clamp
material
Standards
adjustable saddles
size of pipe support
design of foot

6-8 GASKETS

(a) Approved Makes of Gaskets for
Superheated steam
Saturated steam
Moderate pressure steam

6-9 COVERINGS

(a) Material to be Used and Thickness
With what thickness of canvas
shall covering be finished?
Painting
Banding
Any re-canvassing?

6-10 EXHAUST PIPING

(a) Material

Steel
Wrought iron
Galvanized

(b) Weight

Up to what sizes shall Merchant
weight pipe be used?
Will any of the exhaust piping be
done with galvanized riveted
pipe? If so, what thickness of
pipe?
Any test of this piping required?

6-11 BONDS

(a) Material

Steel
Wrought iron
Brass
Copper

(b) Design

Shall bonds not used to take up ex-
pansion be built to finished di-
mensions?
Shall bonds used to take up expan-
sion be built to less than fin-
ished dimensions?
Who furnishes drawings?
Any minimum radius compared to
diameter of pipe?
What tests are to be applied?

6-12 CAST-IRON PIPING

(a) Will any Cast-Iron Pipe be Used
Between Exhaust Outlet and
Condenser?

(b) Or from Condenser to Pumps,
Etc.?

6-13 FLANGES, COUPLINGS AND UNIONS

Where shall flanges be used?
Where shall couplings be used?
What standard used for dimen-
sions, bolt sizes and number
of holes?

(a) Flanges

Material
cast-iron
cast-steel
For standard weights what flanges
to be used?

How will flanges be secured to
pipe?

Shall flanges have raised spaces for
ring gaskets or will gaskets be
full size?

Shall flanges be finished rough or
machined?

(b) Couplings

Material
Weight

(c) Unions

Material
Weight

6-14 FITTINGS

(a) Material

(b) Weight

(c) Flanged or Screwed

(d) Any Cast Fittings of Special De- sign?

6-15 VALVES

(a) Material of Body and Yoke

Cast-iron
Cast-steel
Bronze
Steam metal

(b) Where Shall Gate Valves be Used?

(c) Where Shall Globe Valves be Used?

(d) Where Shall Angle Valves be Used?

(For details of Gate and Globe
Valves see Section 6-6; of
High Pressure Piping see
Section 6-2)

6-16 SUPPORTS

(a) Type

Hangers
roller
pipe
clamp
material
Standards
adjustable saddles
size of pipe support
design of foot

6-17 GASKETS

(a) Approved Makes of Gaskets for
Superheated steam
Saturated steam
Moderate pressure steam

6-18 COVERING

(a) Material to be Used and Thickness
With what thickness of canvas shall
covering be finished?

Painting
Banding
Any re-canvassing?

6-19 BOILER-FEED PIPING

(a) Material

Wrought iron
Steel
Brass
Copper

(b) Weight

What weight of pipe shall be
used?

(c) Test

To what test shall pipes be sub-
jected?

(d) Shall Pipe Joints be Flanged? Above What Size?

Or, shall coupling be used?

(e) Where Shall Unions be Used?

Shall unions be standard weight or
extra heavy?

(f) Flanges

(Same questions as apply to high-
pressure piping apply to the
flanges for feed line, see Sec-
tion 6-4)

(g) Fittings

(Same questions as apply to high-
pressure piping apply to fittings
for feed line, see Section 6-5)

(h) Valves

(Same questions apply as in high-
pressure work, except that
there will be no non-return
valves, see Section 6-6)

6-20 BLOW-OFF LINE

(a) Material

Wrought iron
Steel
Brass
Copper

(b) Weight

What weights of pipe shall be
used?

(c) Test

To what test shall pipes be sub-
jected?

(d) Shall Pipe Joints be Flanged? Above What Size?

Or, shall coupling be used?

(e) Where Shall Unions be Used?

Shall unions be standard weight or
extra heavy?

(f) Flanges

(Same questions as apply to high-
pressure piping apply here, see
Section 6-4)

(g) Fittings

(Same questions as apply to high-
pressure piping apply here, see
Section 6-5)

(h) Valves

(Same questions as apply to high-
pressure piping apply here, ex-
cept that there will be no non-
return valves, see Section 6-6)
Is asbestos-packed cock to be used
in addition to angle-pattern
blow-off valve? If so, of what
materials shall valves be made?
(For specification digest on Separ-
ators, Condensers, Water Weigh-
er, etc., see Sections, 4-1, et
seq., Steamfitting)

7-STEAM ENGINES

7-1 NUMBER OF ENGINES

7-2 LOCATION OF PLANT

7-3 CHARACTER OF BUILDING

7-4 TYPE

(a) High-speed

(b) Slow-speed

(c) Single-cylinder

(d) Compound

Cross
Tandem

(e) Single-valve

(f) Four-valve

(g) Corliss Type

(h) Poppet Valve

(i) Piston Valve

(j) Pressure Plate and Slide Valve

(k) Telescopic Unbalanced Valve

7-5 SIDE CRANK OR CENTER- CRANK TYPE?

7-6 PURPOSE FOR WHICH ENGINES ARE TO BE USED

7-7 ENGINES TO BE ATTACHED TO
DRIVEN APPARATUS HOW?

- (a) Directly Connected
- (b) Directly Coupled
- (c) Belted
- (d) Coupled to Shaft
- (e) Hand of Engine

7-8 CYLINDER INSIDE DIAMETER
(MINIMUM)

7-9 LENGTH OF STROKE

7-10 SPEED

7-11 STEAM PRESSURE AT ENGINE
THROTTLE

- (a) Number of Degrees Superheat, if Any

7-12 BACK PRESSURE AT ENGINE
EXHAUST

7-13 REQUIRED CAPACITY

- (a) If for Driving Electrical Apparatus, What Is the Kilowatt Capacity of Same?
- (b) If Alternating Current, What is the K. V. A. Capacity and Probable Power Factor?
- (c) If Alternating Current, What is the Cycle?

7-14 REQUIRED OVERLOAD CA-
PACITY AMOUNT AND
PERIOD

7-15 PAINTING

7-16 SPEED REGULATION

- (a) How Measured

7-17 SPEED VARIATION ALLOWED
UNDER SUDDEN VARIA-
TIONS OF LOAD

7-18 SPEED VARIATIONS AL-
LOWED UNDER GRADUAL
VARIATIONS OF LOAD

7-19 FROM WHAT PERCENTAGE
OF FULL LOAD TO WHAT
PERCENTAGE OF FULL
LOAD?

7-20 ANY REQUIREMENT AS TO
VARIATION FROM CON-
STANT ANGULAR VELOC-
ITY DURING EACH REVOLU-
TION? (A. C. WORK)

7-21 NOISE AND VIBRATION

- (a) How Determined?
- (b) Amount Permitted

7-22 TESTS AND INSPECTIONS

- (a) Where Made?
- (b) How Made?
- (c) By Whom?
- (d) Who Pays Expenses of Trips to Factory?
- (e) Any Charge for Inspection?
- (f) Who Pays for Fuel, Oil, and Operating Care During Acceptance Run?
- (g) Who Supplies Load for Test?
- (h) Who Makes Connections?
- (i) What Will be Covered by Test at Shop?
- (j) What Will be Covered by Test After Erection?
Economy guarantees
mechanical efficiency and steam
consumption per horse-power
hour

Regulation
Capacity
Overload capacity
Noise and vibration
Valve adjustment
Steam tightness of pistons
Steam tightness of valves

7-23 MECHANICAL CONNECTIONS
TO DRIVEN APPARATUS

(a) Directly Connected to a Dynamo
(Solid Shaft)

Who will press armature on shaft?
Where will armature be pressed on shaft?
Who furnishes key?
Who furnishes gage for shaft?
Who furnishes dynamo shaft?
If shaft is shipped to generator builder, who pays freight?
Who pays freight to destination on combined shaft and rotor?
Who pays for erection, and who is responsible for damage, if any?

(b) If Directly Coupled to a Dynamo
(Coupled Shaft)

Who furnishes coupling (both halves)?
Who furnishes dynamo shaft?
Will dynamo armature be shipped to engine manufacturer?
Who pays for shipping armature and shaft from engine works to engine room?

(c) Whether Dynamo is Directly Con-
nected or Coupled?

Who furnishes key?
Who furnishes gage for shaft?
Who furnishes sub-base, if any is required?
Who furnishes sole plates, if any are required?
Who furnishes holding-down bolts?
Who furnishes outboard bearing?
Who fits field frame to sub-base of sole plate at job?
Who is to be responsible for mistakes in fitting dynamo parts to engine parts?

(d) If Engine Is Belted to Dynamo or
Shaft

Shall belt be run tight or slack? If tight, how is belt to be kept so?
Diameter and face of driving wheel; diameter and face of driven pulley
maximum horse power to be transmitted
Distance between belt centers
tape-line measurement around pulley
Will drive be with tight side on top or below?
belt forward or back?
Will belt be below floor in any part?
who makes pit?
how will pit be drained?
where will drain discharge?
material of pit?
Any guard rail around belt?
Any guard rail around pit?
How will static electricity be collected from belt?
Who supplies belt?
Who installs belt?
width of belt?
how is joint in belt to be made? endless? If so, made endless at factory, or ends left open and joined at the job?
shall belt manufacturer make allowance for endless lap?
thickness
material
allowed makes

(e) How Is Exciter to be Driven?

7-24 CONSTRUCTION DETAILS

NOTE: Items which are starred (or preceded by an asterisk) may be specified, or, preferably, may be left for the engine builder to specify.

They are noted here to call attention to the necessity of definite knowledge on these points before placing a contract.

(a) Cylinders

Material
Finish of cylinder and head and valve chest
Covering cylinder barrel and head
*Method of support
Blow holes in casting
Provision for re-boring
Draining

(b) Pistons

*Type
*Kind of rings
*How secured to rod?
Steam tightness
Material
If a large piston, will junk-ring be lined with anti-friction metal?

(c) Piston Rod

Material
*Diameter
Packing of stuffing box
metallic or soft packing?
*How connected to cross-head?

(d) Cross-head

*Type
*Method of adjustment
*Method of lubrication
*Length and width of shoes
*Diameter and length of pin

(e) Connecting Rod

*Length
*Cross-sectional area
*Method of securing to cross-head
*Method of securing to crank
*Means of adjustment
Material
Finish, polished, or ground, or rough. If any casting, shall it be filled only or filled and painted?

(f) Crank and Pin

Diameter and length of pin
*Type of crank
*How counter-weighted?
*How balanced?
Material
Finish, polished, or ground, or rough? If any casting, shall it be filled only or filled and painted?

(g) Main Bearings

*Diameter and length
*Oiling System
self-oiling bearing?
*How re-lined?
removable shells
*Adjustments
for alignment?
for wear?
any provision for water-cooling?

(h) Shaft .

*Diameter and length
*Material
Finish, polished, or ground, or rough. If any casting, shall it be filled only or filled and painted?
*Provision for preventing oil from traveling along shaft

(i) Fly-wheel

Number per engine

- *Diameter
- *Weight
- *How secured to shaft?
- *Balance
- *Finish
- *Material

(j) Governing Device

- *Type of governor
- *Detail of construction
- *Method of adjustment for different speeds
- If eccentrics are used, are there to be one or two?
- *Lubrication
- Shields for prevention of spattering of oil
- *Provision for wear

(k) Valves

- *Type
- *Number per engine
- *Means of adjustment
- *Method of control
- Steam tightness
- means of preserving steam tightness
- *Lubrication
- *Range of cut-off
- Material
- Finish
- If superheated steam is to be used, are valves suitable?

(l) Frame

- *Type
- *Material
- *Finish, polished, or ground, or rough. If any casting, shall it be filled only or filled and painted?
- Painting

(m) Foundations

- Dimensions
- Material
- Who builds?
- Who makes drawings?
- Insulation from building
- Who supplies bolts, nuts and anchors, sleeves and template?
- Are bolts, etc., to be shipped before engines?
- Who sets template?
- Who does grouting?
- Is base to be filled?
- Sheet piling
- Piling
- Water-proofing

(n) Excavation

- Who makes?
- Who removes dirt and rubbish?
- Who cleans up after completion?

(o) Throttle Valve

- Type, standard weight or extra heavy? Flanged or screwed?
- if flanged who supplies companion flange?
- Any by-pass?
- Any drip?
- Allowed makes
- Finish

(p) Relief Valves

- Size
- Type
- Allowed makes
- Finish

(q) Cylinder Lubricators

- Types—force-feed, sight-feed, hand-pump
- number of feeds
- reservoir capacity
- method and location of drive
- Size
- Finish
- Allowed makes
- Who erects lubricators?

- Any graphite to be used as lubricant?
- Any special feeding devices?

(r) Engine Lubrication

- Any central system? (see Section 4—51)
- Type
- Size of feeds
- Piping, material and finish
- Size and type of filter
- Size and type of separate storage tank, if any?
- Means for re-circulation
- Any grease cups?
- type and capacity of grease cups
- Oil guards
- Oil drains
- Telescopes, center oilers
- Allowed makes

(s) Engine Indicator

- Any required?
- Supplied by whom?
- Type
- Allowed makes
- Finish
- Any reducing motion?

(t) Indicator Piping

- Material
- Finish
- Diameter
- Three-way or single cock?
- What make of indicator?
- Are angle valves required at both ends of cylinder?

(u) Steam Piping Connections

- Who supplies?
- *Size steam and exhaust
- *Size drip piping
- Who is responsible for cleaning out piping?
- Who is responsible for insuring dry steam?
- Where will exhaust steam be delivered?
- Limits of contractor's work

(v) Receiver and Piping

- Plain or with re-heating coil?
- Any provision in piping for running either side separately?
- Who furnishes supports?
- Who furnishes traps?
- Who furnishes non-conducting covering for receiver and pipe?

(w) Engine Stop

- Steam pressure
- Speed of engine
- Size of steam line
- Method of operation
- mechanical
- electrical
- combined

(x) Erection

- Is complete erection desired?
- If not, who pays for time and services of erector?
- who furnishes cartage?
- who furnishes labor help?
- who furnishes runways into building?
- who furnishes jacks, falls and other tools?
- who furnishes non-conducting covering?

7—25 GENERAL NOTES

- (a) Opening for Delivery of Plant?
- (b) Engineer's Services to Operate Plant
- (c) Location of Engine Room
- (d) Ventilation of Engine Room
- (e) Head Room
- (f) Level of Engines Compared to Drip Tank

8—TURBINES**8—1 TURBINES**

Steam turbines are steam engines; hence the CHECKING-LIST for Engines applies largely to the specification of turbines. Of the preceding sections, these numbers apply directly and may be used: 7—1, 7—2, 7—3, 7—6, 7—7 (see note as to gear drive), 7—10, 7—11, 7—12, 7—13, 7—14, 7—15, 7—16, 7—17, 7—18, 7—19, 7—21, 7—22, 7—23, sub-headings *g, h, j, m, n, o, p, r, u* under 7—24, and 7—25.

Additional matters which should be considered are:

8—2 TYPE

- (a) Single or Multi-stage?
- (b) Impulse or Reaction?
- (c) High-pressure
- (d) Low-pressure
- (e) Mixed Flow

Flow valve and oil separator to be installed?

8—3 ANY STEAM TO BE TAKEN OUT FOR OTHER PURPOSES

- (a) Heating
- (b) Manufacturing
- (c) Pressure Required
- (d) How Is Quantity to Be Compensated for?
- Automatically or hand controlled?
- (e) Quantity Required
- Probable steam requirement curve
- Probable load curve

8—4 ALLOWED MAKES OF TURBINES**8—5 GEARING (WITH IMPULSE TYPE)**

- (a) *Helical Gear
- (b) *Spiral Gear
- (c) *Worm Gear
- (d) *Chain Drive
- (e) *Enclosure of Gear
- (f) *Lubrication of Gear
- (g) Noiseless Operation of Gear
- (h) *Method of Compensating for Wear
- (i) *Material

8—6 CASING

- (a) *Material
- (b) *Joints
- (c) *Bolting
- (d) Absence of Leakage
- (e) *Finish of Inside Faces
- (f) *Finish of Outside Faces
- (g) *Location of Jets
- (h) Number of Jets

8—7 NOZZLES

- (a) *Material
- (b) *Number
- (c) *Type
- (d) *How Controlled?
- (e) *How Supplied with Steam?
- (f) *Method of Support

8—8 EXHAUST OUTLET

- (a) *Type
- (b) Number
- (c) How Controlled?
- (d) Material

- (e) Method of Support
- (f) Finish

8-9 BUCKETS

- (a) *Material
- (b) *Section
- (c) *How Held to Rotor?
- (d) *How Renewed?
- (e) *Clearance
- (f) *Clearance Measurement
- (g) *How Is Leakage Prevented?
- (h) *Finish

8-10 ROTOR

- (a) *Material
- (b) *How Held to Shaft?
- (c) *How Balanced?
- (d) *Diameter
- (e) *Thickness
- (f) *Peripheral Speed
- (g) *How Is Balance Obtained with Unequal Expansion of Rotors in Multi-stage Turbine?
- (h) *How Is Oil Prevented from Traveling Along Shaft from Bearings?

8-11 ACCUMULATOR

(If exhaust-steam turbine is used.)

- (a) Type of Accumulator
- (b) Capacity
 - Average quantity of exhaust steam supplied
 - Minimum quantity of exhaust steam supplied
 - Maximum quantity of exhaust steam supplied
 - Probable load curve of supplying apparatus
 - Probable load curve of exhaust-steam turbine
 - What part of exhaust steam from other apparatus will be available?
- (c) *Dimensions
- (d) *Material
- (e) *Method of Support
- (f) Covering
- (g) Painting
- (h) Foundation
- (i) Who Makes Connections to and from?
- (j) Relief Discharges Where?
- (k) *Make-up Boiler-steam Connection
 - Enters where?
 - Supplied by whom?
 - How controlled?

- (l) Allowed Makes of Accumulators

8-12 OIL SUPPLY: HORIZONTAL TURBINES

- (a) Method of Removing the Dirty Oil and Refilling With Clean Oil?
- (b) Who Furnishes Filtering and Storage Outfit for Turbine?
- (c) Allowed Makes of Outfit

9-INTERNAL COMBUSTION ENGINES

9-1 NUMBER

9-2 LOCATION OF PLANT

9-3 CHARACTER OF BUILDING

9-4 ALLOWED MAKES

9-5 TYPES

- (a) Gas
- (b) Oil
 - Diesel
- (c) Two or Four Cycle
- (d) Horizontal or Vertical
- (e) Suction or Pressure
- (f) Single or Double-acting
- (g) Number of Cylinders

9-6 GAS OR FUEL ON WHICH ENGINE SHALL OPERATE

- (a) Producer
- (b) Natural
- (c) Illuminating
- (d) Gasoline
- (e) Kerosene
- (f) Oil
 - What is chemical analysis and percentage of silt?
- (g) Effective Heat Units in Gas
- (h) Maximum Percentage of Hydrogen
- (i) Maximum Percentage of Impurities

9-7 GENERAL NOTES

- (a) Opening for Delivery of Plant?
- (b) Engineer's Services to Operate Plant
- (c) Location and Dimensions of Engine Room
- (d) Ventilation of Engine Room
- (e) Head Room

9-8 PURPOSE FOR WHICH ENGINES ARE TO BE USED

9-9 ENGINES TO BE ATTACHED TO DRIVEN APPARATUS, HOW?

- (a) Directly Connected
- (b) Directly Coupled
- (c) Belted
- (d) Coupled to Shaft

9-10 CYLINDER INSIDE DIAMETER (MINIMUM)

9-11 LENGTH OF STROKE

9-12 SPEED

9-13 GAS PRESSURE

- (a) Will Engine Create Its Own Suction?
- (b) Will Gas be Delivered under Pressure?

9-14 REQUIRED CAPACITY

9-15 REQUIRED OVERLOAD CAPACITY, AMOUNT AND PERIOD

9-16 PAINTING

9-17 SPEED REGULATION

- (a) How Measured?
 - Percentage to be based on full-load speed of engine
- (b) How is Speed Regulation Obtained at Light Load?
- (c) How is Speed Regulation Obtained at Heavy Load?

9-18 SPEED VARIATION ALLOWED UNDER SUDDEN VARIATIONS OF SPEED

9-19 SPEED VARIATION ALLOWED UNDER GRADUAL VARIATIONS OF SPEED

9-20 FROM WHAT PERCENTAGE OF FULL LOAD TO WHAT PERCENTAGE OF FULL LOAD?

- (a) Percentage to Be Based On Full-load Speed of Engine

9-21 ANY REQUIREMENT AS TO VARIATION FROM CONSTANT ANGULAR VELOCITY DURING EACH REVOLUTION (A. C. WORK)

9-22 NOISE AND VIBRATION

- (a) How Determined
- (b) Amount Permitted

9-23 TESTS AND INSPECTIONS

- (a) Where Made?
- (b) How Made?
- (c) By Whom?
- (d) Who Pays Expenses of Trips to Factory?
- (e) Any Charge for Inspections?
- (f) Who Pays for Fuel, Oil and Operating Care During Acceptance Run?
- (g) Who Supplies Load for Test?
- (h) Who Makes Connections?
- (i) What will be Covered by Test at Shop?
- (j) What will be Covered by Test at Erection?
 - Economy guarantees
 - Regulation
 - Capacity
 - Overload capacity
 - Noise and vibration
 - Valve adjustment

9-24 MECHANICAL CONNECTIONS TO DRIVEN APPARATUS

- (a) If Direct-Connected to a Dynamo (Solid Shaft)
 - Who will press armature on shaft?
 - Where will armature be pressed on shaft?
 - Who furnishes key?
 - Who furnishes gage for shaft?
 - Who furnishes dynamo shaft?
- (b) If Directly Coupled to a Dynamo (Coupled Shaft)
 - Who furnishes coupling? (Both halves)
 - Who furnishes dynamo shaft?
 - Will dynamo armature be shipped to engine manufacturer?
 - Who pays for shipping armature and shaft from engine works to engine room?
- (c) Whether Dynamo is Directly Connected or Coupled
 - Who furnishes key?
 - Who furnishes gage for shaft?
 - Who furnishes sub-base, if any is required?
 - Who furnishes sole plates, if any are required?
 - Who furnishes holding-down bolts?
 - Who furnishes outboard bearing?
 - Who fits field frame to sub-base or sole plate at job?
 - Who is to be responsible for mistakes in fitting dynamo parts to engine parts?

(d) If Engine is Belted to Dynamo or Shaft

- Shall belt be run tight or slack? If slack, how is belt to be kept so?
- Diameter and face of driving wheel; diameter and face of driving pulley
- Maximum horse power to be transmitted
- Distance between belt centers
- tape-line measurement around pulleys
- Will drive be with tight side on top or below?
- belt forward or back?

Will belt be below floor in any part?
 who makes pit?
 how will pit be drained?
 where will drain discharge?
 material of pit?
 Any guard rail around belt?
 Any guard rail around pit?
 How will static electricity be collected from belt?
 Who supplies belt?
 Who installs belt?
 width of belt?
 how is joint in belt to be made?
 endless? If so, made endless at factory, or ends left open and joined at the job?
 shall belt manufacturer make allowance for endless lap?
 thickness
 material
 allowed makes

9-25 CYLINDERS

- (a) *Material
- (b) *Method of Cooling
- (c) *Method of Support
- (d) Blow Holes in Castings
- (e) Lubrication
 Oil, dry or liquid graphite?
- (f) *Clearance
- (g) *Scavenging
- (h) *Location and Number of Igniter Plugs
- (i) Finish of Heads
- (j) Finish of Barrels
- (k) Gaskets or Packing in Cylinder Heads and Manifold Flanges

9-26 PISTON

- (a) *Type
- (b) *How Secured to Rod?
- (c) *Cooling
- (d) Material
- (e) Finish

9-27 PISTON ROD

- (a) *Material
- (b) *Dimensions
- (c) *Packing of Stuffing Box if Double-acting
 Metallic or soft packing?
- (d) *Cooling, if Double-acting
- (e) *How Connected at Each End?

9-28 CROSS-HEAD

- (a) *Type
- (b) *Method of Adjustment
- (c) *Method of Lubrication
- (d) *Area
- (e) *Diameter and Length of Pin

9-29 CONNECTING ROD

- (a) *Length
- (b) *Cross Sectional Area
- (c) *Method of Securing to Cross-head
- (d) *Method of Securing to Crank
- (e) *Means of Adjustment
- (f) Material
- (g) Finish, Polished, or Ground, or Rough. If any Casting, Shall It be Filled Only or Filled and Painted?

9-30 CRANK AND PIN

- (a) Diameter and Length of Pin
- (b) *Type of Crank
- (c) *How Counterweighted?
- (d) *How Balanced?
- (e) Material
- (f) Oiling Device on Crank Pin

- (g) Finish, Polished, or Ground, or Rough

9-31 MAIN BEARINGS

- (a) *Diameter and Length
- (b) *Oiling System
 Self-oiling bearings?
- (c) *How Re-lined?
 Removable shells
- (d) *Adjustment
 For alignment?
 For wear?

9-32 SHAFT

- (a) *Diameter and Length
- (b) *Material
- (c) Finish, Polished, or Ground, or Rough
- (d) *Provision for Preventing Oil From Traveling Along Shaft

9-33 FLY-WHEEL

- (a) *Diameter
- (b) Number per Engine
- (c) *Weight
- (d) *How Secured to Shaft?
- (e) *Balance
- (f) *Finish
- (g) *Material

9-34 GOVERNING DEVICE

- (a) *Type of Governor
- (b) *Detail of Construction
- (c) *Method of Adjustment for Different Speeds
- (d) *Lubrication
- (e) Shields for Prevention of Spattering of Oil
- (f) *Provision for Wear

9-35 FRAME

- (a) *Type
- (b) *Material
- (c) *Finish: Polished, or Ground, or Rough. If any Casting, Shall It be Filled Only or Filled and Painted?
- (d) Painting

9-36 FOUNDATIONS

- (a) Dimensions
- (b) Material
- (c) Who Builds?
- (d) Insulation from Buildings
 Bolts, nuts, and anchors, sleeves
- (e) Template
- (f) Are Bolts, etc., to be Shipped Before Engines?
- (g) Who Sets Template?
- (h) Who Does Grouting?
- (i) Is Base to be Filled?

9-37 EXCAVATION

- (a) Who Makes?
- (b) Who Removes Dirt and Rubbish?
- (c) Who Cleans Up After Completion?

9-38 IGNITION

- (a) Type
- (b) How Many and What Sources of Supply?
- (c) Single or Multiple Igniters in Each Cylinder?
- (d) Ignition Wiring by Whom?
- (e) Sources of Supply by Whom?
- (f) *Is Timing to be Adjustable?
- (g) *Cooling

- (h) *Removal and Renewal
- (i) *Material

9-39 WATER COOLING

- (a) *System
- (b) *Manifold by Whom?
- (c) Who Supplies Valves on Inlet and Outlet?
- (d) *Quantity Needed at What Temperature?
- (e) *Pressure Needed
- (f) Discharge Where?

9-40 VALVES

- (a) *Type
- (b) *How Controlled?
- (c) *Removable Cages
 Any spare valves and cases?
- (d) *How Cooled?
- (e) *Material
- (f) *How Held From Dropping Into Cylinder?
- (g) *Where are Valves Located?

9-41 MIXING DEVICE

- (a) Where Is Mixing Controlled?
- (b) How Is Mixing Controlled?

9-42 CYLINDER AND ENGINE LUBRICATION

- (a) Cylinder Lubricators
 Types
 forced-feed
 number of feeds
 reservoir capacity
 location and method of mechanical drive
 sight-feed
 hand-pump
 Size
 Finish
 Allowed makes
 Who erects lubricators?
 Any graphite to be used?
 Any special feeding devices?
- (b) Engine Lubrication
 Any central system? (See Section 4-51)
 Type
 Size of feeds
 Piping, material and finish
 Size and type of filter
 Size and type of separate storage tank, if any
 Any grease cups?
 type and capacity of grease cups
 Allowed makes

- (c) Means for Re-circulation

9-43 PIPING

- (a) Limits to Which Engine Contractor Goes With
 Gas-supply piping
 Air-supply piping
 Exhaust piping
 provisions for expansion at manifolds
 Water-supply and drip piping
 Oil piping
 Compressed-air piping
 Electric wiring
 Covering of piping and flanges
- (b) Method of Muffling Exhaust

9-44 STARTING EQUIPMENT

- (a) System
- (b) Pressure of Air Required
- (c) Capacity of Air Tanks
 Test for tightness of air tanks
- (d) Relief Valves

- (e) How Will Compressed Air be Supplied?
- (f) Any Automatic Control?
- (g) Any Gages?
- (h) Allowed Makes of Compressors
- (i) Type of Compressors
- (j) How is Compressor Driven?
- (k) Noise and Vibration
- (l) Lubrication
- (m) Method of Support
- (n) Foundation: How Made? Of What Material? Any Special Facing? Supplied by Whom?
- (o) Painting

9-45 PLATFORM AND RAILING

- (a) Material
- (b) Finish

9-46 IF AN OIL ENGINE IS CON-TEMPLATED

- (a) Oil-storage Tank
 - Size
 - Material
 - Location
 - Gravity or suction feed?
 - Fire protection
 - Filling and emptying
 - Vent
 - Painting
- (b) Oil Piping from Tank to Engine
 - Material
 - Valving
 - Pumping
- (c) Ignition
 - Type
 - How many and what sources of supply?
 - Single or multiple igniters in each cylinder?
 - Ignition wiring by whom?
 - *Is timing to be adjustable?
 - *Cooling
 - *Removal and renewal
 - *Material
- (d) No Ignition
- (e) No Gas-supply Piping
- (f) Character and Analysis of Oil to be Used
 - Specific gravity
 - Thermal value
 - Base
 - Percentage of silt

10-DYNAMOS

10-1 NUMBER OF DYNAMOS

10-2 LOCATION OF PLANT

10-3 CHARACTER OF BUILDING

10-4 PURPOSE FOR WHICH DYNAMOS ARE TO BE USED

10-5 TYPE

- (a) Direct-connected
- (b) Direct-coupled
- (c) Belted
- (d) Direct-current. Two or Three-wire
- (e) If Three-wire, Self-contained or Separate Balancing Device
- (f) Alternating-current, Single, Two or Three-phase Star or Delta Connection

10-6 Required Capacity

- (a) Kilowatts for Direct Current
- (b) Kilovolt-Amperes (K. V. A.) for Alternating Current

(c) With Alternating-current, Dynamo Power Factors Should Be Stated

10-7 REQUIRED OVERLOAD CAPACITY

10-8 VOLTAGE

10-9 SPEEDS

10-10 MAXIMUM TEMPERATURE RISES PERMITTED

- (a) Under Full Load
- (b) Under Over-load
- (c) In Commutators
- (d) In Fields
- (e) In Armature Winding
- (f) How Long Under Full Load?
- (g) How Long Under Over-load?
- (h) Will Over-Load Follow Full Load?
- (i) How Will Rises be Measured?

10-11 PAINTING

10-12 ERECTION

- (a) Who Erects Dynamo?

10-13 REGULATION

- (a) Voltage at Over-load
- (b) Voltage at Full Load
- (c) Voltage at Quarter Load
- (d) Voltage at No Load
- (e) Is Compounding to be Variable?
- (f) What Variation Permitted in Line Joining No Load and Full Load (or Over-Load) Voltage?
- (g) How Will Compounding be Measured? After Full Load Run?
- (h) What Drop in Speed is to be Allowed for in Changing from No Load to Over-load?
- (i) What Momentary Variation, Under Sudden Changes of Load, Will be Permitted?
- (j) Will Hand Adjustment be Permitted?

10-14 SPARKLESS OPERATION

10-15 NOISELESS OPERATION

10-16 FLICKERING OF LIGHTS

10-17 ELECTRICAL BALANCE OF WINDING

10-18 WITH THREE-WIRE DIRECT-CURRENT DYNAMOS

- (a) What is Maximum Unbalanced Load
- (b) What Difference in Voltage Between the Two Sides of System Will be Permitted?

10-19 TESTS AND INSPECTION

- (a) Where Made?
- (b) How Made
- (c) By Whom?
- (d) Who Pays Expenses of Trips to Factory?
- (e) Any Charge for Test?
- (f) Who Supplies Load During Test?
- (g) Who Operates Plant?
- (h) What Will be Covered by Test at Shop?
- (i) What Will be Covered by Test After Erection?
 - Efficiency guarantees
 - Regulation
 - Noiselessness
 - Capacity
 - Overload
 - Balance
 - Absence of flickering

10-20 MATERIAL AND CONSTRUCTION

NOTE: These starred items may be specified, or preferably may be left for dynamo builder to specify.

They are noted here to call attention to the necessity of definite knowledge on these points before placing contract.

- (a) Field Frame
 - *Material
 - *Number of poles
 - *Pole clearance
 - (b) Armature
 - *Type of winding
 - *Method of insulation
 - *Method of fastening ends of winding to commutator lugs
 - *Depths of slots
 - *Ventilation
 - (c) Commutator
 - *Material
 - *Insulation
 - *Wearing depth
 - *Number of segments per pole
 - Truing up
 - (d) Brushes
 - Material
 - *Size
 - *Number per pole
 - Maximum current density
 - *Method of support
 - *Adjustment
 - *Connection to brush holder
 - (e) Field Rheostat
 - Who supplies?
 - Type
 - Range of voltage
 - Allowed makes
 - Finish
 - (f) Bearings
 - *Number
 - *Size
 - Self-oiling
 - Who supplies?
 - *Adjustment
 - (g) Pulley (Belted Dynamo Only)
 - Material
 - Diameter and face
 - Method of support
 - *How fastened to shaft?
 - (h) Sub-base
 - Material
 - By whom supplied?
 - *Construction
 - (i) Shaft
 - *Size
 - Protection against oil
 - *Material
- 10-21 MECHANICAL CONNECTIONS TO DRIVING APPARATUS
- (a) If Direct-connected to an Engine (Solid Shaft)
 - Who will press armature on shaft?
 - Where will armature be pressed on shaft?
 - Who furnishes key?
 - Who furnishes gage for shaft?
 - Who furnishes dynamo shaft?
 - (b) If Directly Coupled to an Engine (Coupled Shaft)
 - Who furnishes coupling? (Both halves)
 - Who furnishes dynamo shaft?
 - Will dynamo armature be shipped to engine manufacturer?
 - Who pays for shipping armature and shaft from engine works to engine room?

- (c) Whether Dynamo Is Directly Connected or Coupled
 Who furnishes key?
 Who furnishes gage for shaft?
 Who furnishes sub-base, if any is required?
 Who furnishes sole plates, if any are required?
 Who furnishes holding-down bolts?
 Who furnishes outboard bearing?
 Who fits field frame to sub-base or sole plate at job?
 Who is to be responsible for mistakes in fitting dynamo parts to engine parts?

(d) If Dynamo Is Belted to Engine or Shaft

- How is belt to be kept tight?
 Diameter and face of driving wheel
 Diameter and face of driven pulley
 Distance between belt centers
 tape-line measurement around pulleys
 Will drive be with tight side on top or below?
 belt forward or back?
 Will belt be below in any part?
 who makes pit?
 how will pit be drained?
 where will drain discharge?
 material of pit?
 Any guard rail around belt?
 Any guard rail around pit?
 How will static electricity be collected from belt?
 Who supplies belt?
 Who installs belt?
 width of belt?
 how is joint in belt to be made?
 endless? If so, made endless at factory, or ends left open and joined at the job?
 shall belt manufacturer make allowance for endless lap?
 thickness
 material
 allowed makes

10-22 EXCITERS

(a) Excitation of Fields

- Will fields be self-excited?
 Will there be an exciter integral with dynamo?
 Will exciter be separate?
 If so, will it be motor or engine driven, or driven by belt from main engine? (See Section 10-21d)
 If exciter is motor or engine driven, method of drive? (See Section 7-23d)
 Details of engine or motor
 steam engine (see Section 7-1)
 turbine (see Section 8-1)
 internal combustion engine (see Section 9-1)
 motor (see Section 11-24)

(b) Other Details, see Sections:

10-7, Capacity; 10-8 Voltage; 10-9, Speeds; 10-10, Maximum Temperature Rise Permitted; 10-11, Painting; 10-12, Erection; 10-13 a, b, c and d, Regulation; 10-14, Sparkless Operation; 10-15, Noiseless Operation; 10-19, Tests and Inspection; 10-20, Material and Construction; 10-23, Electrical Connections; 10-24, Foundations; 10-25, Excavations.

10-23 ELECTRICAL CONNECTIONS

- (a) Connections about Dynamo
 (b) Connections from Dynamo to Switchboard
 (c) Lugs for Connections
 (d) Size and Drilling of Lugs
 (e) Switchboard
 (f) Test Connections
 (g) Operation of Test Load

10-24 FOUNDATIONS

- (a) Dimensions
 (b) Material
 (c) Who Builds?
 (d) Insulation from Building
 Bolts, nuts and anchors, sleeves
 (e) Template
 (f) Are Bolts, Etc., to Be Shipped before Dynamos?
 (g) Who Sets Template?
 (h) Who Does Grouting?
 (i) Is Base to be Filled?

10-25 EXCAVATIONS

- (a) Who Makes?
 (b) Who Removes Dirt and Rubbish?
 (c) Who Cleans up after Completion?

11-ELECTRIC WIRING

NOTE: The electrical wiring section of a specification may apply merely to the wiring, or it may, and frequently does, include the electric-power plant, storage batteries, switchboard and panel distributing boards, and lighting fixtures. The advisability of separating these parts or combining them in one contract is a matter of opinion and also a matter of preference and conditions. Unless the work is located at a distance, making it desirable to have one contractor in charge of the whole work, it has been the writer's experience that sub-division results in better control of the work and a lower cost. For this reason the CHECKING-LIST under the heading of Electrical Equipment deals with electric wiring and all matters directly connected therewith, but provides also separate sections on

- (1) Engines
 (2) Dynamos
 (3) Switchboards
 (4) Storage batteries

As to electric fixtures there is no possibility of writing either a general specification or a specification digest. The selection of this work is a matter of taste.

11-1 GENERAL DESCRIPTION OF ELECTRICAL WORK

(a) Work and Materials to be Included in Electrical Contract

- Who furnishes generator units?
 Who furnishes storage-battery equipment?
 Who furnishes switchboard?

(b) Who Makes Wiring Connections Between the Foregoing?

(c) Does Electrical Contractor Furnish Fans, Pumps or Compressors?

(d) Who Makes Connections to and Between Electrical Apparatus Furnished by Other Contractors?

(e) Who furnishes Automatic Electrical Controllers for Pumps, Compressors, Etc.?

(f) Are Power Feeders Required for Use of Tenants?

(g) Is Tenant's Light to be Separately Metered?

Is tenant's power to be separately metered?

- (h) Who Furnishes Distributing Panel Boards?
 (i) Any Emergency or Night Lighting?
 (j) Any Outside Sign or Marquise Lighting?
 (k) Any Special Lighting?
 (l) Are All Outlets Shown on Plans to be Connected?
 (m) Are Any Outlets not Shown to be Provided For?
 (n) Are Any Special Outlets Required for Power, Heater, Irons, Etc.?
 (o) Any Bell and Annunciator System?
 (p) Any Local or Interior Telephone System?
 (q) Any Conduit System for Outside Telephone Service?
 (r) Any Watchman's-Clock System?
 (s) Any Time-clock System?
 (t) Any Fire-alarm System?
 (u) Any Telautograph System?
 (v) Any Carriage-signal System?
 (w) Any Dictagraph System?
 (x) Is Elevator Signal System Connected to Separate Source of Power?
 (y) Are there Any Special Devices, Such as Door-openers, Etc.?

(z) Who Furnishes Electric-light Fixtures?

Who furnishes incandescent, arc, Nernst, Cooper-Hewitt, Moore or tungsten lights?

Who furnishes electric plate-warmers, heaters, irons, etc.?

Who furnishes drop cords?

Who furnishes extension cords and plugs from receptacles and floor outlets for lighting or bell system?

11-2 ELECTRIC SYSTEM TO BE USED

(a) Will Electricity be Supplied from Private Plant or Outside Service?

(b) Electric System Inside of Building

Will same service be used for light and power?

Direct or alternating current?

If alternating, single, two- or three-phase?

Two-wire or three-wire system?

Voltage for lighting

Voltage for power

How far does electrical contractor's work extend as regards connections to service?

(c) Outside Electric Service

Intermediary apparatus, such as transformers, rotary converters or motor generators?

Installed by public service corporation or by owner?

Break-down service required?

Provisions made for metering outside power

Nature of transmission line

Service enters building where?

Direct or alternating current?

Voltage of outside system

Frequency of outside system

11-3 CERTIFICATES AND PERMITS

(a) Fire Underwriters

(b) Municipal Authorities

(c) State Authorities

(d) Who Pays Fees for Inspection, Repairing, Etc.?

(e) What Parts of Work Are to be Covered by Certificates?

Work done by electrician

Work not done by electrician, or apparatus not purchased by him but requiring such certificates

11-4 WIRE

- (a) Material
- (b) Conductors
 - Percentage conductivity
 - Tinning
 - Stranding
- (c) Character and Quality of Insulation
 - Material
 - Percentage of rubber
 - Thickness of rubber or other insulating material
 - Number of braids
- (d) Mechanical Protection
- (e) Tests
 - Mechanical tests
 - Insulation tests
 - Test voltage to be used
 - alternating or direct?
 - Length of time of test
 - Required insulation resistance
 - Who pays for expense of test
 - Who pays for inspector?
 - Who supplies instruments and other test needs and voltage and current?
 - Where shall tests be made?
 - When shall tests be made?
- (f) Size of Wire
 - Where are sizes shown?
 - Where not shown, what rule is to govern?
- (g) Stranding of Wire Required When Larger Than What Size?
- (h) Any Special Wire or Insulation for Electric heating appliance
 - Bell work
 - Portable lights
 - Telephones
 - Storage-battery connections
 - Outside work
 - Rooms with damp air
 - Rooms with acid-impregnated air
 - Rooms with gaseous atmosphere
- (i) Allowed Makes
 - Is manufacturer's certificate required?
- (j) Joints in Wires and Cables
 - Sleeves for conductor, insulation and sheath
 - Taping
 - Insulating compound

11-5 CONDUITS

- (a) Interior Conduits
 - Kind
 - rigid or flexible
 - enamelled iron
 - galvanized iron
 - steel flexible
 - circular loom
 - Size required
 - Limits in use of bent conduit
 - Burrs and sharp edges
 - Water-tightness
 - Protection of conduit and joints in concrete or underground
 - Protection of conduit in acid fumes
 - Threading and making up of joints
 - Plugging of ends during construction
 - Grounding of conduits
 - Support of exposed or boxed-in conduit
 - horizontal
 - vertical
 - Following of ceiling line with exposed conduit
 - How fastened to outlet boxes?
 - Location of runs
 - floor, ceiling, or partition

where indicated? Are plans diagrammatic or designed to show actual runs?

Allowed makes

- (b) Exterior Conduits
 - Kind
 - terra cotta
 - fibre
 - pipe
 - How laid?
 - Joints water-tight
 - Construction details
 - Drainage
 - Manholes
 - size
 - material
 - drainage covers
 - cable racks

11-6 OUTLETS

- (a) How Indicated on Plans?
 - Key to Symbols
- (b) Type
- (c) Material
- (d) Centering
 - Ceilings
 - Wall panels
 - Floors
- (e) Location
 - Receptacles
 - Switch boxes
 - Side brackets
 - Closet lights
- (f) Any Drawings to be Obtained from Architects before Locating Outlets?
- (g) Any Directions to be Obtained from Superintendent?
- (h) Height of Outlets
- (i) Flush with Face of Walls or Ceilings?
- (j) Any Covers for Outlet Boxes?
 - Finish of covers
- (k) Method of Support
 - Where outlets occur under beams
- (l) Floor Outlet Boxes
 - Adjustable for concrete floors
- (m) Any Special Type or Size Outlet Boxes Required?
- (n) Allowed Makes

11-7 CIRCUIT WIRING

- (a) Two or Three-wire?
- (b) Size of Wire
- (c) Number of Wires to be Pulled in a Conduit
- (d) Joints
 - Where allowed?
 - How made?
- (e) Where Exposed
 - How supported?
 - How far apart are supports?
 - How protected in damp or acid air?
 - How protected against mechanical injury?

11-8 DISTRIBUTING PANELS

- (a) Location Indicated Where?
 - Height above floor
- (b) Number of Circuits
 - Any extra circuits to be allowed for?
- (c) Material, Thickness and Finish
 - Panel boards
 - Linings, material and thickness
 - Outside boxes, material and thickness

Flush or surface mounting?
Gutter and no-gutter boxes

- (d) Mains
 - Lugs only
 - Fuses only
 - Switch only
 - Switch and fuses
- (e) Mains and Branches
 - Two or three-wire mains?
 - Two or three-wire branches?
 - Bus-bars form part of mains, or are they connected as a branch from mains? If bus-bars form part of mains, state ampere capacity
 - Support of mains in panel box
 - Are any circuits to be controlled in groups?
- (f) Bus-Bars and Connections to Switches
 - Material
 - Finish
 - Minimum thickness
 - Allowable current density
- (g) Switches on Panels
 - Push, knife or rotary?
 - Double or triple pole?
 - How connected to bus-bars?
 - Are fuses to be between bus-bars and switch, or between switch circuit?
 - Kind of handle for knife switches
 - Finish of pushes for push switches
 - Finish of handles for rotary switches
 - Allowable amperage
 - Are switches to be in same compartment as fuses, or in a separate compartment?
 - Any switches to control groups?
 - Material
 - Allowed makes
 - Are any branch circuits to carry more than 660 watts?
- (h) Fuses
 - Type: cartridge, link or plug?
 - Any extra fuses to be supplied?
 - Who fuses panels to start with?
 - Carrying capacity of fuses
 - Allowed makes
- (i) Trim
 - Material
 - Finish
 - Who supplies?
 - Thickness
 - Design of doors
 - Hardware
 - Diagram holder
- (j) Diagram
 - How are outlets and circuits to be indicated?
 - Material of diagram
 - Support and protection of diagram
 - By whom furnished?
- (k) Special Panels
 - Elevators?
 - Bell system?
 - Sprinkler alarm?
 - Show window?
 - Emergency or night panels?
- (l) Drawings to be Submitted
- (m) Provisions for Metering
- (n) Pull Boxes for Power Tap
 - Material, thickness, and finish
 - Size
 - Cover plate or door
- (o) Allowed Makes

11-9 WALL AND PENDANT SWITCHES

- (a) Types
 - Push, single-pole
 - Push, two-pole
 - Push, three-way or four-way
 - Key operated
 - Snap
 - Pendant
- (b) Finish of Buttons and Plates
- (c) Symbols
- (d) Location and Height
- (e) Use of Gang Switches
 - Plates for gang switches
- (f) Marking of Snap Switches
- (g) Pendant Switches
 - Type
 - Furnished by whom?
 - Length of cord
 - Kind and covering of cord
 - Any extra ones?
- (h) Allowed Makes

11-10 RECEPTACLES

- (a) Types
 - Wall
 - Ceiling
 - Outdoor
 - Electric heating
 - Flush or on face?
- (b) Base
 - Screw
 - Push
- (c) Plugs
 - Finish
 - Length of extension cord required to be furnished, if any
- (d) Plates
 - Finish
 - Size
 - Shape

11-11 PORTABLE LIGHTS

- (a) Number
- (b) How Indicated?
- (c) Construction
 - Kind of plug
 - Handle
 - Guard and holder
 - Kind of socket
- (d) Cord
 - Length
 - Kind
- (e) Allowed Makes

11-12 DROP LIGHTS

- (a) Number
- (b) How indicated?
- (c) Cord
 - Length
 - Kind
- (d) Kind of Socket
- (e) Shade of Holder
- (f) Lamp Guard, if Any
- (g) Pendant Switch
- (h) Any Special Types for
 - Damp places
 - Acid rooms
 - Outdoor work

11-13 SUPPORTS

- (a) For Vertical Conduits
- (b) For Fixtures
- (c) Drop Lights
- (d) Switch Boxes

11-14 PUSH BUTTONS

- (a) Kind
- (b) Finish
 - Special for fire
- (c) Diameter
- (d) Name Plate
- (e) Floor and Table Pushes
- (f) For Remote Control Switches
- (g) Allowed Makes

11-15 BELLS AND BUZZERS

- (a) Type
 - Buzzer or bell
- (b) Diameter of bell
- (c) Finish
- (d) Location Shown Where?
- (e) Bells or Buzzers Required for Which of Following?
 - Entrances
 - Dining rooms
 - Other rooms
 - Elevators
 - Dumb waiters
 - Office calls
 - Fire drill
 - Sprinkler alarms
 - Fire gongs
 - Water tanks, high and low-water
 - Boiler tanks, high and low-water
 - Circuit breaker alarms
 - Engine-room entrance
 - Freight
 - Burglar alarm
 - Elevators to engine room
 - Apartments to servants' quarters
 - Thermostatic alarms
- (f) Mats
- (g) Allowed Makes

11-16 ANNUNCIATORS

- (a) Number
- (b) Location
 - Indicated on plans how?
 - Height
- (c) Type
- (d) Finish
- (e) Support
- (f) Number of drops
 - Any spare drops?
- (g) Annunciators Required for Which of Following?
 - Apartment pushes
 - Elevators supplied by whom?
 - Fire systems
 - Sprinkler system
 - Engine-room from apartments
 - Engine-room from elevators
- (h) Allowed Makes

11-17 MOTOR DYNAMOS

- (a) Number
- (b) Type
 - One armature
 - Two armatures
- (c) Speed
- (d) High and Low-voltage
- (e) Capacity of Dynamo End
- (f) Kind of Current
 - Received
 - Delivered
 - If alternating, single, two- or three-phase and number of cycles?
- (g) Heating Limits
- (h) Method of Support
- (i) Control
 - Switches for motor dynamos

Switches or cut-outs for bell circuits

- (j) Cross Connection
- (k) Painting
- (l) Allowed Makes

For Motors, see Section 11-24; and for Dynamos, see Sections 10-8, 10-9, 10-10, 10-12, 10-14, 10-15, 10-16, 10-17, 10-18, 10-19, 10-20, 10-21 and 10-22.

11-18 BATTERIES

- (a) Number
- (b) Type
- (c) Connection
- (d) Enclosure
- (e) Support
- (f) Allowed Makes

11-19-INTERIOR TELEPHONE SYSTEM

- (a) What is System to Accomplish
- (b) Is System to be Intercommunicating?
- (c) Will System be Independent of, or a Part of Public Telephone System?
- (d) Switchboard
 - Desk or cabinet type?
 - Type of signal
 - Finish
- (e) Outlying Telephone Sets
 - Desk or wall type?
 - Finish
 - Height above floor
 - Is selective signalling desired?
 - Is secret service desired?
- (f) Source of Power
- (g) Wiring
 - Will it be in conduit?
 - Are outlet boxes required?
 - Who will install wiring?
 - Number of wires to each station
 - Metallic circuit or common return?
 - How many conversations must be carried on simultaneously without interference?
 - Will each station be able to call every other station or system?
 - What shall be ultimate capacity of each station and what shall be capacity of main distributing cable?
 - Is main distributing cable to be provided with cross connection strips in all distributing boxes?
 - Is any provision to be made for installing additional stations in future?
 - Is any provision made for secret talking between any stations?
 - Is cable to be lead covered?
 - Will it contain extra battery pairs of larger size than talking pairs?

- (h) Connecting Boxes
 - Size of material
 - Location
- (i) Allowed Makes

11-20 CONDUIT FOR PUBLIC TELEPHONE SERVICE

- (a) Is Service to be Direct or Through an Operating Board?
- (b) Who is to Install Connecting Boxes? Telephone Company?
- (c) What Size Conduits Are Required by Telephone Company?
- (d) Where is Cable to be Run?
- (e) Size of Connecting Boxes?
- (f) Where Does Service Enter?

11-21 FIRE-ALARM SYSTEM

- (a) Type
- (b) Location of Boxes
- (c) Wiring Run How?
- (d) Any Outside Connections?
- (e) Allowed Makes

11-22 WATCHMAN'S CLOCK AND TIME CLOCKS

- (a) Number of Clocks
- (b) Types of Clocks
Type of master clock
clock program
bells connecting board, etc.
- (c) Location of Clocks
- (d) Who Does Wiring?
- (e) How is Wiring to be Run?
- (f) What Size and Kind of Wire?
- (g) Any Duplicate Keys?
- (h) Any Connection to Time-Clock System?
- (i) Source of Power
- (j) Allowed Makes

11-23 ELECTRIC PUMPS

- (a) Number of Boiler-feed Pumps, Sizes and Types
- (b) Number of Drain Pumps, Sizes and Types
- (c) Number of House Pumps, Sizes and Types
- (d) Number of Fire Pumps, Sizes and Types
- (e) Number of Elevator Pumps, Sizes and Types
- (f) Number of Oil Pumps, Sizes and Types
- (g) Number of Circulating Pumps, Sizes and Types
- (h) Number of Brine Pumps, Sizes and Types
- (i) Number of Ammonia Pumps, Sizes and Types
- (j) Number of Vacuum Pumps, Sizes and Types
- (k) Number of Air Pumps, Sizes and Types
- (l) Sizes, Diameter and Stroke of Cylinders
- (m) Speeds Allowed
- (n) Number of Gallons Per Minute to be handled
- (o) Pressure Against Which Pump Must Work
- (p) Suction Lift
- (q) Hot or Cold?
- (r) Types, Single or Double-acting
- (s) Drive
Maximum speed and minimum speed
Horse power desired of motors
- (t) Speed Control
What part of control is to be by field regulation and what part by armature resistance?
Is maximum speed to be obtained with weakened field and no resistance in circuit?
- (u) Motors
Voltage
Direct or alternating-current? If latter, single, two- or three-phase, and number of cycles per second? If direct-current shunt or compound wound?
Is motor to be direct, coupled or mounted on shaft?

Is motor to be belted? If so, maximum and minimum speeds of motor?
Who supplies belt? Any idler equipment? Belt-tightener?
(For further details of Belt see Section 7-23d)
Types and makes of controllers. any automatic control?
If motor is directly coupled or mounted on shaft is support of motor to be part of pump housing or frame, or is separate base to be built?
Lubrication of motors
Allowable temperature rise of motors under maximum operating conditions
Are motors open or enclosed or semi-enclosed types?
Approved makes of motors
Who erects?
Who connects?

(v) Construction with Cross-head or Trunk Pistons

(w) Materials

Linings
Rods
Pistons or plungers
Valves

(x) Air Chambers, Size and Number and Location of Pet Cocks

(y) Relief Valves

(z) Self-oiling Bearings

(aa) Foundations: How Made? Of What Material? Any Special Facing? Supplied by Whom?

(bb) Painting

(cc) Guarantee

11-24 ELECTRIC MOTORS

- (a) Voltage
- (b) Direct or Alternation-current? If latter, Single-, Two- or Three-phase and Number of Cycles per Second? If Direct-current, Shunt or Compound-wound?
- (c) Is Motor to Be Directly Coupled or Mounted on Shaft?
- (d) Is Motor to be Belted? If so, Maximum and Minimum Speeds of Motor? Who Supplies Belt? Any Idler Equipment? Belt Tightener? Quality of Belt
(For further details of Belt see Section 7-23d)
- (e) Types and Makes of Controllers
Any automatic control?
Any remote control?
- (f) If Motor Is Directly Coupled or Mounted on Shaft, Is Support of Motor to be Part of the Housing or Frame, or Is Separate Base to be Built?
- (g) Lubrication of Motors
- (h) Allowable Temperature Rise of Motors under Maximum Operating Conditions
- (i) Are Motors Open or Enclosed or Semi-enclosed Types?
- (j) Approved Makes of Motors
(For other details of Dynamos see Sections 10-7, 10-8, 10-10, 10-11, 10-14, 10-15, 10-19, 10-20, 10-22, 10-24 and 10-25)

11-25 SPECIAL WIRING

- (a) Describe Any Special Work
Such as
Wiring of marquise
Elevator connections
Elevator lighting
Elevator signals

Pump-motor signals
Fan-motor signals
Machine-motor signals
Show-window lighting
Show-case lighting
Office lighting
Dome lighting
Electric heating
Public halls to allow partial lighting
Thermostatic signals
Any tank switch connections?

(b) On All These Cover Following Items

Connection from what point?
Where is connection to be run?
How terminated?
Any enclosure required for switch?
Any fuses required?

11-26 MAINS AND FEEDERS

- (a) Where Shown?
- (b) Two or Three-wire?
- (c) Sizes
- (d) If Sizes Are Not Specified or Shown, What Governs?
- (e) Any Special Mains or Feeders?
Public Lighting
Elevators
Hall lights
Toilet lights
Service quarters
Sign lighting

11-27 PRIVATE PLANT WIRING

- (a) Sizes and Number of Armature Connections, Dynamo to Switchboard
Connections from balancing coil of three-wire dynamos
- (b) Sizes and Number or Series Field, Dynamo to Switchboard
Equalizer connections
- (c) Sizes and Number of Shunt Connections to Switchboard
- (d) How and Where Will These Connections be Run?
- (e) How Protected Against Water?
- (f) Test Connections
Who supplies rheostat to absorb power?
Type of rheostat
Capacity of how long a period?
Electric connections, size and how run?
Operation of rheostats during test
- (g) Storage-battery Connections
Main battery to switchboard
End calls to switchboard
Booster motor to switchboard
Booster dynamo to switchboard
Booster exciter to switchboard
Number and size of each of foregoing
How run?
How protected against fumes?
How supported?
- (h) Where Are Dynamo and Battery Connections Shown?

11-28 ARC LAMPS

- (a) Number
- (b) Type
- (c) Amperage
- (d) Voltage
- (e) Direct or Alternating Current
If a. c., cycles per second
- (f) Method of Support
- (g) Finish
- (h) Numbering for Trimming
- (i) Who Installs?

- (j) Who Connects?
 (k) Type and Kind of Inner Globe
 (l) Type and Kind of Outer Globe
 (m) Type and Kind of Carbons
 (n) Any Cooper-Hewitt Mercury Arcs?
 (o) Any Moore Lights?
 (p) Allowed Makes
- 11—29 **TUNGSTEN, CARBON OR NERNST LAMPS**
- (a) Number
 (b) Who Supplies and Installs?
 (c) Wattage
 (d) Voltage
 (e) Kind of Bulbs
 (f) Finish of Bulbs
 Clear or frosted
 White or colored
 (g) Kind of Base
 (h) Test Requirements
 Who pays for test?
 Kind and duration of test
 Watts per candle power
- 11—30 **FOUNDATIONS**
- (a) Who Supplies?
 (b) Material
 Below floor
 Above floor
 (c) Outside Finish Above Floor, Sides and Corners
 (d) Top Finish, Material and Thickness?
 (f) Sheet Piling
 (g) Piling
 (h) Waterproofing
 (i) Painting
- 11—31 **LIST OF MOTORS**
- 11—32 **LIST OF CLOCKS**
- 11—33 **LIST OF FLOOR HEIGHTS**
- 11—34 **TEMPORARY WIRING**
- (a) Elevators
 (b) Pumps
 (c) Fans
 (d) Machines Used During Construction
 (e) Arc Lighting
 (f) Incandescent Lighting
 Who supplies lights?
 Who replaces lights?
 Who trims arc lamps?
- 12—**SWITCHBOARDS**
- 12—1 **LOCATION**
- 12—2 **MATERIAL**
- 12—3 **THICKNESS**
- 12—4 **HEIGHT**
- 12—5 **LENGTH**
- 12—6 **NUMBER OF PANELS**
- 12—7 **CONSTRUCTION**
- (a) Cornice
 (b) Subbase
 (c) Method of Support
 (d) Method of Bracing
- 12—8 **FOUNDATION (See Index)**
- 12—9 **GRILLE**
- (a) Material
 (b) Location
- (c) Width and Spacing of Mesh
 (d) Doors
- 12—10 **FUNCTIONS OF BOARD**
- (a) Current from What Sources?
 (b) How Distributed?
 (c) Power and Light Distribution
 What part of current is to be metered at switchboard?
 Any apparatus other than electrical apparatus to be mounted on board?
- 12—11 **APPARATUS CONTROLLED**
- (a) Dynamos
 Number and size
 (b) Storage Battery
 Capacity and number of cells
 Number of end cells
 Booster
 (c) Motor Feeders
 (d) Light Feeders
 (e) Street Service
- 12—12 **VOLTAGE**
- 12—13 **CURRENT**
- (a) If Alternating Current, Number of Cycles, Phases and Wires?
 (b) If Direct Current, Whether Two or Three Wire?
- 12—14 **ALLOWED MAKES**
- 12—15 **INSTRUMENTS REQUIRED ON BOARD**
- (a) Ammeters, Indicating and Recording Type
 Allowed makes
 (b) Voltmeters, Indicating and Recording Type
 Allowed makes
 (c) Wattmeters, Indicating and Recording Type
 Allowed makes
 (d) Curve-drawing Instruments
 Allowed makes
 (e) End-cell Switches
 (f) Voltmeter Switches
 (g) Knife Switches
 (h) Oil Switches
 (i) Circuit Breakers
 (j) Enclosed Fuses
 (k) Open Fuses
 (l) Clock
 (m) Ground Detector
 (n) Allowed Makes
- 12—16 **FINISH OF SWITCHBOARD**
- (a) Finish of Instruments
 (b) Finish of Switches and Circuit Breakers
 (c) Bus-bars
 (d) Grille
 (e) Other Exposed Metal Work
 (f) Concealed Metal Work
 (g) Mounting of Instruments
 (h) Finish of Panels
- 12—17 **BUS-BARS**
- (a) Number of Sets
 (b) Number of Bars per Set
 (c) Any Removable Sections?
 (d) Allowable Carrying Capacity
 (e) How Supported?
- (f) Minimum Thickness
 (g) Minimum Spacing
- 12—18 **SWITCHES (CONSTRUCTION)**
- (a) Types
 Single or double break?
 Single or double throw?
 (b) Allowable Carrying Capacity
 Sliding contact
 Cross-sectional area
 (c) How Fused?
 (d) Handles
 (e) Method of Support
 (f) Construction Details
 (g) Name Plates, Front and Rear
 (h) Connection to Bus-Bars
 (i) Connection to Feeders
 (j) Number of Poles
- 12—19 **CIRCUIT BREAKERS (CONSTRUCTION)**
- (a) Types
 Underload
 Overload
 No voltage
 Shunt trip
 Time limit
 Alarm
 Interlocking
 Reverse current
 (b) Construction Details
 (c) Name Plates
 (d) Method of Support
 (e) Connection to Bus-bars
 (f) Connection to Feeders
 (g) Number of Poles
- 12—20 **APPARATUS SUPPLIED BY OTHER CONTRACTORS**
- (a) Rheostats
 (b) Starting Boxes
 (c) End-cell Switches
 (d) Gages
 (e) Lamp Indicators
- 12—21—**LIGHTING OF BOARD**
- (a) Number in Front
 (b) Number in Rear
 (c) How Connected?
 (d) How Controlled?
 (e) How Supported?
 (f) How Shaded?
- 12—22 **GROUND DETECTOR**
- (a) Type
 (b) How Connected?
- 12—23 **GARANTEE OF MATERIAL**
- (a) Instruments
 (b) Circuit Breakers
 (c) Clock
- 12—24 **DYNAMO PANELS**
- (a) Ammeters
 Range of scale
 Number
 Shunts located where?
 (b) Voltmeters
 Range of scale
 Number
 (c) Wattmeters
 Capacity
 Number
 Shunts located where?

- (d) Switch
Single or double-throw?
Number of poles
Capacity
Type
- (e) Circuit Breaker
Number of poles
Type
Capacity
- (f) Rheostats
- (g) Lamp Brackets
Pilot lamps

12-25 TOTALIZING PANEL

- (a) Ammeters (Recording or Indicating)
Range of scale
Number
- (b) Voltmeters (Recording or Indicating)
Range of scale
Number
- (c) Wattmeters (Recording, Indicating or Integrating)
Number
Capacity
- (d) Lamp Brackets
- (e) Ground Detector
- (f) Voltmeter Switch

(With alternating current work there may be transformer, motor-generator, rotary panels, etc., but foregoing will serve as a guide.)

12-26 FEEDER PANELS

- (a) Number of Feeder Panels
- (b) List of Feeders
- (c) Light or Power
- (d) Capacities
- (e) Switches or Circuit Breakers
- (f) Lamp Brackets
- (g) Name Plates
- (h) Double- or Triple-pole Switches
- (i) Single-, Double-, or Triple-pole Circuit Breakers
- (j) How Will Feeders Lead to Switch Lugs?

12-27 STORAGE-BATTERY PANELS

- (a) Booster Control
- (b) Automatic Regulator
- (c) Circuit Breaker
- (d) Special Switching Device for Battery Regulation
- (e) Starting Switches for Motors
- (f) End-cell Switches
- (g) Ammeters
- (h) Voltmeters
- (i) Wattmeters
- (j) Ampere-hour Meter

13-STORAGE BATTERY

13-1 GENERAL INFORMATION

- (a) Location
Where is space provided?
- (b) Purpose
To supply electricity for lighting when battery is not being charged
To supply electricity for lighting when battery is being charged
To supply electricity for elevators and other motors with or without light
To equalize elevator or other motor

fluctuations, receiving and discharging electricity continually

- (c) Whence Will Charging Current be Obtained?
- (d) How Will Battery be Charged?
From outside service?
From dynamos direct?
From dynamo through booster?
- (e) When Will Battery Be Charged?
Is electricity to be drawn from charging source for other purposes at the same time as charging current?
- (f) Allowed Makes

13-2 CAPACITY OF BATTERY

- (a) Capacity for 8 Hours Continuous Discharge at Steady Rate
- (b) Capacity for Momentary Discharge, as in Elevator Work
- (c) Capacity for Three and Five Hours, Continuous Discharge at Steady Rate
- (d) Minimum Number and Dimensions of Plates
- (e) Minimum Number of Cells in Main Battery and in End Cells
- (f) How Will Capacity be Tested?

13-3 BOOSTERS

- (a) Type and Number of Boosters
Constant current
Differential
Shunt wound
Coupled or single shaft or belted
(For details of Belt see Section 7-23d)
Separately excited
- (b) Speed
- (c) Range of Voltage
- (d) Range of Amperes
- (e) Average Charging Current
- (f) Average Discharging Current
- (g) Impressed Current, Direct Current, or Alternating Current? If Latter, Single Phase, Two-phase or Three-phase?
Number of cycles
Impressed voltage
- (h) Allowable Rise in Temperature Under Full Load for 8 Hours and 25 Per Cent Over-load for 2 Hours, also Under Regular Working Conditions
- (i) Noiselessness and Freedom from Vibration
- (j) Sparklessness, Self-oiling
- (k) Foundation: How Made? Of What Material? Any Special Facing? Supplied by Whom?
Bed plate?
- (l) Painting
- (m) Speed-governing Device
- (n) Allowed Makes

3-4 CONTROLLING APPARATUS

- (a) End-cell Switches
Number of switches
Number of points per switch
Who supplies these switches?
Who connects these switches?
Who installs these switches?
Lugs
Where are switches to be delivered?
Capacity in amperes of switches
Any automatic end-cell switches?
- (b) Regulator
Type
Who supplies?
Who installs?

Who connects?
Regulation required
Any details from bidder?

- (c) Rheostats
Number
Who supplies booster-dynamo rheostats?
Who supplies starting rheostat or motor-starting device?
Who supplies exciter-motor rheostats?
- (d) Switches and Switchboard
Who supplies switchboard? (If supplied by battery contractor, see Switchboard Section in CHECKING LIST)
Who supplies starting switches for booster? For exciter?

13-5 JARS OR TANKS

- (a) Number
Any spaces?
- (b) Sediment Space
- (c) Space for Increase in Number of Plates
- (d) Construction of Tanks
Material
Joints
Draining and ventilating of bottoms
Lead lining
Treatment of tanks before lining
Supports for plates
Separators for plates
Covers
- (e) Glass Jars
Supports for plates

13-6 CONNECTION OF PLATES

- (a) Connection of Plates in Each Cell
- (b) Connections from One Cell to Next
- (c) Connections of End Cells
Terminal lugs
- (d) Reinforcing of Terminal Cells and End Cells
- (e) Protection of Bolts

13-7 RACKS AND STRINGERS

- (a) Number of Tiers
- (b) Arrangement of Batteries
- (c) Any Plan Required of Supporting Structure?
Who supplies structure?
Who erects structure?
- (d) Type of Insulators
- (e) Type and Material of Sand Trays
- (f) Who Supplies Sand?
- (g) Numbering of Cells
- (h) Painting
- (i) Foundation

13-8 ELECTROLYTE

- (a) Any Spare Carboys of Acid?
Weight of acid per carboy
- (b) Any Empty Carboys to be Left?
- (c) Hydrometer
- (d) Cell Filler

13-9 CHARGING CURRENT

- (a) Supplied by Whom?
- (b) Supplied for What Period?

13-10 SUNDRIES

- (a) Thermometers
- (b) Portable Voltmeter
Seals of Voltmeter

- (c) List of Instruments and Switches
- (d) Diagram of Connections
- (e) Templates for Drilling by Switch-board Maker

14—REFRIGERATION

As stated in Section 4—1, Refrigeration is broadly a part of the steamfitting specifications, but on account of its importance is here treated separately.

NOTE: Items starred or prefaced by an asterisk may be specified or, preferably, may be left for the machinery builder to specify.

They are noted here to call attention to the necessity of definite knowledge on these points before placing a contract.

14—1 PURPOSE OF PLANT

- (a) Ice Making
- (b) Cold Storage of Food Products
- (c) Water Cooling
- (d) Fur Storage
- (e) Air Drying
- (f) Room Cooling for Manufacturing, Entertainment or Business Purposes
- (g) Manufacturing Processes

14—2 LOCATION OF PLANT AND COOLED SPACES

- (a) Location of Building
- (b) Location of Refrigerating Plant in Building
- (c) Location of Space to be Cooled in Building
- (d) Location of Brine-storage Tank
- (e) Location of Ice-making Tank
- (f) Altitude

14—3 PRODUCTION OF REFRIGERATING GAS

- (a) Ammonia
 - Compression with compressor steam-engine driven
 - Compression with motor drive
 - Compression with gas or oil-engine drive
 - Absorption with generator operated by boiler steam
- (b) Carbonic-acid Machine
- (c) Sulphurous-acid Machine

14—4 TRANSFER OF COOLING EFFECT FROM GAS TO COOLED SPACES

- (a) With Piping Placed in Cooled Space
 - Direct expansion of compressed gas
 - Brine circulation with either of above
- (b) By Cold Air Delivered to Space by Fans
 - Cold air delivered by gravity from bunker space
- (c) Any Tanks for Reserve Cold Storage?

14—5 PLANT

- (a) Number of Units
- (b) Rated Tonnage
 - At what head and suction pressures?

At what condensing-water temperature?

Tonnage in ice melted equivalent? (or stated in b. t. u.)

(c) Work to be Done in Various Parts

- Ice making
- Water cooling
- Brine refrigeration
- Air cooling
- Air drying
- Are these all to be done at one time?

14—6 SPEEDS

- (a) Compressor
 - Engine driving compressor
 - Motor driving compressor
- (b) Pumps
 - Ammonia pumps
 - Brine pumps
 - Water pumps
 - Oil pumps

14—7 ICE MAKING (CAN SYSTEM)

- (a) Amount of Ice per Day
 - When required
 - Storage and delivery into storage
 - Cutting
 - Removal
- (b) Cans
 - Size cans, length, width and height
 - Number
 - Means for removal of cans
 - Ice melting
 - Material
 - Method of support
 - Can filling
- (c) Tanks
 - Length, width and height
 - Material
 - Thickness of metal
 - Bracing
 - Painting
 - Location
 - Outlets
 - Insulation
 - painting of insulation
 - Top and covers of can openings
 - Crane
 - Test of tank
- (d) Coils
 - Size of pipe?
 - Standard or extra heavy?
 - Iron, steel or brass?
 - Black or galvanized on outside?
 - Continuous welded or made up with screwed or flanged fittings?
 - Style of coil? (Oval, zigzag, cylindrical or special)
 - Details of construction?
 - Return-bend or header type?
 - How supported?
 - Method to determine that iron or steel has been used as specified?
 - Test?

14—8 WATER COOLING

- (a) System of Circulation
- (b) Location of Cooler
- (c) Size
- (d) Length of Coil
- (e) Diameter of Pipe
- (f) Material
- (g) Open or Closed Tank
- (h) Filtration
- (i) Insulation of Cooler, Tank and Piping
- (j) Valving

14—9 BRINE CIRCULATION

- (a) Location of Cooling Coils Shown Where?

- (b) How is Brine Cooled?
 - Passing through a Hendrix type cooler
 - Passing through a double-pipe cooler
 - Passing through a submerged shell-and-tube brine cooler
- (c) Balanced or Unbalanced System of Circulations
 - Single or two-pipe system?
- (d) Brine Mains and Risers
 - Material
 - Painting of pipes
 - Insulation
 - Finish
 - Painting of covering
 - Method of support of risers and mains
 - Where are sizes indicated?
 - Strainer
 - Means of cleaning strainer
 - Means of cleaning risers
 - Valving
 - How are connections taken off?
- (e) Thermometer
- (f) Connection to and from Tank
- (g) Connection to and from Pump and Cooler

14—10 GAS PIPING

- (a) Material. (Spiral Riveted, Lap-Welded, Cast-Iron)
- (b) Painting
- (c) Where Are Sizes Indicated?
 - Should contractor specify sizes?
- (d) Valving
 - Type of valves
 - Flanged or screwed
 - Glands
 - Seats
 - Expansion valves
- (e) Allowed Makes
- (f) Joints
 - Method of making joints
 - Type of joints
- (g) Test of Piping
- (h) Insulation
- (i) Method of Support

14—11 AUXILIARY APPARATUS

- (a) Thermometers
 - Brine inlet and outlet of cooler?
 - Brine inlet and outlet of bunker?
 - Inlet and outlet of condenser?
 - Water inlet and outlet of water cooler?
 - Cooled rooms
 - And recording thermometers?
 - Any alarm-ringing thermometers?
 - Range of thermometers in each case
- (b) Psychrometer
- (c) Hydrometer
- (d) Salometer
- (e) Gages
 - Brine
 - Head
 - Back-pressure
 - Steam
 - Allowed makes
- (f) Indicator
 - Allowed makes
- (g) Pressure Regulators
 - Compressors
 - Generator
 - Pumps
 - Allowed makes
- (h) Wrenches
 - Finish of wrenches

- Wrench board
Erection
- (i) Lubricators
Size
Finish
Allowed makes
- (j) Oil and Ammonia Separators
Construction
- 14-12 BRINE**
- (a) Material
Salt or calcium chloride?
Specific gravity
Quantity required?
- 14-13 AMMONIA OR OTHER GAS**
- (a) Who Supplies?
(b) Allowed Makes
(c) Any Spare Quantity?
- 14-14 COOLING SYSTEM BY AIR CIRCULATION**
- (a) Method of Circulating
- (b) Ducts
Sizes
Location shown where?
Thermostatic control of dampers
Method of support
Insulation
Construction
(For other details of Ducts see Section 4-10.)
- (c) Fans (see Section 4-13)
Motors outside cold room?
Thermostatic control?
- (d) Motors (see Sections 11-24 and 26-9)
- (e) Brine Bunker
Number of stacks
Coils
size of pipe
standard or extra heavy?
iron, steel or brass?
black or galvanized on outside?
continuous weld or made up with screwed or flanged fittings?
style of coil? (Oval, zigzag, cylindrical or special)
details of construction?
return-bend or header type?
how supported?
method to determine that iron or steel has been used as specified test?
Location of joints and valves
Drip pans
Draining of pans
Painting
Foundation: How made? Of what material? Any special facing? Supplied by whom?
- (f) Removal of Frost
Method
Details
- (g) Rooms and Boxes
Size
Openings
Shelving
Number of feet of pipes and diameter in coils
Coils. For details of Coils see Section 11-14e or 14-7d)
Drains
Hardware
Insulation of columns or pipes
Lighting
Ventilation
Cleaning facilities
Thermometers
Character of insulation
Finish

Painting
Special fixtures
tracks
hangers
racks
shields

14-15 COMPRESSOR

- (a) Type
Vertical or horizontal
Double or single-acting
Condensing or non-condensing?
Straight-line or duplex
- (b) Number of Cylinders
- (c) Character of Drive
Type of engine
Type of motor

(For details of Engines or Motors see Section 7-1, Engines; Section 9-1, Internal Combustion Engines; Sections 11-23 and 11-24, Motors)

- (d) Foundation
- (e) Painting
- (f) Speeds
Limit of piston speed
- (g) Bore and Stroke of Compressors
Capacity in cubic feet of free air per minute
Air pressure or altitude
- (h) Details of Water Cooling
- (i) Lagging of Cylinder

(For other details of construction of Compressor which it may be advisable to cover in specifications, see Section 7-1, Steam Engines)

- (j) Cross Connection of Suction and Discharge
- (k) Lubrication
Oil, dry or liquid graphite?
- (l) Noiseless Operation
- (m) Valves
Type
Size
Where placed?
*Construction details?

14-16 CONDENSER

- (a) Type
Hendrix
Double-pipe
Atmospheric
Submerged
- (b) Material
- (c) *Square Feet of Cooling Surface
*Diameter and length of pipe
*Standard or extra heavy pipe
- (d) Valving
Number of sections
Series of parallel operation
Flow of water and gas
- (e) Provision for Saving Water
- (f) Draw-off.
- (g) Provision for Cleaning
- (h) With Atmospheric Type
Protection against freeze-up
Sun and wind protection
Damage to neighbors
- (i) With Submerged Type
Overflow and drain
Material and thickness of tank
Construction details
Coils. (For details of Coils see Section 14-7d)
- (j) Number of Condensers
Painting
Method of support
Foundation: How made? Of what material? Any special facing? Supplied by whom?
Test

14-17 COOLERS

- (a) Number
- (b) Type
Hendrix
Double-pipe
Shell-and-tube
- (c) Rated Capacity
With Hendrix type
*diameter
*coil surface
*height and head room required
*valving
With double-pipe
*number of feet of pipe
*diameters of pipe
*material
With shell-and-tube
pipe
diameter
length
cooling surface
tank size
agitation
- (d) Lagging
Painting
Finish, polished, or ground or rough
Insulation
- (e) Valving
- (f) Draining and Purging
- (g) Method of Support
- (h) Foundation
- (i) Test
Working pressure
Test pressure

14-18 Pumps

- (a) Number
- (b) Services and Construction
(For other details of Pumps see Section 4-18, Steamfitting; and Section 11-23, Electric Fitting)
- (c) Insulation of Cold End?
- (d) Governor
- (e) Working Pressure
Static head
- (f) Allowable Piston Speeds

14-19 GENERAL

- (a) Who Makes Steam and Drip Connections?
- (b) Who Makes Electrical Connections?
- (c) Who Makes Plumbing Connections?
- (d) Who Supplies Steam?
- (e) Who Supplies Water?
- (f) Who Supplies Electricity?
- (g) Who Runs Test?

14-20 GENERATORS (ABSORPTION SYSTEM)

- (a) Number
- (b) Capacity
*Coil surface
- (c) Initial Steam Pressure
- (d) Condensed Steam Delivered Where?
How trapped?
Valving?
- (e) Insulation and Lagging
- (f) Painting
- (g) Finish
- (h) Foundations
- (i) Cross Connections
- (j) Connections to Exchanger, Analyzer and Rectifier by Whom?

14-21 OTHER PARTS OF PLANT

- (a) *Analyzer
- (b) *Exchanger
- (c) *Rectifier
 - Whence is cooling water derived?
 - Where is cooling water discharged?
- (d) *Weak-liquor Cooler
- (e) Method of Support
- (f) Painting
- (g) *Valving

14-22 ABSORBERS

- (a) Number
- (b) Capacity
 - *Coil Surface
- (c) Water Connections
- (d) Finish
- (e) Method of Support
- (f) Foundations: How Made? Of What Material? Any Special Facing? Supplied by Whom?

14-23 AMMONIA PUMPS

- (a) Number
- (b) Size
- (c) Speed
- (d) Governing
- (e) Cross Connections
 - (For other details see Section 4-18, Steam Fitting, and Section 11-23, Electric Fitting)

14-24 WATER CIRCULATION

- (a) Where Derived?
- (b) Where Can it be Used?
- (c) Any Re-cooling?
 - Cooling tower
 - Evaporative condenser
- (d) Any Diagram of Connections?
- (e) Size of all Piping

15-FUEL

15-1 LOCATION OF PLANT

15-2 QUANTITY TO BE PURCHASED

15-3 KIND OF COAL

- (a) Anthracite
- (b) Bituminous
- (c) Lignite

15-4 SIZE OF COAL (ANTHRACITE)

- (a) Furnace
 - Egg
 - Stove
 - Chestnut
 - Pea
 - No. 1 Buckwheat
 - No. 2 Buckwheat (Rice)
 - No. 3 Buckwheat (Barley)
 - Dust
 - Yard screenings
- (b) Semi-Bituminous and Bituminous
 - Run-of-mine
 - Screened
 - what size?
- (c) Lignite
 - Run-of-mine
 - Screened
 - what size?
- (d) Crushed at Plant (see Section 2-23d)

15-5 USES OF COAL

- (a) Steam
 - Stationary power plant
 - Locomotive

- (b) Illuminating Gas
- (c) By-product
- (d) Producer Gas
- (e) Cement Manufacture
- (f) Domestic

15-6 DELIVERY REQUIRED

- (a) On Cars
- (b) Alongside Dock
- (c) In Bins
- (d) How Will Delivery be Made?
- (e) Special Regulations Governing Delivery, If Any
- (f) Agreement as to Guarantee of Supply

15-7 TIME OF DELIVERY

- (a) Hours When Delivery Will be Permitted
- (b) What Storage Capacity Is Available at Plant?

15-8 PROPOSAL TO BE IN BY WHAT DATE?

15-9 PROPOSAL TO BE DELIVERED WHERE?

15-10 ANY BOND OR GUARANTEE REQUIRED?

15-11 CONTRACT SHALL BE AWARDED ON WHAT BASIS

- (a) Heat Unit Contents
- (b) Percentage of Ash
- (c) Lowest Price
- (d) Certain Trade Name or Region
- (e) Certain Mine or Mines

15-12 WHAT WEIGHT SHALL GOVERN

- (a) Shall Coal be Purchased by Gross or Net Ton?
- (b) Who Pays for Weighing?

15-13 WHAT PROCEDURE IN EVENT OF FAILURE TO MAKE DELIVERIES

- (a) Who Shall Stand Loss If Any Occurs?

15-14 SAMPLING

- (a) Who Shall Supervise Taking of Samples?
- (b) Where Will Samples be Taken?
- (c) What Size Samples and How Selected?
- (d) Size of Fragments After Pulverizing
- (e) Quartering and Mixing
- (f) Size of Final Sample
- (g) Who Shall Make Test?
- (h) What Type Calorimeter Shall be Used?

15-15 ASH

- (a) White or Red Ash (Anthracite)
- (b) Percentages Allowed By Contract
 - Usual percentages 15 to 18 for Pea Coal and 18 to 29 for Buckwheat
- (c) What Percentage Shall Cause Rejection?
- (d) What Additions or Deductions for Change In Percentage of Ash From Contract?

15-16 SULPHUR

- (a) What Percentage Allowed?

15-17 DUST

- (a) Shall Coal be Screened Before Weighing and Delivery?
- (b) What Provision As to Excessive Amount of Dust?
- (c) How Shall Screening be Done?

15-18 CLINKERING

- (a) Freedom from Clinker

15-19 MOISTURE

- (a) Shall Any Correction be Made in Price for Moisture?

15-20 PRACTICE TESTS

- (a) Shall Any Tests be Made Under Working Conditions?

15-21 VOLATILE MATTER

- (a) Maximum Allowable Percentage

15-22 HEAT UNIT VALUE OF FUEL

- (a) Shall Actual Heat Unit Value As Found By Test be Used to Determine Price per Ton?
- (b) Shall Price per Ton be Raised or Lowered In Direct Proportion to Increase or Decrease In Heat Value?

15-23 WHAT VARIATION SHALL BE PERMITTED IN B. T. U. VALUE?

15-24 OIL FUEL

- (a) Location of Plant
- (b) Quantity Required
- (c) In Tank or Tank Car Load Lots?
- (d) Storage Facilities
- (e) How Shall Oil be Delivered to Furnaces?
 - Pump
 - Hydraulic
 - Air Compressor
- (f) Steam or Compressed Air for Atomizing
- (g) Pressure Available

15-25 CHARACTERISTICS

- (a) Specific Gravity
- (b) Chemical Composition
- (c) B. T. U. per Pound
- (d) Percentage Sulphur

15-26 OIL-BURNING EQUIPMENT (see Section 2-23)

16-LUBRICANTS AND LUBRICATION

16-1 LOCATION OF PLANT

- (a) Quantity of Lubricant Required?
- (b) Delivery?
- (c) Contract to be Awarded on What Basis?
- (d) Price per Gallon?
- (e) Price per Horse Power Hour?

16-2 PURPOSES

- (a) High-Pressure Steam Cylinders
 - 100-250 Pounds
- (b) Low-Pressure Steam Cylinders
- (c) Steam Turbines
- (d) Engine Bearings
- (e) Pins and Rock Shafts
- (f) Motor Bearings
- (g) Gears

- (h) Slides
- (i) Refrigerating Machinery
- (j) Pumps
- (k) Air Compressors
- (l) Producer-gas Engines
- (m) Natural-gas Engines
- (n) Illuminating-gas Engines
- (o) Blast-Furnace-gas Engines
- (p) Fuel-oil Engines (Low Pressure)
- (q) Water Turbines

16-3 STEAM CONDITIONS

- (a) Pressure?
- (b) Superheated or Saturated?
- (c) If Superheated, Degree of Superheat?
- (d) If Saturated, Probable Degree of Moisture?

16-4 REFRIGERATION CONDITIONS

- (a) Head and Back Pressure
- (b) Brine and Ammonia Temperatures

16-5 ENGINE AND PUMP CONDITIONS

- (a) Simple or Compound Cylinder?
- (b) Force or Sight Feed?
- (c) *Piston Speeds
- (d) *Cylinder Dimensions
- (e) *Bearing Construction
- (f) *Bearing Material
- *Valuable information but not essential

16-6 SPECIAL NOTES

- (a) Any Special Causes Tending to Overheating?
- (b) Any Requirements as to Pressure of Oil Delivery?
- (c) Cooling of Lubricant Required?

16-7 KIND OF OIL

- (a) Mineral
- (b) Sperm
- (c) Neatsfoot
- (d) Lard
- (e) Castor
- (f) Tallow

16-8 CHARACTERISTICS OF OILS

- (a) Specific Gravity
- (b) Cold Test
- (c) Flash Test Limits
- (d) Fire Test Limits
- (e) Viscosity at 70 Degrees F.
- (f) Permissible Degree of Acidity?
- (g) Percentage of Acidless Tallow Permissible
- (h) Percentage Insoluble Soap
- (i) Percentage Pure Strained Lard Oil Required
- (j) Oil to be Clear or Dark.

16-9 GRAPHITE

- (a) Any Deflocculated Graphite to be Used?
- (b) Any Flake Graphite to be Used?

16-10 GREASES

- (a) Purposes for Which Greases Are to be Used
- (b) How Will Grease be Fed?
- (c) Any Specially Hot Conditions?
- (d) Any Specially Cold Conditions?
- (e) Any Soapstone to be Used?

- (f) Any Specification of Base of Grease?

- (g) Lard
- (h) Tallow

16-11 LUBRICATING APPARATUS

See Central Oiling System, Section 4-51; also Sections 4-13e, 4-18x, 4-19s, 4-20i, 7-24g, 7-24r, 9-25e, 9-28, 9-31b, 9-42, 11-23z, 11-24g, 14-11i and 14-15k.

17-ELEVATORS**17-1 TYPE OF BUILDING**

- (a) Dimensions
- (b) Number of Stories
- (c) Use

17-2 NUMBER OF ELEVATORS

- (a) Passenger
- (b) Freight
- (c) Sidewalk
- (d) Dumbwaiters
- (e) Escalator

17-3 SHAFT SIZES AND OPENINGS

- (a) Openings on Different Sides
- (b) Automatic or Safety Doors Required?

17-4 TRAVEL

- (a) Number of Stories Each Elevator?
- (b) Any Cars Go to Roof?

17-5 LOADS AND SPEEDS

- (a) Maximum Loading
- (b) Average Loading
- (c) Speed Required?
- At what load?
- the above for each type of car

17-6 MOTIVE POWER AND TYPE

- (a) Electricity
- Voltage
- Kind of current. If alternating current:
- number of cycles
- number of phases
- Traction 1-1
- Traction 2-1
- Duplex tandem, helical worm gear
- Single tandem, helical worm gear
- Duplex tandem worm gear
- Single screw worm gear
- Spur gear
- Belt drive

- (b) Hydraulic
- How is pressure obtained?
- What pressure carried?
- Plunger
- Horizontal multiple sheave
- Vertical cylinder

- (c) Steam
- Pressure carried
- Direct acting (sidewalk lifts)
- Drums

- (d) Compressed Air (Sidewalk Lifts)
- How is pressure obtained?
- What pressure carried?

- (e) Hand Operated (see Section 17-12f)

17-7 CARS

- (a) Design
- Allowed value exclusive of sling
- Any special flooring for passenger cars?
- Any special flooring for freight cars?
- Any removable panels, side or top?

Special construction for sidewalk lifts?

Seat
Mirrors
Dimensions

- (b) Lighting
- How controlled?
- Source and location of supply
- (c) Finish of Cars
- (d) Gates
- (e) Automatic Doors
- (f) Safety Latches
- (g) Telephone from Car to Hall or Engine Room
- (h) Any Temporary Cars During Construction?
- (i) Allowed Makes

17-8 SIGNALS

- (a) Type
- Flash
- Hotel type
- Automatic target reset annunciators
- Magnet drop annunciators
- Allowed makes
- (b) Pushes
- Kind of pushes
- Cases
- Night service
- Signal cut-out in car
- (c) Floor Dials
- Design
- Finish
- Allowed makes
- (d) Sources of Supply
- Any duplicate set?
- Where is signal current delivered?

17-9 HOISTING CABLES

- (a) Number
- (b) Diameter
- (c) Material
- (d) How Secured?
- (e) How Equalized?
- (f) Stretch in Cables Taken Up by Whom?
- (g) Required Safety Factor

17-10 ELECTRIC CABLES

- (a) Number
- (b) Method of Support
- (c) Colors of Covering

17-11 COUNTER WEIGHTING

- (a) Number
- (b) What Proportion of Live Load Is to be Balanced?
- (c) How Are Filling Weights to be Secured?
- (d) Lubrication
- (e) Shoes or Gibs
- (f) With Two Counterweights, How Are Ropes to Bottom Counterweight Protected?
- (g) Sheathing
- (h) Any Chain Counterbalance?
- How secured?
- Any covering?
- Any special construction to avoid noise?
- Any special construction to balance peculiar loading?

17-12 HOISTING MECHANISM

- (a) Traction or Worm Gear Drum (Electric)

- Motors (see Sections 11—24 and 14—14d.)
Driving sheath or drum diameter and width
Driving sheave material
How secured to motor?
Method of braking
How mounted?
Rope grooves
How ropes are led to car and counterweight?
Diameter and length of bearings
Lubrication (with worm gear machines)
Type of gear
Speed reduction ratio
Diameter of worms
Diameter of gear
Diameter of shafts
Materials of worm and gear and shaft
How is thrust taken?
How is thrust bearing adjusted?
Prevention of oil travel along shaft
Method of alignment
Shall motor operate continuously?
- (b) Belt Elevators (Electric)
Belt-shifting mechanism
Length of drive
Diameters of driving and driven pulleys
Motors (see Sections 11—24 and 14—14d.)
- (c) Applying to All Types
Supports
Foundation
Painting
Location of winding mechanism
- (d) Plunger Elevators
Diameter
Material
Thickness of metal
Joining of sections
Construction of ends
Stuffing boxes
construction
packing
gland
Method of boxing
Method of determining alignment
Material of casing
- (e) Hydraulic Cylinder Elevators
Vertical or horizontal cylinder
Location
Diameter of plunger
Ratio of speed increase
Lubrication of nests of sheaves
Diameter of sheaves
- (f) Hand Power
Bearing
single reduction spur gear
double reduction spur gear
Number of hoist wheels
Diameter of hoist wheels
Supports
Painting
Materials
Safety devices
automatic stops
brake
Any provision for possible future power application?
Counterweighting
Rise
Capacity
Size of platform
Construction of platform
Guides and supports
material
erection
Ropes
size
material
method of adjustment
- Pushes and bells
kind
location
- 17—13 SAFETY DEVICES
- (a) Excessive Speed
Safety clutch operating on up motion. (On traction only.)
Safety clutch operating on down motion
Slowing down when speed increases above regular limit
Armature short-circuiting
- (b) Breaking of Cables
Safety clutch (see Section 17—13a), with provision for release
Emergency hand lever, to lock car to guides
Oil bumpers
Spring bumpers
Air lock
- (c) Limits
Hatchway limits
Winding mechanism limits
Protection of motor
No voltage switch
Fuses
Circuit breaker
Emergency switch in car cutting off all current
- (e) Switch to Open if Cables Slacken
- (f) Self-centering Car Operating Switch
- (g) Self-closing Electric Brake
- (h) Door Latches Preventing Starting of Car Until Door Is Closed
- 17—14 OPERATING DEVICES
- (a) Type of Control Switch
- (b) Number of Speed Desired
- (c) Is Acceleration to be at Will or Automatically Controlled?
- (d) In What Space Is Full Acceleration to be Obtained?
- (e) In What Space Is Stop to be Made from Full Speed?
- (f) Allowed Excess of Starting Over Running Current
- (g) Allowed Rise in Temperature of Resistance
- (h) Allowed Carrying Capacity of Copper and Carbon Contracts?
- (i) Is Car to be Operable from Point Near Hoisting Mechanism?
- 17—15 EXTRA PARTS
- (a) Guide Lubricators
- (b) Spare Parts for Controller
- (c) Spare Brushes for Motor
- 17—16 SPECIAL DETAILS
- (a) Who Supplies Overhead Grating?
- (b) Supports for Overhead Work
- (c) Supports for Hoisting Mechanism
- (d) Elevator Pit
- (e) Hoistway
- (f) Doors
- (g) Elevator Room Enclosure
- (h) Covering of Hatchway and Overhead Work
- (i) Painting
- (j) First Supply of Lubricants
- (k) Electricity for Operation
- (l) Permits and Certificates
- (m) Test Weights and Instruments
- 17—17 TEMPORARY ELEVATOR
- (a) Car
- (b) Gate
- (c) Alarm Gong
- (d) Connections
- (e) Operator
- 18—DAMS
- 18—1 SITE ON WHAT RIVER?
- 18—2 LOCATION
- 18—3 DISTANCE FROM RAILROAD STATION
- 18—4 DEPTH OF RIVER AT LOW-WATER LEVEL
- 18—5 DEPTH OF RIVER AT HIGH-WATER LEVEL
- 18—6 MAXIMUM FLOOD IN CUBIC FEET PER SECOND
- 18—7 MATERIAL OF RIVER-BED
- (a) Hard-rock Ledge
- (b) Shale
- (c) Soft Rock
- (d) Hard Pan
- (e) Cemented Gravel
- (f) Boulders
- (g) Clay
- (h) Sand
- (i) Silt
- 18—8 MATERIAL IN RIGHT-HAND BANK (LOOKING DOWN STREAM)
- 18—9 MATERIAL IN LEFT-HAND BANK
- 18—10 WHERE CAN BUILDING MATERIAL BE HAD?
- (a) Gravel
- (b) Crushed Stone
- (c) Stone Quarry
- (d) Coarse, Clean Sand
- (e) Distance in Feet (Haul by Team)
- (f) Distance in Miles (Haul by Railroad)
- 18—11 PROBABLE COST TO DELIVER AT SITE
- (a) Gravel per Cubic Yard
- (b) Crushed Stone per Cubic Yard
- (c) Sand per Cubic Yard
- (d) Cement per Barrel
- (e) Rough Lumber per Thousand Feet
- 18—12 COST OF FUEL
- (a) Coal per Ton
- (b) Wood per Cord
- (c) Oil per Barrel
- 18—13 WAGES OF COMMON LABOR
- 18—14 WAGES OF ROUGH CARPENTER
- 18—15 PRICE PER DAY FOR DOUBLE TEAMS
- 18—16 PROVISION AGAINST FLOOD, ICE, RAINY OR DRY SEASON, WHICH MUST BE TAKEN DURING CONSTRUCTION
- 18—17 PERMITS FOR BUILDING AND STORING MATERIAL
- 18—18 WHO CLEANS UP AND REMOVES DIRT AND RUBBISH?
- 18—19 PROVISION FOR TEMPORARY HOUSING

- 18-20 LOCAL LABOR MARKET
- 18-21 KIND OF COMMUNICATION WITH NEAREST CITY OR TOWN
- 18-22 TIME OF STARTING AND COMPLETION
- 18-23 WHO SUPERVISES THE CONSTRUCTION?
- 18-24 WHO PAYS FOR SUPERVISION?
- 18-25 WHO IS RESPONSIBLE FOR ACCIDENTS?
- 18-26 PENALTY FOR DELAY IN COMPLETION
- 18-27 WHO FURNISHES WORKING DRAWINGS?
- 18-28 SIZE OF DAM
- (a) Height of Crest Above River Bed
 - (b) Length of Crest
 - (c) Width of Crest
 - (d) Length of Base
 - (e) Width of Base
 - (f) Height of Spillway Crest
 - (g) Length of Spillway Crest
- 18-29 WOODEN PILES
- (a) Kind of Wood
 - (b) Chemical Treatment
 - (c) Length of Piles
 - (d) Diameter at Top
 - (e) Diameter at Bottom
 - (f) Bearing Power per Pile
 - (g) Depth to Which Pile Should Go
 - (h) Weight of Driver
- 18-30 CONCRETE PILES
- (a) Mixture of Concrete
 - (b) Nature of Reinforcement
 - (c) Length of Piles
 - (d) Size of Pile at Top
 - (e) Size of Pile at Bottom
 - (f) Bearing Power of Pile
 - (g) Depth to Which Pile Should Go
 - (h) Weight of Driver
- 18-31 COFFER DAMS
- (a) Piling
 - Wood
 - Steel
 - Size
 - Length
 - (b) Planking
 - Size
 - Length
 - Kind of wood
 - (c) Braces
 - (d) Stop-hogs
 - (e) Spikes and Drift-bolts
 - (f) Nature of Filling
- 18-32 EARTH DAM
- (a) Method of Building Dam
 - (b) Material of Dam
 - Stone
 - Gravel
 - Sand
 - Loam
 - Clay
 - (c) Slope of Up and Down Stream Sides
 - (d) Facing of Slopes
 - (e) Where Is Material to be Had?

- (f) Any Piling to be Done?
 - (g) Material for Core
 - (h) Provision for Flash-boards
- 18-33 TIMBER DAM
- (a) Kind of Lumber
 - (b) Chemical Treatment of Lumber
 - (c) Size of Timber
 - (d) Size of Planking
 - (e) Size of Spikes and Drift-bolts
 - (f) Length and Size of Piles
 - (g) Slope of Up and Down Stream Sides
 - (h) Provisions for Flash-boards
 - (i) Nature of Filling
 - (j) Waterproofing
- 18-34 MASONRY DAMS
- (a) Types
 - Gravity
 - Arch
 - (b) Nature of Masonry
 - Concrete
 - Cyclopean
 - Puddle
 - (c) Material
 - Size of stones
 - Character of sand
 - Brand of cement
 - Proportion of mixture
 - (d) Slopes of Up and Down Stream Sides
 - (e) Shape of Apron
 - (f) Facing
 - (g) Waterproofing
 - (h) Provision for Drainage
 - (i) Provision for Flash-boards
- 18-35 REINFORCED - CONCRETE DAMS
- (a) Material
 - Size of stones
 - Character of sand
 - Brand of cement
 - Proportion of mixture
 - (b) Reinforcement
 - Size of rods
 - Spacing of rods
 - Quality of rods
 - (c) Foundations
 - (d) Piers or Buttresses
 - Thickness
 - Spacing
 - (e) Deck
 - Thickness at bottom
 - Thickness at top
 - (f) Slopes of Up and Down Stream Sides
 - (g) Shape of Apron
 - (h) Facing
 - (i) Waterproofing
 - (j) Provision for Drainage
 - (k) Provision for Flash-Boards
- 18-36 STEEL-FRAME DAMS
- (a) Foundations
 - Masonry
 - Piling
 - (b) Piers or Buttresses
 - Dimensions
 - Spacing
 - (c) Bracing
 - Material
 - Spacing

- (d) Deck
 - Material
 - Thickness
 - (e) Slope of Up and Down Stream Sides
 - (f) Shape of Apron
 - (g) Painting
 - (h) Provision for Drainage
 - (i) Provision for Flash-boards.
- 18-37 MOVABLE DAMS
- (a) Types
 - Bear traps
 - Needle dam
 - Chanoine dam
 - Butterfly dam
 - Cylindrical dam
 - Stoney roller dam
 - Movable crests?
 - (b) Foundation
 - (c) Buttresses
 - (d) Material
 - (e) Operating Mechanism
 - (f) Chemical Treatment of Lumber
 - (g) Painting
 - (h) Operating Walkway
 - Material
 - Supports
- 18-38 FLASH-BOARDS
- (a) Material
 - Wood
 - Steel
 - (b) Types
 - Temporary
 - Permanent
 - (c) Height
 - (d) Supports
 - (e) Anchor-bolts
 - (f) Operating Walkway
 - Material
 - Length
 - Width
 - Supports
 - (g) Chemical Treatment of Lumber
- 18-39 FISHWAYS
- (a) Type
 - Cascades
 - Chute
 - (b) Velocity of Water
 - (c) Size
 - Length
 - Width
 - (d) Material
 - Wood
 - Masonry
 - (e) Height of Risers in Cascade
 - (f) Slope of Chute
 - (g) Chemical Treatment of Lumber
- 19-HEAD AND TAIL RACES
- 19-1 LOCATION
- 19-2 NATURE OF SOIL
- 19-3 EXCAVATION
- 19-4 TRANSPORTATION FACILITIES
- 19-5 LABOR SUPPLY
- 19-6 RESPONSIBILITY FOR ACCIDENTS
- 19-7 SUB-CONTRACTORS

- 19—8 REMOVAL OF DIRT
- 19—9 WAGES OF COMMON LABOR
- 19—10 WAGES OF ROUGH CARPENTER
- 19—11 PRICE PER DAY FOR DOUBLE TEAMS
- 19—12 WHO SUPERVISES?
- 19—13 WHO PAYS FOR SUPERVISION?
- 19—14 PERMIT FOR BUILDING AND STORING MATERIAL
- 19—15 PROVISION AGAINST FLOOD, RAINY OR DRY SEASONS DURING CONSTRUCTION
- 19—16 PROVISION FOR TEMPORARY HOUSING
- 19—17 WHERE CAN BUILDING MATERIAL BE HAD?
- (a) Gravel
- (b) Crushed Stone
- (c) Stone Quarry
- (d) Coarse Clean Sand
- (e) Distance
- 19—18 PROBABLE COST TO DELIVER AT SITE
- (a) Gravel per Cubic Yard
- (b) Crushed Stone per Cubic Yard
- (c) Sand per Cubic Yard
- (d) Cement per Barrel
- (e) Rough Lumber per Thousand Feet
- 19—19 NATURE OF SOIL
- (a) Hard Rock Ledge
- (b) Shale
- (c) Soft Rock
- (d) Hard Pan
- (e) Cement Gravel
- (f) Boulders
- (g) Clay
- (h) Sand
- (i) Silt
- 19—20 TUNNELS
- (a) Types
- Pressure
- Non-pressure
- (b) Length
- (c) Pitch
- (d) Size
- Width
- Height
- (e) Method of Construction
- Tunnel form
- Open-trench form
- (f) Lining
- Bottom
- Sides
- Top
- Material
- Thickness
- Reinforcement
- Waterproofing
- (g) Method of Ventilation
- (h) Method of Lighting
- (i) Walkway for Inspection
- Material
- Supports
- (j) Overflow
- Number
- Size
- Discharge of water

- (k) Sand and Gravel Traps
- Number
- Size
- Slope
- (l) Velocity of Water
- 19—21 TRENCHES
- (a) Length
- (b) Width at Bottom
- (c) Slope at Side
- (d) Lining
- (e) Pitch
- (f) Velocity of Water
- (g) Depth of Water
- (h) Covers
- Material
- Size
- Length
- 19—22 FLUMES
- (a) Masonry
- Material of walls
- Thickness
- Lining
- Reinforcement
- Expansion joints
- Foundation
- (b) Wooden
- Size of lumber
- Chemical treatment
- Supports
- Bracing
- Foundations
- Anchor-bolts
- Spikes and drift-bolts
- (c) Size
- Width
- Height
- Depth of water
- (d) Velocity of Water
- (e) Waterproofing
- (f) Cover
- (g) Vents
- (h) Length
- (i) Pitch
- (j) Provision for Inspection
- (k) Covers
- Material
- Size
- Length
- 19—23 COLLECTING BASIN
- (a) Location
- (b) Excavation
- (c) Capacity
- (d) Size of Walls
- (e) Slope of Bottom
- (f) Overflow
- (g) Sand and Gravel Trap
- (h) Method of Discharge
- (i) Sluice Gates
- Number
- Size
- Material
- (j) Racks and Screens
- Number
- Size
- Material
- (k) Gate Valves
- Number
- Size
- By-pass
- (l) Gate and Screen House
- Size
- Material
- Hoisting device
- Method of operation
- Method of lighting

- (m) Waterproofing
- (n) Painting
- 19—24 SLUICE GATES
- (a) Number
- (b) Size
- (c) Material
- (d) Method of Operation
- Manual
- Mechanical
- Electrical
- Hydraulic
- Pneumatic
- (e) Time of Operation
- (f) Local or Distance Control
- (g) Construction of Guides
- (h) Method of Water-tightening
- (i) Chemical Treatment of Lumber
- (j) Painting
- 19—25 RACKS AND SCREENS
- (a) Type
- stationary
- traveling
- (b) Number
- (c) Size
- (d) Material
- (e) Spacing of Bars
- (f) Method of Cleaning
- (g) Method of Hoisting
- Manual operation
- Mechanical operation
- Electrical operation
- 19—26 GATE AND SCREEN HOUSE
- (a) Location
- (b) Size
- (c) Walls
- (d) Roof
- (e) Floor
- (f) Doors
- (g) Windows
- (h) Crane Runway
- (i) Crane or Hoist
- Capacity
- Method of operation
- (j) Method of Lighting
- (k) Water Level Indicator
- 19—27 PENSTOCKS
- (a) Number
- (b) Size
- (c) Length
- (d) Course of Run
- (e) Nature of Ground
- (f) Foundation
- Size
- Material
- (g) Saddles
- (h) Anchorage
- Size
- Material
- (i) Expansion Joints
- (j) Vents
- (k) Waterproofing
- (l) Method for Inspection
- (m) Painting
- (n) Protection Against Frost and Boulders
- (o) Operating Pressure
- (p) Test Pressure
- (q) Transportation and Haulage Facilities
- (r) Methods of Inspection
- 19—28 STEEL PENSTOCKS
- (a) Thickness of Plates
- (b) Length of Plates

- (c) Length of Penstock Sections
- (d) Method of Shipment
- (e) Section to be Riveted or Bolted
- (f) Size of Rivets and Bolts
- (g) Size and Drilling of Flanges
- (h) Reinforcement
 - Method
 - Size
- (i) Packing

19-29 WOODEN PENSTOCKS

- (a) Kind of Wood
- (b) Chemical Treatment of Wood
- (c) Staves
 - Size
 - Length
- (d) Bands
 - Spacing
 - Length
 - Size
 - Material
- (e) Lugs
 - Size
 - Material
- (f) Dowels to Fit Ends of Staves
 - Size
 - Material

19-30 REINFORCED-CONCRETE PENSTOCKS

- (a) Material, Size and Grade
 - Stone
 - Sand
 - Cement
 - Proportion of mixture
- (b) Thickness of Wall
- (c) Method of Reinforcement
 - Length of roads
 - Size of roads
 - Spacing
- (d) Method of Construction

19-31 SIPHON SYSTEM

- (a) Material
 - Steel
 - Reinforced concrete
 - Wood
- (b) Size
- (c) Elevation of Lower and Upper Ends
- (d) Length
- (e) Supports
- (f) Anchors
- (g) Expansion Joints
- (h) Thickness and Size of Material
 - Walls
 - Reinforcement
 - Bracing
 - Bolts and rivets
- (i) Waterproofing
- (j) Painting
- (k) Vent

19-32 AUTOMATIC QUICK-CLOSING VALVES

- (a) Number for Penstock
- (b) Location
- (c) Method of Operation
- (d) Size
- (e) Material

19-33 STAND PIPES

- (a) Size
- (b) Height
- (c) Material

- (d) Reinforcement
- (e) Anchorage
- (f) Foundation
- (g) Provision for Drainage and Over-flow
- (h) Waterproofing
- (i) Protection Against Frost
- (j) Location
- (k) Provision for Inspection
- (l) Painting

19-34 PENSTOCK-RELIEF VALVES

- (a) Type
- (b) Number
- (c) Capacity of Discharge
- (d) Discharge Pipe
- (e) Connection with Turbine Casing
- (f) Connection with Governor
- (g) Adjustment of Closing Time

19-35 MAIN PENSTOCK VALVES

- (a) Type
 - Butterfly valve
 - Gate valve
 - Sluice gate
 - Cylindrical valve
 - Drum gate
 - Flap gate
- (b) Method of Operation
 - Automatic
 - Non-automatic
 - Local control
 - Distance control
 - Manual
 - Mechanical
 - Electrical
 - Hydraulic
- (c) Size
- (d) Number
- (e) Material
- (f) Location

19-36 TAIL RACE

- (a) Nature of Soil
- (b) Excavation
- (c) Length
- (d) Size
- (e) Slope of Sides
- (f) Lining
- (g) Pitch
- (h) Provision to Cut Off Turbine-discharge Chamber from Tail Race
- (i) Stop-logs
 - Kind of wood
 - Size
 - Number

20-POWER PLANT BUILDING

20-1 LOCATION OF BUILDING

20-2 TRANSPORTATION FACILITIES

20-3 NEAREST DELIVERY POINT BY RAIL OR WATER

20-4 PROVISION AGAINST RAINY OR DRY SEASON

20-5 LABOR SUPPLY

20-6 TIME OF STARTING AND COMPLETION

20-7 WHO FURNISHES WORKING DRAWINGS?

20-8 WHO SUPERVISES THE CONSTRUCTION?

20-9 WHO IS RESPONSIBLE FOR ACCIDENTS?

20-10 ANY SUB-CONTRACTING TO BE DONE?

20-11 WHO FURNISHES THE BUILDING MATERIAL?

20-12 WHO REMOVES DIRT AND RUBBISH?

20-13 WHO DOES THE EXCAVATING?

20-14 DISTANCE TO DUMP FOR DIRT AND RUBBISH

20-15 WHO FURNISHES STRUCTURAL STEEL?

20-16 WHO FURNISHES ROOFING, DOORS, WINDOWS, ETC.?

20-17 STATE DAY OF DELIVERY OF MATERIAL

20-18 WAGES OF COMMON LABOR

20-19 WAGES OF BRICKLAYERS

20-20 WAGES OF CARPENTERS

20-21 PRICE PER DAY FOR DOUBLE TEAMS

20-22 SITE OF BUILDING

- (a) Character of Soil
- (b) Who Makes Test of Soil?
- (c) Bearing Power of Soil
- (d) Is Soil to be Reinforced?
- (e) Can Excavated Soil be Used for Building Material?
- (f) Protection Against Ground Water

20-23 PILING

- (a) Number of Piles
- (b) Bearing Power of Piles
- (c) Depth to Which Piling Should Go
- (d) Weight of Driver
- (e) Who Furnishes Piles?
- (f) Who Furnishes Driver?
- (g) Day of Delivery

20-24 SHEET PILING

- (a) Material
 - Wood
 - Steel
- (b) Size
- (c) Length
- (d) Shall Sheet piling be Removed After Work is Completed or Remain in Place?
- (e) Who Furnishes Material?
- (f) Where Delivered?

20-25 WOODEN PILES

- (a) Kind of Wood
- (b) Length of Piles
- (c) Diameter at Top
- (d) Diameter at Bottom
- (e) Chemical Treatment
- (f) Bearing Power per Pile
- (g) Depth to Which Pile Should Go
- (h) Weight of Driver

20-26 CONCRETE PILES

- (a) Mixture of Concrete
- (b) Nature of Reinforcement
- (c) Length of Piles
- (d) Size of Pile at Top
- (e) Size of Pile at Bottom
- (f) Bearing Power per Pile
- (g) Depth to Which Pile Should Go
- (h) Weight of Driver

20-27 FOUNDATIONS

- (a) Who Furnishes Working Drawings?
- (b) Material
 - Stone
 - Sand
 - Cement
- (c) Method of Construction
- (d) Machine or Hand-mixed Concrete
- (e) Who Furnishes Templates for Anchor-bolts?
- (f) Who Furnishes Material for Forms?
- (g) When Shall Forms be Removed?
- (h) Any Waterproofing?
- (i) Who Furnishes Waterproofing?

20-28 WALLS

- (a) Material
- (b) Thickness
- (c) Number and Size of Windows
- (d) Number and Size of Doors
- (e) Columns
- (f) Crane Runway
- (g) Anchor Bolts and Washers
- (h) Who Furnishes Crane Runway?
- (i) Who Erects Columns and Crane Runway?

20-29 STRUCTURAL STEEL

- (a) Character of Steel
- (b) Fiber Stresses
- (c) Workmanship
- (d) Roof Trusses
 - Slope of Roof
 - Number and size
- (e) Columns
 - Number and size
 - Base plates
 - Anchor plates
- (f) Purlins
 - Number and size
 - Method of fastening
- (g) Bracing
 - Method and size
 - Location
- (h) Who Supplies Material?
- (i) Who Erects Material?

20-30 FLOORS

- (a) Material of Floor Proper
- (b) Material and Nature of Floor Finish
- (c) Floor Beams
- (d) Curbing for Openings
- (e) Floor Plates
- (f) Who Furnishes Beams, Curbing and Floor Plates?

20-31 TOILETS

- (a) Number
- (b) Location
- (c) Number and Size of Lockers
- (d) Number of Baths
- (e) Number of Wash Basins
- (f) Number of Sinks
- (g) Number of Seats and Stands
- (h) Material of Equipment
- (i) Material of Partitions and Doors
- (j) Finish of Walls and Floor
- (k) Material and Size of Plumbing
- (l) Provision for Floor Drainage
- (m) Method of Ventilating
- (n) Method of Heating
- (o) Method of Lighting

20-32 STAIRWAYS

- (a) Number
- (b) Location
- (c) Material
- (d) Width
- (e) Length
- (f) Height of Tread
- (g) Width of Tread
- (h) Riser Covered with Anti-slip Material
- (i) Railing
- (j) Painting

20-33 DOORS

- (a) Number
- (b) Size
- (c) Material
 - Wood
 - Iron
 - Wood covered with metal
- (d) Type
 - Swinging
 - Sliding
 - Folding
 - Rolling shutter
- (e) Trimmings
- (f) Automatic Closing Device in Case of Fire
- (g) Who Furnishes Doors?

20-34 WINDOWS

- (a) Number
- (b) Size
- (c) Type
- (d) Material
 - Wood
 - Iron
 - Wood covered with metal
- (e) Glass
 - Plain
 - Wired
 - Ribbed
- (f) Sashes
 - Swinging
 - Sliding
- (g) Who Furnishes Window Frames?
- (h) Who Furnishes Glass?

20-35 VENTILATION

- (a) Method
 - Window
 - Monitors
 - Louvres
 - Ventilators
- (b) Size
- (c) Number
- (d) Regulating Devices
- (e) Location
- (f) Material
- (g) Painting
 - (See also Section 4-1m, Ventilating Equipment)

20-36 HEATING

- (a) System
 - Single-pipe
 - Two-pipe
 - With or without air line
 - Pressure
 - Hot-water
 - Dry-air
 - Vacuum
- (b) Method of Distribution
- (c) Method of Return
- (d) Size of Heating Plant

- (e) Size of Piping
- (f) Size of Ducts
- (g) Material
- (h) Painting
- (i) Covering
- (j) Method of Support
 - (See also Section 4-42, Heating System)

20-37 LIGHTING

- (a) System
 - Direct-current
 - Alternating-current
- (b) Voltage
- (c) Phase
- (d) Frequency
- (e) Two-wire or Three-wire
- (f) Switchboard
- (g) Wiring
- (h) Electrical Protection
- (i) Mechanical Protection
- (j) Lamps
 - Arc
 - Incandescent
- (k) Supports
- (l) Material
 - (For other items see Section 11-1, Electric Wiring)

20-38 CRANES

- (a) Type
 - Hand operated
 - Electrically operated
- (b) Span
- (c) Capacity
- (d) Traveling Speed
- (e) Hoisting Speed
- (f) Material
 - Lattice-girder construction
 - Plate-girder construction
- (g) Who Erects Crane?
- (h) Painting
 - (See also Section 2-23i, Hoists and Cranes)

21-MECHANICAL EQUIPMENT OF POWER PLANT

21-1 NUMBER OF TURBINES OR WHEELS

21-2 LOCATION OF POWER PLANT

21-3 TRANSPORTATION AND UNLOADING FACILITIES

21-4 NEAREST RAILROAD STATION OR LANDING

- (a) Distance from Point of Unloading and Data of Haulage Conditions

21-5 CLASSIFICATION OF TURBINE

- (a) Low Head (Up to 30 Feet)
- (b) Medium Head (From 30 to 200 Feet)
- (c) High Head (Above 200 Feet)

21-6 TYPES OF TURBINES

- (a) Francis Turbine
- (b) Pelton or Impulse Wheel? Horizontal or Vertical Shaft? One or More Runners?

21-7 FOUNDATION FOR TURBINES

- (a) Number

- (b) Material
(c) Dimensions
(d) Who Furnishes Drawings?
(e) Who Builds?
(f) Who Supplies Anchor-bolts, Washers, Nuts, Sleeves and Templates?
(g) Waterproofing
(h) Are Anchor-bolts to be Shipped Before Turbine?
- 21-8 EXCAVATION FOR FOUNDATIONS
(a) Who Makes?
(b) Who Removes Dirt and Rubbish?
(c) Who Cleans Up After Completion?
- 21-9 SIZE OF TURBINE
(a) Horse Power (H. P.)
(b) Speed (R. P. M.)
(c) Head (In Feet)
(d) Volume of Water (Cu. Ft. per Second)
(e) Draft-head
(f) Efficiencies
At half load
At three-quarter load
At normal rated load
At maximum load
- 21-10 REGULATION
Load Changes Speed Changes
(a) 10 per cent — per cent
(b) 25 per cent — per cent
(c) 50 per cent — per cent
(d) 100 per cent — per cent
- 21-11 TIME OF DELIVERY AND OPERATION
- 21-12 PENALTY FOR DELAY IN DELIVERY
- 21-13 PENALTY FOR LACK OF EFFICIENCY
- 21-14 BONUS FOR EARLIER DELIVERY
- 21-15 BONUS FOR HIGHER EFFICIENCY
- 21-16 WHO PAYS FOR PATENT RIGHTS OR INFRINGEMENT?
- 21-17 TURBINE CONSTRUCTION
(a) Casing
Spiral
Cylindrical
Without casing (to be set in the flume or masonry foundation)
(b) Material of Casing
Number of pieces
Number and size of bolts
(c) Size of Inlet (Penstock Connection)
(d) Size and Drilling of Flange
(e) Size of Outlet (Draft Tube Connection)
(f) Anchor Bolts
Number
Size
(g) Finish: Polished, Rough or Painted
- 21-18 RUNNERS
(a) Number
(b) Size
(c) Material
- 21-19 OUTSIDE REGULATION
(a) Gate Rings
Number
- Size
Material
(b) Wicket Gates
Number
Size
Material
(c) Gate Levers
Number
Material
(d) Link Connection Between Gate-Rings and Gate-levers
Number
Material
- 21-20 INSIDE REGULATION
(a) Gate Rings
Number
Size
Material
(b) Wicket Gates
Number
Size
Material
(c) Link Connection Between Wicket Gate and Gate Ring
Number
Material
(d) Pivot Butts for Wicket Gate
Number
Size
Material
- 21-21 DRAFT TUBES
(a) Number of Draft Tubes per Turbine
(b) Draft-head
(c) Size at Top
(d) Size at Bottom
(e) Length
(f) Length of Submerged Bottom
(g) Number of Pieces per Tube
(h) Material
(i) Anchors
Number and size
(j) Anchor Bolts
Number and size
(k) Reinforcement
(l) Painting
- 21-22 IMPULSE WHEELS, CONSTRUCTION
(a) Number of Runners
(b) Size of Runner
(c) Material of Runner
(d) Number of Buckets per Runner
(e) Material of Buckets
(f) Method of Fastening Buckets to Runner
(g) Type of Casing
Material
Number of pieces
Number and size of bolts
(h) Size and Number of Nozzles
(i) Size of Penstock Connection
(j) Method of Regulating Anchor-bolts
Size
Number
(k) Finish: Polished, Rough or Painted
- 21-23 BEARINGS
(a) Number
(b) Size
(c) Type
(d) Location
(e) Number and Size of Bolts
(f) Method of Lubrication
- (g) Provision for Water-cooling
(h) Material of Box
(i) Lining of Box
- 21-24 SHAFT
(a) Material
(b) Size
(c) Finish: Polished or Rough
- 21-25 FLY-WHEEL
(a) Weight
(b) Size
(c) Material
(d) Finish
- 21-26 STUFFING BOXES
(a) Number
(b) Size
(c) Material
(d) Packing
- 21-27 MAIN VALVES
(a) Number per Turbine
(b) Type
(c) Size
(d) Material
(e) Method of Control
(f) Drilling and Size of Flange
- 21-28 GOVERNING DEVICE
(a) Type and Capacity of Governor
(b) Detail of Construction
(c) Method of Drive
Gears
Belt
Chain
(d) Method of Adjusting Speed Regulation
(e) Finish: Polished, Rough or Painted
(f) Type and Capacity of Oil Pump
(g) Capacity of Oil Tank
(h) Oil Pressure Used
- 21-29 CONNECTION BETWEEN GOVERNOR AND RING OR NOZZLE
(a) System
Direct
Indirect
(b) Levers and Links
(c) Piping and Valves
- 21-30 HAND REGULATION
(a) Describe Method
- 21-31 MECHANICAL CONNECTIONS BETWEEN TURBINE AND GENERATOR
(a) Direct-connected
Rigid
Flexible
Insulated
(b) Gears
(c) Belts
(d) Chain
(e) Rope
(f) Who Furnishes Mechanical Connections?
(g) Who Furnishes Key and Gage of Shafts?
(h) Who Pays for Making Connections?
- 21-32 TURBINE INDICATORS
(a) Any Required?
(b) Supplied by Whom?
(c) For Speed

- (d) For Pressure
(e) For Vacuum
(f) Material
(g) Finish
- 21—33 TURBINE LUBRICATION**
- (a) Method
(b) Central System?
Type and capacity
(c) Size and Material of Piping
(d) Type of Valves
(e) Size and Material of Storage Tank
(f) Oil-Circulating Pumps
Number and capacity
(g) Who Supplies Piping?
(h) Who Supplies Central System?
(For additional items see Section 4—51)
- 21—34 ERECTION**
- (a) Who Erects?
(b) Who Pays for Erection?
(c) Who Supervises?
(d) Who Pays for Supervision?
(e) Who Furnishes Common Laborers?
(f) Who Pays for Shipment?
(g) Who Pays for Crating?
(h) Who Protects Machinery Against Damage?
(i) Who Furnishes Laborers and Facilities for Transportation from Railroad to Power Plant?
(j) Who Pays for Transportation?
(k) Weight of Largest Piece
(l) Approximate Dimension of Largest Piece
(m) Who Pays for Grouting?
(n) Who Furnishes Erecting Material?
(o) Is a Traveling Crane in Plant?
Type and capacity
(p) Who Cleans Up After Erection?
(q) Who Pays for Painting After Erection?
- 21—35 TESTS**
- (a) At Shops
Test pressure for all parts subjected to hydrostatic pressure
(b) At Power Plant
When is test to be made?
Who supplies material for test?
Who pays for supervision?
Method of measuring water
- 21—36 SPARE PARTS**
- (a) Runners
(b) Wicket Gates
(c) Gate Levers
(d) Stuffing Boxes and Packing
(e) Lining
(f) Nozzle Tips
(g) Needles
(h) Parts of Governor
- 21—37 WRENCHES**
- (a) Who Furnishes Complete Set of Wrenches?
- 22—ELECTRICAL EQUIPMENT OF POWER PLANT**
- 22—1 NUMBER OF GENERATORS**
- 22—2 LOCATION OF PLANT**
- 22—3 TRANSPORTATION AND UNLOADING FACILITIES**
- 22—4 NEAREST RAILROAD STATION**
- 22—5 PURPOSE FOR WHICH GENERATORS ARE TO BE USED**
- 22—6 FOUNDATIONS**
- (a) Dimensions
(b) Who Furnishes Drawings?
(c) Who Furnishes Foundations?
(d) Who Furnishes Anchor-bolts? Washers and Sleeves?
(e) Are Anchor-bolts to be Shipped Before Generators?
- 22—7 TYPES**
- (a) Direct Current (Two or Three Wire)
(b) Alternating Current
(c) Single, Two or Three Phase
- 22—8 CAPACITY**
- (a) Direct Current in K. W.
(b) Alternating Current in K. V. A.
Power factor
- 22—9 OVERLOAD CAPACITY**
- (a) Duration (in minutes)
- 22—10 VOLTAGE**
- 22—11 REVOLUTION (R. P. M.)**
- 22—12 FREQUENCIES (PER SECOND)**
- 22—13 EFFICIENCY (IN PER CENT.)**
- 22—14 METHOD OF EXCITATION**
- 22—15 REGULATION**
- (a) Voltage at No Load
(b) Voltage at $\frac{1}{4}$ Load
(c) Voltage at $\frac{1}{2}$ Load
(d) Voltage at $\frac{3}{4}$ Load
(e) Voltage at Full Load
(f) Voltage at $1\frac{1}{4}$ Load
(g) Voltage at $1\frac{1}{2}$ Load
- 22—16 WHAT DROP IN SPEED IS TO BE ALLOWED FOR UNDER SUDDEN CHANGE IN LOAD?**
- 22—17 ALTERNATING CURRENT GENERATOR**
- (a) Stationary Armature
Type of frame
Type of core
Windings
Material
Ventilation
- (b) Revolving Field Structure
Number of pole pieces
Type of pole pieces
Field coil
Material
- (c) Collector Rings
Brushes
Brush holders
Material
Adjustment
- (d) Terminal Board
- (e) Provision for Parallel Operation
- 22—18 DIRECT-CURRENT GENERATORS**
- (a) Magneto Frame (Number of Pieces)
(b) Main Poles (Number)
(c) Communicating Poles (Number)
(d) Armature
(e) Armature Coils (Number)
(f) Commutator
(g) Brushes (Number)
(h) Brush-holder
(i) Terminal Board
- 22—19 SOLE-PLATES**
- (a) Number of Pieces
(b) Rails and Carriers
- 22—20 ANCHOR-BOLTS**
- (a) Number
(b) Size
(c) To be Shipped Before Generator?
- 22—21 BEARINGS**
- (a) Number and Size
(b) Type
(c) Method of Lubrication
(d) Material
(e) Provision for Water Cooling
- 22—22 TESTS AND INSPECTION**
- (a) Where Made?
(b) By Whom?
(c) Who Pays Traveling Expenses?
(d) Who Supervises Tests?
(e) Kind of Tests
Capacity
Overload
Regulation
Balance
Noiselessness
Heating
Efficiency
- 22—23 HEATING OF GENERATORS**
- (a) Under Full Load
(b) Under 25 Per Cent. Overload
(c) Under 50 Per Cent. Overload
(Standard rules of the A. I. E. E.)
- 22—24 MECHANICAL CONNECTION BETWEEN GENERATOR AND TURBINE**
- (a) Who Furnishes Connection?
(b) Who Pays for Making Connection?
(For other items see under Section 8—, Turbines)

- 22—25 **GENERATOR LUBRICATION**
(For items see Section 21—33, Turbine Lubrication; also Section 4—51)
- 22—26 **EXCITER**
- (a) Number
 - (b) Capacity
 - (c) Method of Operation
 - Turbine
 - Motor
 - Belt
 - Direct Connected to Main Generator Shaft
 - (d) Voltage
(For other items see Section 22—18, Direct-Current Generators, and Section 10—22, Exciters)
- 22—27 **TIME OF DELIVERY AND OPERATION**
- 22—28 **PENALTY FOR DELAY IN DELIVERY**
- 22—29 **PENALTY FOR LACK OF EFFICIENCY**
- 22—30 **BONUS FOR EARLIER DELIVERY**
- 22—31 **BONUS FOR HIGHER EFFICIENCY**
- 22—32 **WHO PAYS FOR PATENT RIGHTS OR INFRINGEMENT?**
- 22—33 **WHO ERECTS GENERATORS AND EXCITERS?**
- 23—SWITCH ROOM OF POWER PLANT**
- 23—1 **LOCATION OF SWITCH ROOM**
- 23—2 **NUMBER OF FLOORS**
- 23—3 **SIZE OF FLOOR SPACE**
- 23—4 **GENERAL ARRANGEMENT**
- (a) Bus-bars
 - (b) Switches
 - (c) Switchboards and Controlling Benches
 - (d) Protecting Devices
 - (e) Outgoing Lines
 - (f) Stairs
 - (g) Doors
 - (h) Windows
 - (i) Ventilation
 - (j) Lighting
 - (k) Heating
- 23—5 **SWITCHBOARDS**
- (a) Types
 - Direct-current
 - Alternating-current
 - Generator board
 - Controlling board
 - Outgoing feeder board
 - (b) Number of Panels
 - Material
 - Finish
 - (c) Panel Framework
 - (d) Sills
 - (e) Supports
- 23—6 **BUS-BAR SYSTEM**
- (a) Compartments
 - Location
 - Open or closed system
 - Size
 - Material
 - Doors
 - (b) Bus-bars
 - Capacity
 - Dimensions
 - Material
 - Single, or double ring system
 - Length
 - Method of support
 - Distance between bars
 - (c) Insulators
 - Types
 - Size
 - (d) Insulator Pins
 - (e) Disconnecting Switches
- 23—7 **OIL SWITCHES**
- (a) Location
 - (b) General Arrangement
 - (c) Method of Control
 - Local
 - Remote
 - Hand operation
 - Electric operation
 - Pneumatic operation
 - (d) Ratings
 - Ampere
 - Voltage
 - Kilowatt
 - (e) Types
 - Single-phase
 - Double-phase
 - Three-phase
- 23—8 **VOLTMETER**
- 23—9 **AMMETER**
- 23—10 **WATTHOUR METER**
- 23—11 **KILOWATT METER**
- 23—12 **FREQUENCY METER**
- 23—13 **POWER-FACTOR METER**
- 23—14 **GENERATOR SWITCH**
- 23—15 **FIELD SWITCH**
- 23—16 **EQUALIZER SWITCH**
- 23—17 **PILOT SWITCH**
- 23—18 **SECTION SWITCH**
- 23—19 **RHEOSTATS**
- 23—20 **RESISTANCES**
- 23—21 **OVERLOAD COILS**
- 23—22 **FUSES**
- 23—23 **REGULATORS**
- (a) Types
 - Tirrell regulators
 - Feeder regulators
 - Switch or control regulators
 - Induction regulators
 - Single-phase induction regulators
 - Polyphase induction regulators
- 23—24 **RELAYS**
- (a) Types
 - Overload relays
 - Reserve-current relays
 - Reserve-phase relays
 - Underload relays
 - Low-voltage relays
 - Over-voltage relays
- 23—25 **LIGHTNING ARRESTERS**
- (a) Location
 - At power house
 - At sub-station
 - Along transmission lines
 - (b) Multigap
 - (c) Horn
 - (d) Magnetic Blow-out
 - (e) Electrolytic Blow-out
 - Aluminum
 - Liquid electrodes
 - (f) Choke Coils
 - (g) Water Jets
 - (h) Grounded Wire
- 23—26 **WALL OUTLETS**
(For items on Wall Outlets see under Sub-Stations, Sections 25—1 et seq.)
- 24—TRANSMISSION SYSTEM**
- 24—1 **LOCATION**
- 24—2 **NATURE OF SOIL**
- 24—3 **TRANSPORTATION FACILITIES**
- 24—4 **ROUTE OF TRANSMISSION LINES**
- 24—5 **LATITUDE AND CLIMATE**
- 24—6 **ATMOSPHERIC ELECTRIC DISCHARGES**
- 24—7 **CAPACITY OF LINES**
- 24—8 **SINGLE OR DOUBLE CIRCUITS**
- 24—9 **SINGLE OR DOUBLE POLE LINES**
- 24—10 **TOTAL LENGTH OF SYSTEM**
- 24—11 **AVERAGE NUMBER OF POLES PER MILE**
- 24—12 **STEEL TOWERS**
- (a) Types
 - Two-legged
 - Three-legged
 - Four-legged
 - (b) Height
 - (c) Dimensions at Base
 - (d) Foundations
 - (e) Anchors
 - (f) Guy Wires
 - (g) Material
 - (h) Method of Shipment
 - (i) Method of Erection
 - (j) Galvanizing
 - (k) Paint

24—13 WOODEN POLES

- (a) Kind of Wood
- (b) Chemical Treatment
- (c) Size
 - At top
 - At bottom
- (d) Length (Total)
- (e) Length Extended Into Ground
- (f) Height of Insulators Above Ground
- (g) Guy Wires
 - Method of anchorage
- (h) Spacing of Poles
- (i) Number of Poles
- (j) Method of Shipment
- (k) Method of Erection

24—14 REINFORCED-CONCRETE
POLES AND TOWERS

- (a) Length
- (b) Size at Top
- (c) Size at Bottom
- (d) Mixture of Concrete
- (e) Nature of Reinforcement
- (f) Foundation
- (g) Height of Insulator Above Ground
- (h) Guy Wires
 - Method of anchorage
- (i) Spacing of Poles
- (j) Length of Pole Extended Into Ground
- (k) Number of Poles
- (l) Method of Shipment
- (m) Method of Erection

24—15 CROSS ARMS

- (a) Number of Arms per Pole
- (b) Material
 - Wood
 - Steel
- (c) Method of Fastening
- (d) Bolts
- (e) Length of Arms
- (f) Treatment of Wood
- (g) Galvanizing
- (h) Paint

24—16 SYSTEM OF TRANSMISSION

- (a) Direct-current
- (b) Alternating-current
- (c) Two-phase
- (d) Three-phase
- (e) Three-wire Two-phase

24—17 NUMBER OF CIRCUITS

- (a) One Circuit per Line
- (b) Two Circuits per Line

24—18 INSULATORS

- (a) Types
 - Pin insulators
 - Suspension insulators
 - Strain insulators
- (b) Material
- (c) Size

- (d) Number of Insulators
- (e) Insulator Pins
 - Material
 - Number
 - Connecting links
- (f) Number of Pieces per Insulator
- (g) Operating Voltage
- (h) Testing of Voltage

24—19 CONDUCTORS

- (a) Number per Circuit
- (b) Spacing of Conductors
- (c) Capacity
- (d) Size
- (e) Material
 - Copper
 - Aluminum

24—20 CONDUCTOR TIES

- (a) Type
- (b) Size
- (c) Material

24—21 SECTION SWITCHES

- (a) Type
- (b) Size
- (c) Capacity
- (d) Location
- (e) Number
- (f) Method of Operation

25—SUB-STATIONS

25—1 NUMBER OF SUB-STATIONS

25—2 LOCATION

25—3 TRANSPORTATION FACILITIES

25—4 EXCAVATION

24—5 FOUNDATION

25—6 BUILDING

- (a) Size
- (b) Arrangement
- (c) Walls
- (d) Roof
- (e) Floor
- (f) Doors
- (g) Windows
- (h) Heating
- (i) Lighting
- (j) Ventilation

25—7 TRANSFORMERS

- (a) Capacity
- (b) Number per Circuit
- (c) Total Number
- (d) Type
 - Single-phase
 - Two-phase
 - Three-phase
- (e) Method of Cooling
 - Air blast
 - Gravity oil circulation
 - Forced oil circulation

- (f) Connections
 - Single-phase
 - Two-phase
 - Three-phase—delta
 - Three-phase—star
 - Three-phase—T
 - Three-phase—Y
 - Two-phase, three-phase
 - Three-phase—star and delta

25—8 ROTARY CONVERTERS

- (a) Capacity
- (b) Number
- (c) Ratio of Conversion
- (d) Phase
- (e) Voltage
- (f) Starting Device
- (g) Foundation
- (h) Anchor Bolts

25—9 MOTOR GENERATORS

- (a) Capacity
- (b) Number
- (c) Size of Motor
- (d) Size of Generator
- (e) Overload Capacity
- (f) Voltage
- (g) Frequencies
- (h) Heating of Machine under Different Loads
- (i) Foundation
- (j) Anchor-bolts

25—10 FREQUENCY CHANGERS

- (a) Type
 - Horizontal
 - Vertical
- (b) Capacity
 - Size of synchronous motor
 - Size of alternating-current machine
- (c) Size of Exciter
- (d) Operating Performance
- (e) Foundation
- (f) Anchor-bolts

25—11 SWITCHBOARDS

- (a) Type
 - Direct-current
 - Alternating-current
- (b) Number of Panels
- (c) Capacity
 - (For other items see under Section 23—1, Switch Room of Power Plants; also Section 12—1, Switchboards)

25—12 WALL OUTLETS

- (a) Types
- (b) Voltage
- (c) Climate
- (d) Size and Insulation of Conductors
- (e) Wall Brushings
- (f) Wall Insulators
- (g) Terra Cotta Pipes
- (h) Protection Against Rain
- (i) Panels
 - Glass
 - Slate
 - Wood

- (j) Roof Insulators
Size material
Material

26—POWER TRANSMISSION EQUIPMENT

26—1 SHAFTING COUPLINGS AND COLLARS

- (a) Material
- (b) Sizes
- (c) Ends Key-seated for Couplings?
- (d) Couplings
Single face
Compression
keyed
keyless
Jaw clutches
Friction clutches
Flexible
- (e) Anchor Each Length with Collars?
- (f) Set Screws Recessed?
- (g) Alignment Referred to What?
- (h) What is Maximum Speed for Main Shafting?
- (i) Erected by Whom?
- (j) Any Makes of Shafting or Couplings Specified?

26—2 BEARINGS

- (a) Hangers
Drop
Post
- (b) Pillow Blocks
Rigid
B & S
Adjustable
- (c) Special
Slip
Eccentric
Thrust
- (d) Type
Plain
Roller
Ball-bearing
Self-oiling
- (e) Method of Adjustment
- (f) Height
- (g) Number of Bolts in Feet
- (h) How Secured to Supports
Lag screws
Bolts
Clamps
- (i) Method of Oiling
Any drip pans wanted?
- (j) Method of Support
Number of bolts
Number of lag screws
- (k) Are Bearings Secured to Beams, Stringers or Concrete Foundations?
- (l) Stringers (if used)
Material
Size
By whom furnished?
By whom erected?
- (m) What is Maximum Distance Between Bearings?

- (n) What Extra Bearings Necessary Close to Main Pulleys?

- (o) Any Makes of Bearings Specified?
- (p) Any Makes of Ball Bearings Specified?
- (q) Any Makes of Roller Bearings Specified?

26—3 PULLEYS

- (a) Material
Wood
Steel
Iron
Paper
Cork Insert
- (b) Type
Split or solid
Cone face for fixed belts
Flat face for shifting belts
- (c) Sizes for Different Work
- (d) Balance at High Speeds
- (e) Method of Securing to Shafting
Compression?
Keys?
Set-screws?
Or both?
Through clutches, with sleeves with quills or hollow shafts?
- (f) Are Bushings to be Used?
- (g) Any Makes Specified?

26—4 BELTING

- (a) Material
Leather
Rubber
Canvas
Hair
Patent
- (b) Is Belt to be Run Tight or Slack?
If tight, how is it to be kept so?
- (c) Diameter and Face of Driving Wheel
- (d) Diameter and Face of Driven Pulley
- (e) Maximum Horse Power to be Transmitted
- (f) Distance Between Belt Centers
Tape-line measurement around pulley
- (g) Will Drive be with Tight Side on Top or Below?
Belt forward or back?
- (h) Will Belt be Below Floor in Any Part?
Who makes pit?
How will pit be drained?
Where will drain discharge?
Material of pit?
- (i) Any Guard Rail Around Belt?
- (j) Any Guard Rail Around Pit?
- (k) How Will Static Electricity be Collected from Belt?
- (l) Width of Belt?
- (m) How is Joint in Belt to be Made?
Endless? If so, made endless at factory, or ends left open and joined at the job?
Shall belt manufacturer make allowance for endless lap?
- (n) Thickness
- (o) Allowed Makes

- (p) Is Belt to be Exposed to Steam, Acid Fumes, Dampness or Dust?

26—5 GEARS

- (a) Keyed
- (b) Jaw or Friction Clutches on Sleeve, on Quills
- (c) Type
Spur
Bevel
Miter
Worm
Spiral
- (d) Material
Iron
Steel
Bronze
Mortise:
(wood and iron or steel)
- (e) Teeth
Cast
Cut

26—6 SPROCKETS

- (a) Keyed
- (b) Jaw or Friction Clutch
On sleeves
On quills
- (c) Type
Solid or split—name and number of chain
Traction wheels

26—7 COUNTERSHAFTING

- (a) Are Countershafts Supplied with Machine?
- (b) Are Countershafts Supplied by this Contractor?
- (c) Erected by Whom?
- (d) Alignment Referred to What?
- (e) Are Speeds of Countershafts Such as to Require Jack Shafts?

26—8 ROPE DRIVE

- (a) Amount of Power to be Transmitted
- (b) Method of Transmission
- (c) System
Continuous or English
Separate or American
Character of load
- (d) Driving and Driven Sheaves
Diameter
Face
Revolutions per minute
Number of grooves
Shape of grooves
Width of grooves
Pitch
How secured at shaft
- (e) Rope
Diameter
Material
Exterior
Core
Construction
Number of strands
Character of lay
Fastening
Splicing
Lubrication
Method of taking up slack
Tensile strength

26—9 SILENT CHAIN DRIVE

- (a) Maximum power to be transmitted
- (b) What is chain to drive?
- (c) Source of power?
- (d) Steady or intermittent load?
maximum variation
- (e) Hours of operation per week
- (f) Percentage of time at full load
- (g) Means of adjustment
- (h) If replacement, describe previous drive

26—10 MOTORS. (See also Sections 11—24, 11—31 and 14—14d)

- (a) Erected by Whom?
- (b) Support
Type
By whom supplied?
- (c) Are drip pans required?
- (d) Are speeds low enough for belting direct to main shaft without jack shaft?

26—11 ELECTRIC TRANSMISSION.
(See Sections 24— and 25—)

26—12 GENERAL

- (a) Location
- (b) Character of work
- (c) Plans by whom?

26—13 STRUCTURAL CONDITIONS

- (a) Character of construction
- (b) Character of flooring
- (c) Beams and girders
Spacing
Dimensions
- (d) Carrying capacity of floors
- (e) Height of stories in clear

AMERICAN DRAFTING FURNITURE CO.

22 Railroad Street
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Products.

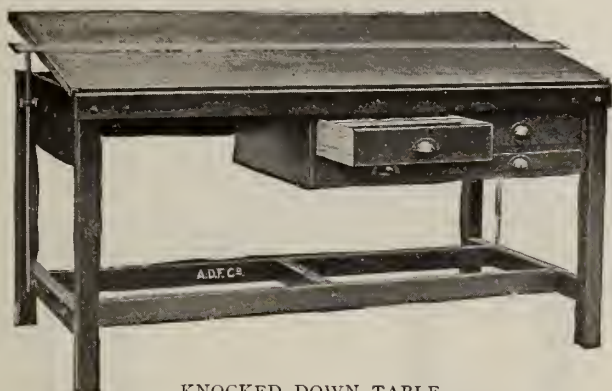
Manufacturers of DRAWING TABLES; DRAWING BOARDS; FILING CABINETS; SPECIAL EQUIPMENT for DRAFTING ROOMS in factory, school or office; BLUE PRINTING FRAMES and CARRIAGES.

Blue Printing Machines and Driers.

Knocked Down Tables.

Made in 9 regular sizes of tops (37 by 60 in. to 48 by 96 in.) with various drawer section arrangements to meet all requirements.

Tops of soft white pine, either adjustable or fixed. Bases of solid oak.



KNOCKED DOWN TABLE
Showing adjustable top, parallel rule and filing cabinet

Monroe Drawing Table.

Unquestionably the most popular and widely used drawing table made.

Bases of solid oak, and tops of white pine made in 7 regular sizes, 31 by 42 in. to 43 by 72 in. Height and tilting adjustments.

Absolutely rigid construction throughout.

The addition of the parallel ruler as illustrated, also the use of the swinging drawer attachment where advisable, will materially increase the efficiency of any drawing table.



MONROE DRAWING TABLE
Shown with parallel rule and one drawer only

"Amco" Iron Base Tables.

Made in 6 top sizes 37 to 42 in. wide, 48 to 72 in. long.

Fitted with several styles of interchangeable sectional filing cabinets.

Adjustable for height and from vertical to horizontal.



Two clamps control all adjustments.



"AMCO" IRON BASE TABLES

Sectional Filing Cabinets.

"American" cabinets are carried in stock in 2 styles and 3 sizes. Various drawer arrangements to meet practically any requirements. High grade construction throughout. Paneled ends and backs. Drawer corners dovetailed. Drawer bottoms of 3-ply veneer. Covers at back to prevent drawings from creeping over.

Catalogue gives complete description.

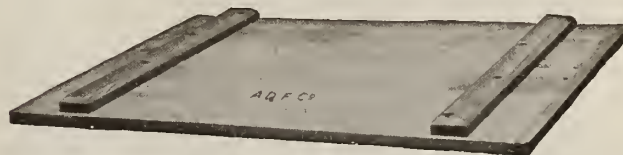
Drawings and prices on special cabinets submitted on receipt of specifications.



STANDARD SECTIONAL FILING CABINET

Drawing and Layout Boards.

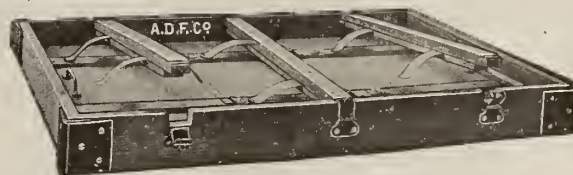
Only the best quality white pine and best construction used in "American" boards. Made in 3 styles and any size. Special boards to order.



LAYOUT OR DRAWING BOARD

Blue Printing Frames and Carriages.

Made in 3 styles of frames, in stock sizes from 12 by 16 in. to 36 by 60 in., with several styles of carriages, track, etc.



Specials.

BLUE PRINTING FRAME

This company manufactures considerable special equipment, of both wood and metal, to customers' specifications, and would appreciate an opportunity to quote on requirements.

ECONOMY DRAWING TABLE & MFG. CO.

Drawing Tables and Sectional Filing Cases

ADRIAN, MICH.

Products.

Manufacturers of DRAWING TABLES and SECTIONAL FILING CASES.

Special Furniture in wood or steel for schools, colleges, drafting rooms.

Steel Cabinets.

A complete line of steel cabinets, similar to the wooden designs shown, is now carried in stock.

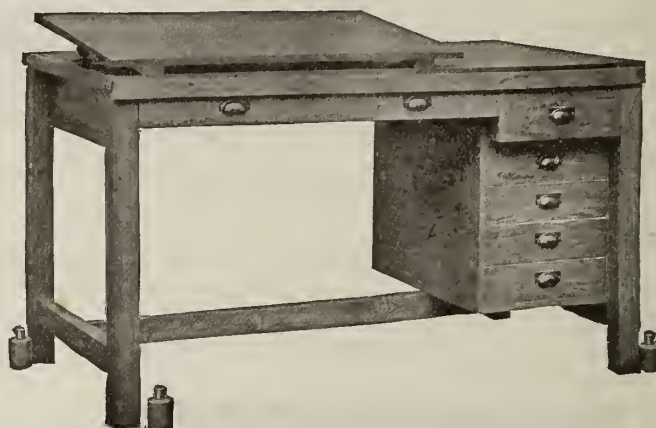
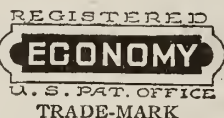
Catalogue, with full information and illustrations, sent on request.

Specifications for Standard Wood Tables and Cases.

MATERIAL—Drawing boards and tops of tables made of soft white pine; all other exposed parts of standard tables and filing cases, plain oak. Drawers and slides of cherry or other hardwood; drawer bottoms a single panel of 3-ply veneer; and other unexposed parts of light, soft wood. All material air seasoned, kiln dried and kept at an even temperature during manufacture. Material heated before gluing.

CONSTRUCTION—Workmanship is best cabinet work; all joints mortised, tenoned and glued. Drawer sides dovetailed to front and back. Tops fastened to frames, with buttons in slots, allowing expansion and contraction. Frame of tables independent of top, firmly constructed and thoroughly braced.

FINISH—3-coat, dull rubbed. Work is finished in antique; other finishes as ordered.

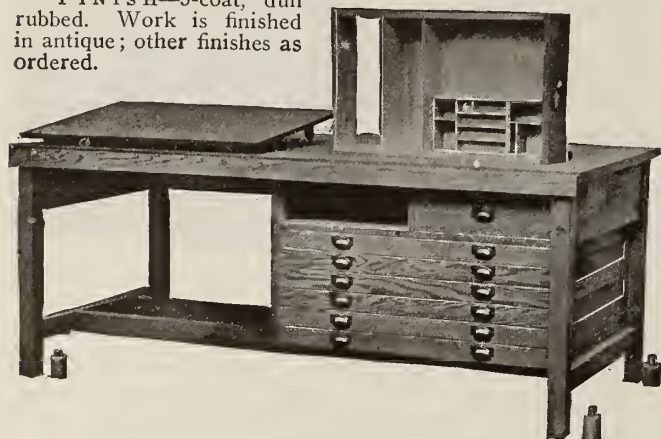


STANDARD WOOD DRAWING TABLE, STYLE NO. 4, WITH LOOSE INCLINED DRAWING BOARD

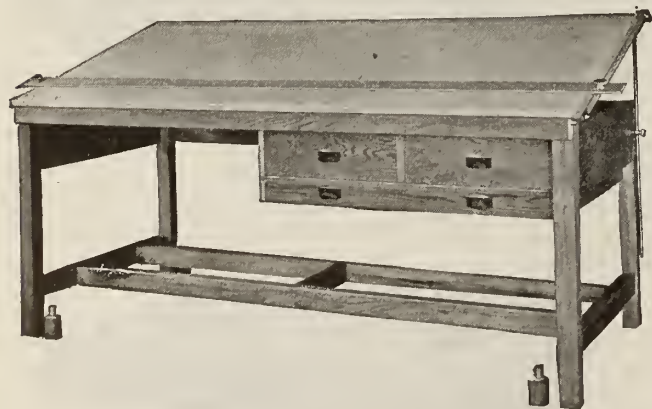


MONARCH DRAWING TABLE NO. 102

Upper illustration shows table No. 102 set up; lower illustration shows same table "knocked down" for shipping or moving. An ideal table for field work, where it is necessary to maintain a portable drafting department



STANDARD WOOD DRAWING TABLE, STYLES NOS. 0, 1 AND 2
Showing loose incline drawing board and drawer with sliding tool tray



ECONOMY ADJUSTABLE TOP DRAWING TABLE

Showing adjustable top and parallel ruler attachment. Styles Nos. 30A, 31A and 32A of wood; styles Nos. 60A, 61A and 62A in steel. Top hinged to the rubbing strip at front; equipped with 2 adjustable metal supports at back, with patent locking device for holding top inclined at any angle. A panel is placed over cabinet to protect contents of drawers and forms an extra shelf.

Parallel ruler attachment, for drawing boards 24 to 108 in., operates easily at any angle of board or table; saves draftsman's time and secures more accurate results; and is much more convenient than the T-square method. The attachments can be fitted to drawing board of any size

Standard Filing Cases.

Standard filing cases are made in sectional units and with same care and class of work as the tables. Drawers are dovetailed together, and not doweled or nailed. Drawers work smoothly, and are provided with a 6-in. cover at the top and back to prevent contents from curling and creeping. Sections are held in position in all directions.



STANDARD WOOD SECTIONAL FILING CASE

A 2-section standard case with 4-in. deep drawer in base. Each section has 6 drawers—the most drawer space of any sectional case made. Economy spring covers will double capacity of drawer

HAMILTON MANUFACTURING CO.

Manufacturers of Drafting Room Furniture

TWO RIVERS, WIS.

Products.

OAK and STEEL BLUE PRINT SECTIONAL CABINETS; ADJUSTABLE DRAWING TABLES; DRAWING BOARDS.

Straightedges; T-squares; Parallel Rule Attachments; Artists' Tables; Typewriter Tables, etc.

Blue Print Sectional Cabinets in Wood and Steel.

Built on the unit plan—add as requirements demand. Thoroughly well made of either seasoned oak or cold rolled furniture steel.

Each drawer fitted with label holder, substantial pulls, paper weights and hood.

SIZES—Carried in stock in two sizes. Units lettered from A to O and numbered 32 and 37. No. 32 units have drawers with inside dimensions 32 by 42½ in., outside dimensions 34½ by 45½ in. No. 37 units have drawers with inside dimensions 25 by 37½ in., outside dimensions 27¼ by 40½ in. Special sizes to order.



BLUE PRINT CABINET UNITS

Drawing Tables.

FRY DRAWING TABLE, STYLE C—Hundreds of these tables are in use. Frames made of best quality gray iron.

Tops can be adjusted from a horizontal to a vertical position without stooping or moving from the seat.

Adjustable as to height, and very rigid in any position.

Made in 3 styles, ranging in price from \$15.00 to \$90.00.



FRY DRAWING TABLE, STYLE C

DRAWING TABLE No. 37-D—Large shallow drawer is 37 by 23 by 2 in. inside. Smaller drawer is 10½ by 23 by 3¾ in. inside.

Top is 34 by 60 by 1½ in. thick, with two hard maple cleats on bottom and parallel rule can be attached. Adjustable as to slant.

Height of table, 34 in., but blocks supplied to raise it if desired. Made of oak with pine top. Shipped knocked down.

DRAWING TABLE No. 40-D—Made in several sizes. Adjustable both as to height and slant of top.

Practically any drawer units can be used with it but the "K" units or the "K" and "C" units are especially desirable.

"K" and "C" units are of two sizes, numbered 32 and 37. No. 32 units have drawers 32 by 42½ in. inside; No. 37 units have drawers 25 by 37½ in. inside.

Made of oak and nicely finished. Shipped knocked down.



DRAWING TABLE NO. 37-D

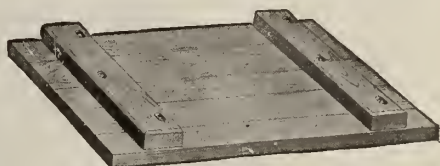


DRAWING TABLE NO. 40-D

Drawing Boards.

This company manufactures six different styles of drawing boards. Made in pine and basswood, in any size, of properly seasoned material.

STYLE D—1½-in. boards with 3 by 1¼-in. maple cleats and oblong washers, staggered.



STYLE D DRAWING BOARD

Facilities and Experience.

The plant is fully equipped with modern labor saving machinery for the manufacture of steel and wood furniture.

About 6,000,000 ft. of lumber are carried in stock to be properly seasoned before going to the dry kilns and tempering sheds.

This company has had over 30 years' experience in making business furniture.

The company has a warehouse at Rahway, N. J., just outside of New York City, so as to insure prompt delivery in the East, as well as in the West.

Special Catalogue.

Special catalogue No. 6 with full details on wood and steel construction furnished on application.

THE PARAGON MACHINE CO.

Manufacturers of Blue Printing Equipment

77 South Avenue
ROCHESTER, N. Y.

Products.

PARAGON BLUE PRINTING MACHINES and EQUIPMENT.

Uses.

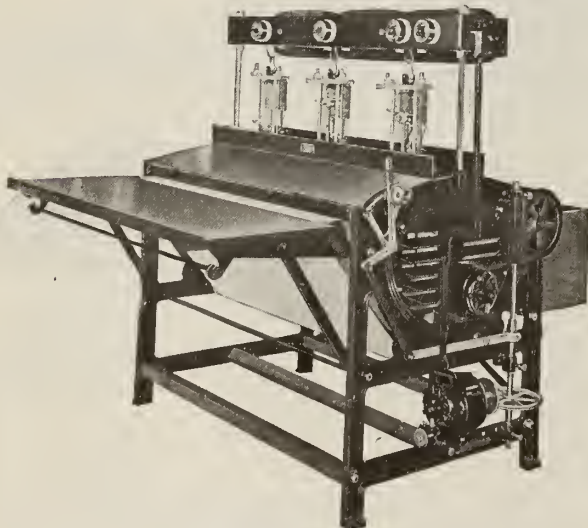
Making of blue prints, brown prints, Vandyke negatives, direct black prints, using either sheets cut to size of tracings or continuous rolls of paper.

Paragon Blue Printing Machine.

The printing bed is constructed of polished plate glass $37\frac{1}{2}$ ins. across (the length depending upon the size machine in which it is to be used) bent to a radius of 12 ins., making a complete half cylinder. This is deep enough to accommodate the special blue print arc lamps so that all their light may be used direct without the use of reflectors, and also allowing the lamps to be placed far enough from the printing surface so that the light equalizes perfectly, producing an absolutely uniformly lighted printing surface.

These are all important points, as reflected light means wasted energy and expense and uneven exposure would mean poor prints.

The apron is 2 ins. wider than the rated capacity of the machine, which allows the making of full width prints without difficulty. It is driven from the rear of



PARAGON BLUE PRINTING MACHINE

the semicylindrical glass, giving an action similar in many respects to a band brake, pressing every particle of air from between the tracings and sensitized sheet. This gives the excellent contact for which the Paragon is famous. It is positively guaranteed that there is no machine in existence which can surpass the Paragon on this feature—contact.

As the Paragon now stands it is the fastest in existence, with such a high rate of efficiency as to make

it second to none for low current consumption on a given amount of work.

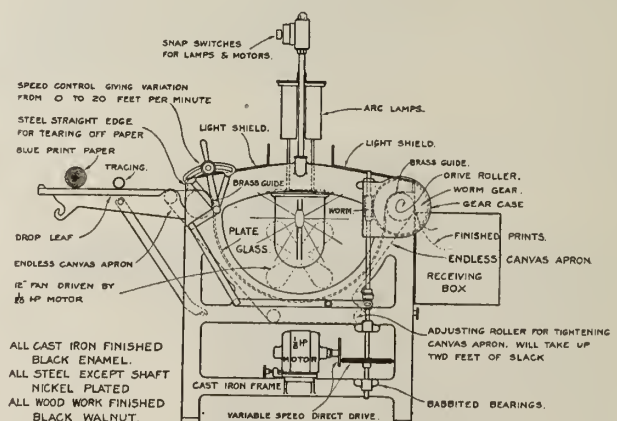
The drive and speed controlling mechanism are most efficient and also the extreme of simplicity.

There are no belts or chains or other appliances easy to get out of order on the Paragon. The range of speed is ample for all classes of work. A reliable constant speed motor is used. All changes in the speed of the machine are made instantly through a noiseless drive giving any speed from 6 lin. ins. to 20 lin. ft. per minute. This is greatly appreciated by those who desire to make direct black line, sepia or blue line prints.

The drive mechanism is self-contained, being a part of the machine enclosed and guarded so as to comply with the strictest factory regulations.

The Paragon machines are wired complete in the most approved and advanced manner complying with all underwriters' regulations.

The machines, unless otherwise ordered, are furnished with complete equipment which includes in the 42-in. machine, 3 special high power blue printing arc lamps, the $\frac{1}{8}$ h. p. drive motor and a small motor direct connected to the ventilating fan. The 54-in. machines are equipped with 4 arc lamps, the $\frac{1}{8}$ h. p. drive motor and fan motor. Snap switches are provided for the motors and 1 switch for each lamp. These are located on the box directly in front of the operator, so that the use of one or more lamps can be discontinued when making narrow prints. This box also contains the fuse cutouts for the lamps and motors.



CROSS SECTION OF PARAGON BLUE PRINTING MACHINE

Paragon Print Drying Machines.

The construction of the machine consists of a smooth steel heated cylinder, supported on ball bearing journals. It is driven by means of variable speed device directly connected to an electric motor, which allows any desired speed between 0 and 10 ft. per min. No belts or chains are used in driving Paragon equipment.

The heat source for the cylinder may be gas, elec-

tricity or steam, the machine necessarily being constructed for one or the other at the factory.

The machine is so constructed that proper combustion is obtained in the gas heated dryer without the use of a blower.

A canvas apron is carried upon a series of steel rollers so arranged as to bring the apron in tight contact with surface of the steel drying cylinder. This apron is kept taut by a steel roller, the weight of which gives uniform tension regardless of the variation in heat and dampness.

A special device is provided for transferring prints from the bath trays to the dryer. Small prints or prints of any length whatever and of any width up to the rated capacity of the machine are handled with equal ease.

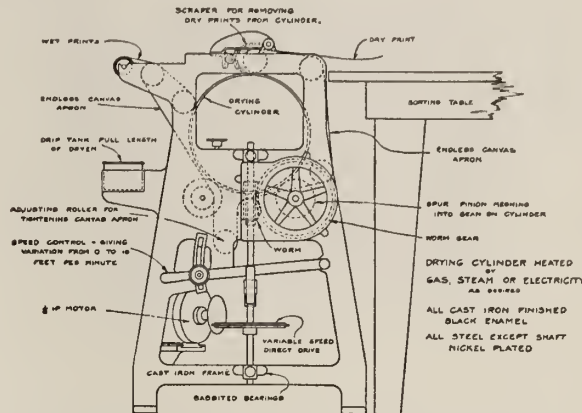
The prints are fed to the apron at one side of the machine and are carried by it into contact with a heated cylinder. The prints are fed from the wash trays to the dryer without the necessity of wringing. The apron holds the paper in direct contact with the heated cylinder until the prints are delivered perfectly dry on the opposite side of the machine. Stripper fingers are provided for automatically running the prints from the heated cylinder and depositing them upon a sorting table which should be provided at the rear of the machine to receive them.

The Paragon print drying machine here described has been built to meet the need of some method of drying various sized prints in separate sheets of any length, without the necessity of hanging them or constructing ovens with racks and lines in them or other makeshift apparatus. This also permits prints to be washed for any desired length of time without interrupting either the printing or drying process.

The area required to hang up the quantity of prints that the Paragon dryer will dry and iron would be so

large as to put it out of the question entirely. The Paragon requires but 8 sq. ft. of floor space.

The 30-in. capacity Paragon print dryer is intended primarily to dry photographic prints and will dry photostat, rectigraph and regular photographic prints perfectly.



CROSS SECTION OF PARAGON DRYING MACHINE

Print Paper Cabinets.

Cabinets are constructed of oak and carefully made and well finished; the partitions are removable so that either cut sheets of paper or continuous rolls can be accommodated.

The cabinet is of great convenience to the operator of the blue printing machine as all sizes and weights of paper are near at hand and quickly accessible.

Cabinet for 42-in. blue printing machine..... \$100.00
Cabinet for 53-in. blue printing machine..... 125.00

Washing Trays and Trimming Tables.

These are constructed entirely of oak except the corners, which are cast iron, and are filled and varnished to withstand severe use. The legs and table tops are removable to facilitate shipping and moving.

DATA, WASHING TRAYS AND TRIMMING TABLES

TRAYS Height, 34 ins.		TABLES	
Inside dimensions	Price	Top dimensions	Price
3'-0"x3'-0"x6"	\$20.00	4'-0"x4'-0"	\$35.00
3'-0"x4'-0"x6"	24.00	4'-0"x6'-0"	40.00
3'-0"x5'-0"x6"	28.00	5'-0"x5'-0"	40.00
4'-0"x4'-0"x6"	32.00	5'-0"x7'-0"	50.00
4'-0"x5'-0"x6"	36.00		
5'-0"x5'-0"x6"	40.00		

Installation of Equipment.

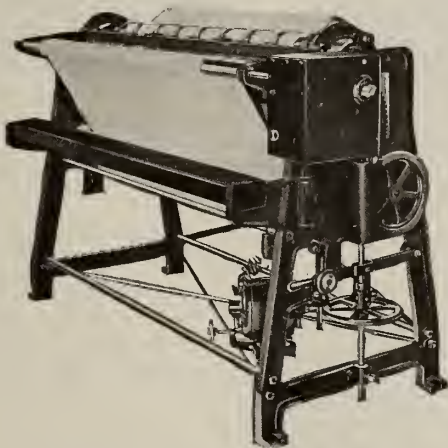
A receiving box is furnished with the printer which adds 12 ins. to the length, but eliminates the use of a table, thus allowing the equipment to be used in smaller quarters. The receiving table, however, allows the work to be handled more rapidly.

Send a sketch showing dimensions of blue print room, and a diagram showing the proper layout for equipment will be forwarded.

Further information on the subject will be gladly furnished on request.

Supplies and Equipment.

Every requisite for the draftsman and engineer in field or office. Price and delivery on application.



PARAGON PRINT DRYING MACHINE

Size, ins.	Prices					Floor space			
	Printer		Dryer			Printer		Dryer	
	D.C.	A.C.	Gas heated	Electric heated	Steam heated	Wide	Long	Wide	Long
30	.....	.....	\$300.00	\$350.00	\$400.00	.....	.....	28"	44"
42	\$650.00	\$825.00	325.00	375.00	425.00	54"	54"	28"	56"
54	675.00	850.00	350.00	400.00	450.00	54"	66"	28"	68"

Note—All machines electrically driven.
Catalogues and Prices—Prices are subject to change. Always write for latest complete catalogue B and prevailing prices.

THE C. F. PEASE COMPANY

Blue Printing Machinery, Drafting Room and Engineers' Supplies

TELEPHONE:
SUPERIOR 9475

237 Institute Place
CHICAGO, ILL.

CABLE ADDRESS:
"PEASECO, CHICAGO"
Codes Used: A.B.C. 5TH
and Private

Products.

BLUE PRINTING MACHINES; WASHING and DRYING MACHINES, Single Sheets and Continuous; BLUE PRINT PAPER SENSITIZING MACHINES; BLUE and BROWN PRINT PAPER and CLOTH, Sensitized and Unsensitized; BLUE PRINT ROOM REQUISITES and ACCESSORIES; "GOLD LABEL" TRACING CLOTH; ART ERASERS.

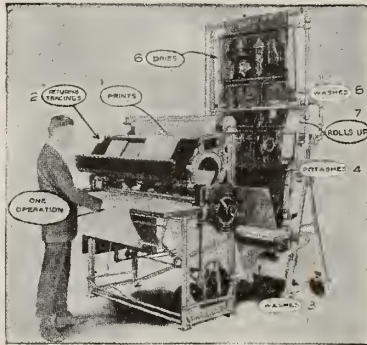
DRAFTING ROOM FURNITURE and SUPPLIES of all kinds; DRAWING INSTRUMENTS and MATERIALS of every sort.

SURVEYING INSTRUMENTS and FIELD SUPPLIES.

Blue Printing Supplies.

This company manufactures everything used in blue print making, from the smallest sun frame and bath tray to the Peerless continuous electric automatic printing, washing and drying machine.

Every blue print room requisite or accessory can be found in this very complete line, no matter how small or seemingly unimportant.



PEASE PEERLESS BLUE PRINT EQUIPMENT

Sensitized Papers and Cloths.

"Veri-Strong," "Royal," "Puritan," and "Superior" blue print papers and "Perfection" blue print cloths are of highest quality stock and carefully sensitized in 5 different printing speeds. Coating is done only after receipt of customer's order and goods shipped same day.

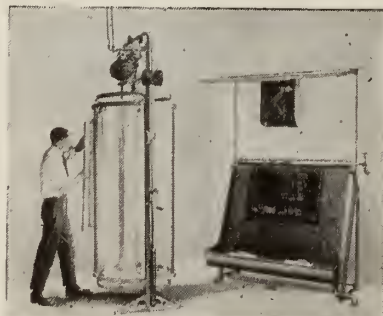
"Perfection" brown process papers and cloths are also unexcelled.

Every roll guaranteed fresh coated, full length and continuous. Full credit allowed on any goods found unsatisfactory and properly returned.

Outfitting Blue Print Rooms.

Special attention given to the complete and economical outfitting of engineers' blue print rooms. Efficient and expert advice always at the service of the profession, particularly when located at points difficult of access, or distant from convenient commercial blue print service.

Write for Catalogue "B-50."



PEASE VERTICAL ELECTRIC BLUE PRINTING MACHINE WITH PEASE SHEET WASHER

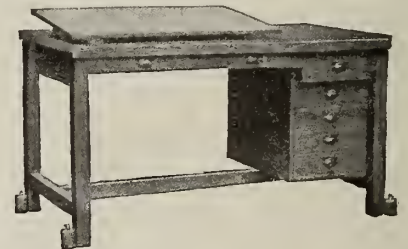
Drafting Room Furniture.

The Pease line of drafting room furniture and engineers' office equipment is most complete, and prompt shipment on everything listed in Catalogue "B-50" is guaranteed.

Particular attention is drawn to the splendid line of drafting room tables and blue print filing cabinets. Made in either wood or steel, in any size, and in practically any style of excellent workmanship and highest grade of material, they are indispensable to a well equipped office.



PEASE TABLE NO. B-02253



PEASE TABLE NO. B-02259



Wood Cabinet Nos.
B-02270 and B-02271



Steel Cabinet Nos. B-02266
and B-02267

BLUE PRINT FILING CABINETS

Drawing Materials.

The Pease stock of drawing, detail and tracing papers and cloths is unsurpassed. Sample book or working samples cheerfully sent on request and no pains spared to meet requirements in every detail.

Special attention given to printing sheets of tracing paper and cloth (cut to required sizes) with customer's titles and appropriate borders.

"Gold Label" Tracing Cloth.



(Made in U. S. A.)

NO. D-091 "GOLD LABEL" TRACING CLOTH

Width, in.....	26	30	36	42
Per roll of 20 yds.....	\$16.45	17.00	19.50	25.00

Pease quality and Pease prices are always backed up by Pease service.

T-squares, Triangles and Scales.

A full line of these, both in wood and in celluloid, in all sizes and qualities. Also slide rules for every calculation.

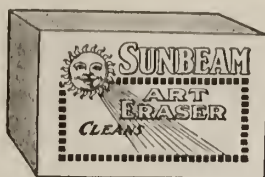
Write for Catalogue "B-50."

Sunbeam Art Eraser.

The best cleaner on the market today. Cleans better, lasts longer and costs no more than similar articles.

Made in five sizes.

Liberal discounts for quantity orders.



SUNBEAM ART ERASER

Drawing Instruments.

Made in Chicago of the highest quality of American material, designed by American draftsmen, and turned out by American machinery operated by American workmen.

Single instruments or complete sets of instruments especially adapted to every class of American trade. They are equal in every respect, if not superior, to those made before the war by foreign firms or by the foreign factories of American firms.

PEASE RULING PENS
NOS. B-0510P, B-0512P
AND B-0514PPEASE DETAIL PENS
NOS. B-0526P, B-0527P
AND B-0528P**SPECIFICATIONS AND PRICES—**

No. B-0510P, Pease Ruling Pen, 4½-in., spring back, aluminum handle, ebony finish, each, \$2.00.

No. B-0512P, Pease Ruling Pen, 5-in., spring back, aluminum handle, ebony finish, each, \$2.25.

No. B-0514P, Pease Ruling Pen, 5½-in. spring back, aluminum handle, ebony finish, each, \$2.50.

No. B-0526P, Pease Detail Pen, 5-in., each, \$2.50.

No. B-0527P, Pease Detail Pen, 6-in., each, \$2.75.

No. B-0528P, Pease Detail Pen, 7-in., each, \$3.00.

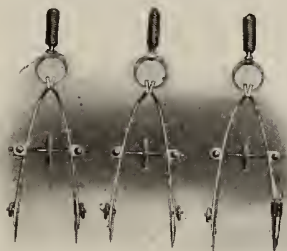
No. B-0523P, spring hinge, 5-in. aluminum handle, ebony finish, each, \$3.75.

No. B-0713AP, Pease Spring Bow Divider, 3¾-in., with central screw, german silver handle and legs, each, \$3.50.

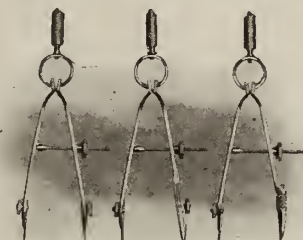
No. B-0713CP, Pease Spring Bow Pen, 3¾-in., central screw with needle point, german silver handle and legs, each, \$4.50.

No. B-0713BP, Pease Spring Bow Pencil, 3¾-in., spring blade, central screw with needle point, german silver handle and legs, each, \$4.25.

No. B-0732AP, Pease Spring Bow Divider, 3¾-in., with side screw, german silver handle and legs, each, \$2.75.

PEASE SPRING HINGE RULING
PEN NO. B-0523P

Nos. B-0713AP, B-0713CP and B-0713BP

Nos. B-0732AP, B-0732CP and B-0732BP
PEASE SPRING BOW INSTRUMENTS

No. B-0732CP, Pease Spring Bow Pencil, 3¾-in., side screw with needle point, german silver handle and legs, each, \$3.25.

No. B-0732BP, Pease Spring Bow Pencil, 3¾-in., spring blade, side screw, with needle point, german silver handle and legs, each, \$3.25.



NO. B-0726 COMPLETE SET OF DRAWING INSTRUMENTS

Compasses, 6½ in., with fixed needle point, pen, pencil point and lengthening bar; plain divider, 6 in.; spring bow divider, bow pen and bow pencil, 3¾ in.; ruling pens, spring back, 5½ in.; lead box containing 6 leads, complete in case.....

\$28.00

With side screw adjustment on bow instruments.....

25.00

Surveying and Engineering Instruments.

Berger, Gurley and Buff & Buff levels and transits are carried regularly in stock.

For the last three or four years the emergencies caused by the war have practically eliminated all stocks of such instruments, and this company has been severely taxed to take care of its friends who needed such supplies.

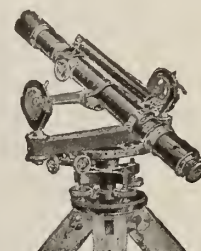
Deliveries along these lines are now rapidly returning to normal and particularly satisfactory service at this time is assured if requirements are stated.

A full line of leveling rods for all purposes, together with all the accessories, such as targets, ribbons, plumb bobs, arrows, measuring chains, etc.

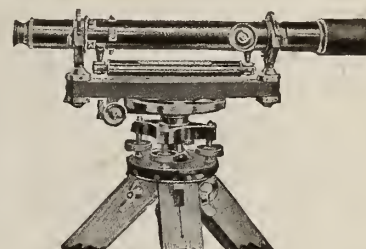
The stock of tapes is also a very full one, and excellent deliveries can be had at all times.

Practically all the well-known makes, such as Chicago Steel Tape, Lucas, Chesterman & Lufkin (in all sizes and divisions), can be delivered at shortest notice.

Inquiries are invited whenever engineers are in need of equipment for either inside or outside work.



B-05185 CONVERTIBLE LEVEL



B-05183 ENGINEER'S TRANSIT

Catalogue "B-50."

THE C. F. PEASE COMPANY will be glad to send their catalogue "B-50" to anyone interested.

It may be well to mention here that the present disturbed conditions of the raw material and labor markets make it necessary to declare all prices subject to change without notice. The catalogue is submitted more as a guide to their line and as an aid in defining and specifying orders or inquiries than as a correct indication at all times of prices and discounts.

COMMERCIAL CAMERA COMPANY

Photographic Copying Machines

299 State Street
ROCHESTER, N. Y.

BRANCH OFFICES

CHICAGO, ILL., 19 La Salle Street
PHILADELPHIA, PA., 1102 North American Building

NEW YORK, N. Y., 15 Park Row
WASHINGTON, D. C., Tenth and G Streets, N. W.

Product.

The PHOTOSTAT, a Photographic Copying Machine.

The word "Photostat" is registered as a trademark in the United States Patent Office and throughout the world.

Description.

The Photostat which is manufactured by the Eastman Kodak Company is a combined camera and copying machine.

The copy is made through a prism attached to the front of the lens. The prism reflects the subject through the lens so that the copy reads from left to right as in the original.

The colors of the copy are, however, reversed, black showing white and white showing black. If the original arrangement of black and white is demanded, this can be quickly obtained by making a copy of the first print.

Operation.

The copy is made directly on a roll of sensitized paper. No intermediate glass plate, film or other negative has to be made. By copying directly on the paper the copy is made very quickly and at a low cost. Also the copy is a facsimile of the original, so that there can be no mistake in it.

The print is developed and fixed in the apparatus itself, this part of the process, as well as the focusing and exposing, all being mechanical.

The print is removed from the fixing bath to a tank of circulating water, which washes the print free from chemicals. The print is then dried, between blotters, or on a cheesecloth stretcher, or by passing through a hot roll mangle. The process is a rapid one, the average speed per print being from 1 to 5 minutes.

No expert knowledge of photography is required for the operation of the Photostat as all the processes are mechanical.

Space.

The Photostat when assembled requires a space of at least 10 by 12 ft. This is not to be construed as the overall measurements of the apparatus, but for the convenience of the operator in making exposures, adjusting the apparatus, washing and drying the prints, a space the size mentioned is advisable and recommended.



A PHOTOSTAT IN OPERATION

Stock Sizes.

Model No. 0—Makes a print 8½ by 13 in.

Model No. 1—Makes a print 11½ by 14 in. and smaller.

Model No. 2—Makes a print 14 by 18 in. and smaller.

Model No. 3—Makes a print 18 by 22 in. and smaller.

The dimensions are the sizes of the finished prints. The Photostat is not limited, however, to copying subjects of these dimensions, but will copy any subject however large to these sizes.

Scope of Use.

The Photostat copies at original size, reduces or enlarges.

The Photostat makes rapid, inexpensive and facsimile copies of pencil drawings, ink drawings, tracings, blue prints, maps, sketches, documents, letters, telegrams, specifications, data sheets, tabulations, record cards, pages from books, insurance records, shipping lists, reports, contracts, illustrations for salesmen, patent drawings, production sheets, cuts and drawings for advertising, small tools and illustrations for setting up machines, etc.

BUFF & BUFF MFG. CO.

Manufacturers of Surveying Instruments

NEW YORK OFFICE
Hudson Terminal, 46 Dey Street

Jamaica Plain Station
BOSTON, MASS.

CHICAGO OFFICE
231 North Welles Street

Products.

"Buff" TRANSIT and LEVELS.

Theodolites, Tripods, Levelling Rods, Plumb Bobs, Plummet Lamps, Steel Tapes, Range Poles, Marking Pins and Current Meters.

Repairs to Instruments.

"Buff" transits, solidly built to resist blows and falls, have metal generously distributed throughout the construction. At the Jamaica Plain Shops, all makes are repaired with economy and despatch. Injured parts of instruments are duplicated from stock in hand. Telegraph orders can be completed in 24 hours.

Specifications 6¼-inch Buff "Precise" Transit No. 1B.

Graduation, 6¼-in. diameter, with 2 opposite double reading verniers to minutes, placed at either 30° or 90° to line of sight. Two rows of opposite inclined figures 0-360. Graduations silvered and covered by pure crystal plate glass.

Telescope, erecting, is balanced and reverses at either end; 12 in. long, 1¼-in. aperture, with power of 26.5 diameter improved eyepiece, unsurpassed large clear field. Center point is provided on top of telescope to permit of accurate centering from above. Adjustment for vertical plane, and line of collimation correct for all distances. Sensitive level bubble, 6 in. long, with clamp and tangent to telescope. Improved lower and upper spring tangent clamps. Shifting center with ¾-in. adjustment. Spirit levels truly ground by special machine, rated and sensitive. Standards are cloth finished. Long taper centers with broad flanges and of hardest bell-metal and phosphor bronze. Compass needle is 4½ in. long and of accepted form. Compass graduation is silvered and figured with a single row 0-90 on each side of N. and S. Tripod improved, split-leg with wing-nuts, weight 7½ lbs.

Mahogany instrument box is provided with strap, brass lock and hooks; contains plumb bob, pocket magnifier, sunshade, wrench, screwdriver, adjusting pins, etc.

Engineers' Levels.

18-INCH WYE LEVEL—Telescope, 18 in.; 1⅜-in. objective; 36 power; protection to object slide; erecting or inverting eyepiece. Telescope and level tube, cloth finished. Phosphor bronze contact points in wyes for bell-metal collars; hard bell-metal center in socket of phosphor bronze. Line of collimation correct for all distances. Adjusted to finest possible accuracy with sunshade in position and focused on mean distance. Mahogany case with strap and hooks, sunshade, wrench, screwdriver, adjusting pin, etc.

Weight, 10¾ lbs.; tripod, 7 lbs. Price, \$168.00

18-INCH DUMPY LEVEL—36 power. Price, \$134.00.

References.

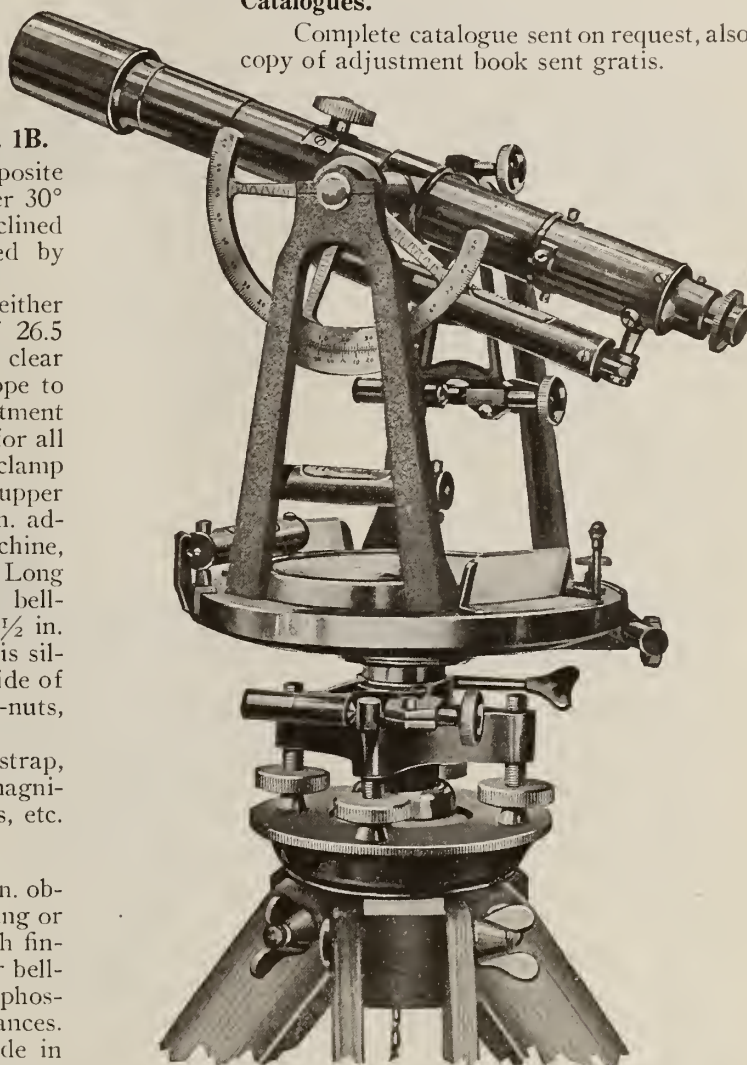
This company are Instrument Makers to the United States Government, many departments; New York Central R. R.; New York, New Haven & Hartford R. R.; New York Water Board; Public Service Commission and Board of Public Works, New York City; Standard

Oil Co.; Guggenheim and Rothschild interests; J. G. White Co., and numberless other engineering organizations. The Pennsylvania R. R. used "Buff" instruments in large numbers in both their North River and East River tunnels. The Subway Commission of New York are now using 150 "Buff" instruments.

Names and addresses of experienced users of "Buff" instruments in the vicinity of any interested inquirer will be furnished on application.

Catalogues.

Complete catalogue sent on request, also copy of adjustment book sent gratis.



6¼-INCH BUFF "PRECISE" TRANSIT NO. 1B

Patented Nov. 6, 1900; Nov. 13, 1900; Feb. 3, 1903

Price as shown.....\$295.00

Size.....	No. 1	No. 2	No. 3	No. 4
Weight.....	13½ lbs.	10 lbs.	7 lbs.	5 lbs.
Diam. of graduation....	6¼ in.	5½ in.	4½ in.	4 in.
Length of needle.....	4½ in.	3¾ in.	3¼ in.	2½ in.
Power erecting telescope.	26.5 diam.	22.5 diam.	18 diam.	17 diam.
Power inverting telescope	29 diam.	25 diam.	21 diam.	20 diam.
Length of telescope.....	12 in.	10¾ in.	8 in.	8 in.
Length level bubble.....	6 in.	5½ in.	4 in.	4 in.
Diam. telescope aperture	1¼ in.	1¼ in.	1½ in.	1½ in.

ESTABLISHED 1845

W. & L. E. GURLEY

Makers of Engineering and Surveying Instruments

TROY, N. Y.

BRANCH: SEATTLE, WASH.

Products.

TRANSITS; LEVELS; PLANE TABLES; ALIDADES.
Also, Compasses; Sketching Cases; "Beaman" Stadia Arc.

Leveling Rods; Stadia Rods; Flagstaffs; Tripods.
Automatic Water Stage Registers; "Price" Hydraulic Current Meters; Hook Gages.

Dealers in Chains, Tapes, Aneroid Barometers, Anemometers, Binoculars, Field Glasses, Drawing Instruments and Materials, Scientific Books, etc.

Manufacture.

From raw material to finished product every detail is of Gurley construction, thus insuring a perfection of manufacture—a precision of operation and adjustment—which has secured for Gurley instruments merited recognition among leaders of the engineering profession. The Gurley has been the accepted *Standard of Quality* for three-quarters of a century, which is evidenced by its close identification with big engineering accomplishments, both past and present.

Guarantee.

All instruments, when purchased directly of this company, are warranted correct in all their parts; and in the event of any original defect appearing after reasonable use, the company agrees to repair or replace with new and perfect instruments, promptly at its own cost, express charges included; or money and express charges paid by purchaser will be refunded.

Prices, Terms and Catalogue.

Prices will be quoted promptly on request.

Terms: Net cash, f. o. b. Troy, N. Y., or Seattle, Wash.; or c. o. d. with privilege of examination, if requested. Safe delivery guaranteed.

Illustrated catalogue describing this company's complete line will be sent to any one free of charge, on request.

General Characteristics of Gurley Transits.

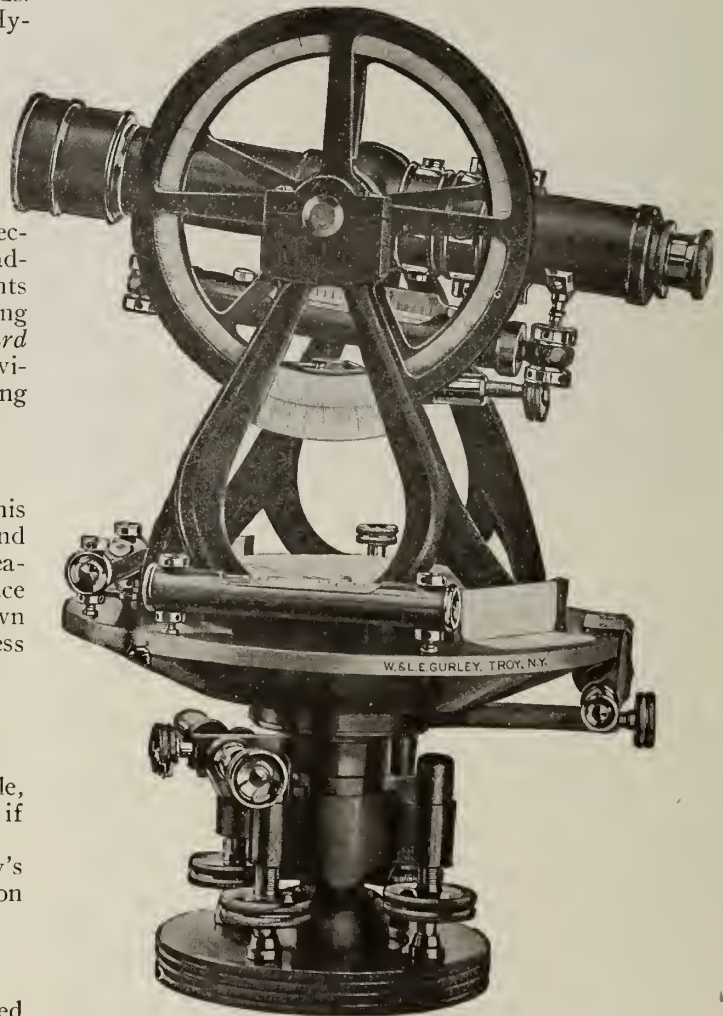
Long compound tapered centers; 4-screw ribbed leveling head; shifting center; radially ribbed and dished limb and plate; horizontal and vertical limbs graduated on *sterling silver*; waterproof flush verniers at 30° to line of sight, reading to 1'; waterproof compass box, with variation arc; sensitive telescope level; superior quality telescope lenses with brilliant illumination, flat field and sharp definition; erecting eyepiece, *platinum* cross wires and stadia wires; telescope reverses either end; center point on top; dust guard. Packed in mahogany box, with plummet, reading glass, etc.

LIMB I—Figured in two rows, the outer row 0 to 360°, the inner row in quadrants 0 to 90°.

LIMB IV—Two rows of opposite inclined figures, 0 to 360°.

Gurley Precise Transits with One Piece Truss Standard.

Designed especially for railroad, bridge, municipal and other work requiring the highest degree of precision.



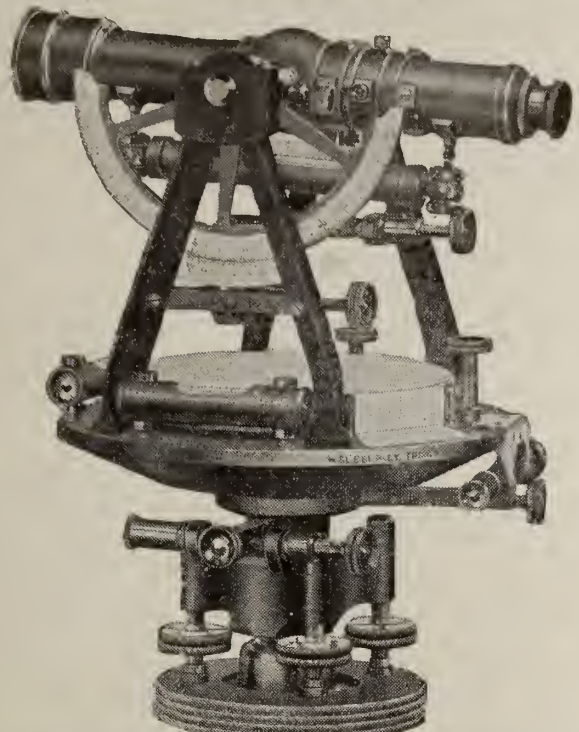
NO. 8-A, or NO. 27-A PRECISE TRANSIT

	No. 8-A	No. 27-A
Diameter of horizontal limb, in.	6.25	5.65
Length of needle, in.	3.5	3
Length of telescope, in.	11	8
Power of telescope, diameters.	26	20
Length of telescope level, in.	7.2	5
Diameter of vertical limb, in.	5	4.5
Vertical limb reads to.	1'	1'
Tripod with cap.	Split legs	Extension legs
Weight of instrument, lbs.	16	12
Weight of tripod, lbs.	11	10
Shipping weight, 2 boxes, lbs.	75	70

Regularly furnished with Limb IV, but Limb I will be substituted if desired. Vertical arc, instead of full vertical circle with aluminum guard, will be substituted, if desired.

A gradienter will be combined with the clamp and tangent to telescope axis, if desired.

Gurley Light Mountain or Mining Transits.



NO. 28 LIGHT MOUNTAIN OR MINING TRANSIT
The best known transit in America

Horizontal limb, 5.65 in. diameter. Graduated to 30', and figured like Limb I (Limb IV figuring, if desired, at no extra cost). Reading by two opposite double verniers to 1'. Compass needle, 4 in. long. Variation arc. Telescope, 8 in. long. Power 20 diameters. *Platinum* cross wires and stadia wires. Level on telescope, 5 in. long. Vertical arc, 2½ in. radius, graduated to 30' and reading to 1'. Angle-section standards with ample bases.

Extension leg tripod, closing to 36 in., weights 10 lbs. Instrument packed in mahogany box.

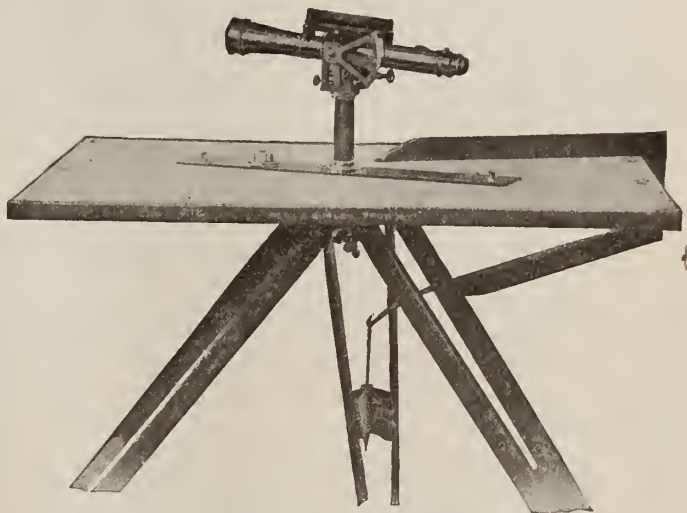
Weight of instrument, 11 lbs. Shipping weight, in 2 boxes, about 65 lbs.

If desired, a 4½-in. diameter vertical circle with aluminum guard, will be substituted for the vertical arc.

A granieter will be combined with the clamp and tangent to telescope axis, if desired.

Gurley Plane Table Outfits.

This outfit consists of No. 570 Johnson movement, with split leg tripod, weighing about 10 lbs.; No. 573 drawing board, size 31 by 24 in., with brass screw plate fitted, and with 8 clamp screws and sockets for fastening the paper; flexible canvas case for the drawing board; No. 574 plumbing arm and plummet; and No. 584-C alidade, with 11-in. telescope, inverting eyepiece with diagonal prism, power about 22 diameters, enlarged objective, 1⅜-in. aperture, *platinum* cross wires and stadia wires; detachable striding level; edge graduated vertical arc reading to 1', combined with Beaman stadia arc; clamp and tangent to telescope axis; blade 18 by 3 in., with left-hand edge beveled; circular level, and box compass with 4-in. needle, mounted on blade. Alidade packed in mahogany carrying case.

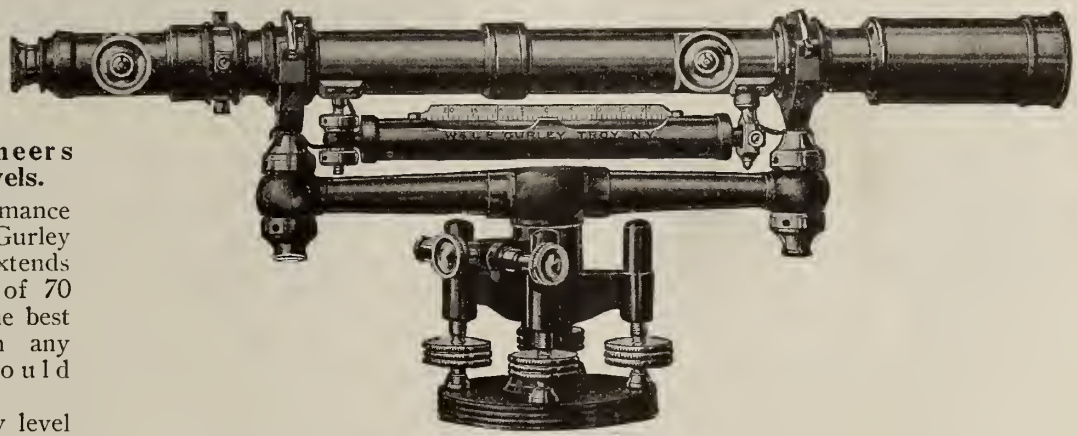


NO. 576-C PLANE TABLE OUTFIT WITH JOHNSON MOVEMENT
AND NO. 584-C ALIDADE
U. S. Geological Survey Standard

Gurley Engineers
Wye Levels.

The performance record of the Gurley wye level extends over a period of 70 years, and is the best recommendation any instrument could have.

The Gurley level is the standard with which all other levels are compared. It is universally preferred for its accuracy, stability, ease and permanence of adjustment, and long wearing qualities.



NOS. 375, 377 OR 378 ENGINEERS WYE LEVEL

	No. 375	No. 377	No. 378
Length of telescope, in.	22	18	15
Power of telescope, diameters.	42	32	26
Aperture of objective, in.	1⅜	1⅜	1⅜
Least focusing distance, from center of instrument, ft.	12	8¾	8⅓
Length of telescope level, in.	10¼	8¾	8⅓
Weight of instrument, lbs.	14½	13¾	11½
Weight of tripod, with solid round legs, lbs.	10	10	10
Shipping weight, 2 boxes, lbs.	75	65	60

On No. 378, the eyepiece is focused by spiral movement, instead of pinion. The objective slide is without dust guard.

BARTON SPIDER-WEB SYSTEM

Flat Slab Reinforced Concrete Construction

GENERAL OFFICES

Kimball Building

CHICAGO, ILL.

Products and Services.

This company furnishes to engineers complete ENGINEERING SERVICES for any type of Reinforced Concrete Structure, including all bending diagrams and lists of steel required.

It also furnishes under contract, for domestic or foreign delivery, completely fabricated jobs of REINFORCING STEEL either under its own or other designs, except in FLAT SLAB CONSTRUCTION, where the operations are confined to the BARTON SPIDER-WEB SYSTEM.

This service aims to keep the job supplied with the necessary reinforcing steel and the company advises itself as to the progress of the work, so as to anticipate requirements.

The Engineering Department will give advice as to the most economical manner in which to lay out any given job and the field advisory superintendent will make suggestions as to economical field methods to pursue for each particular class of construction.

Patent Protection.

This company operates under the Barton patents and the basic Norcross patents and guarantees protection to clients. Infringers will be prosecuted.

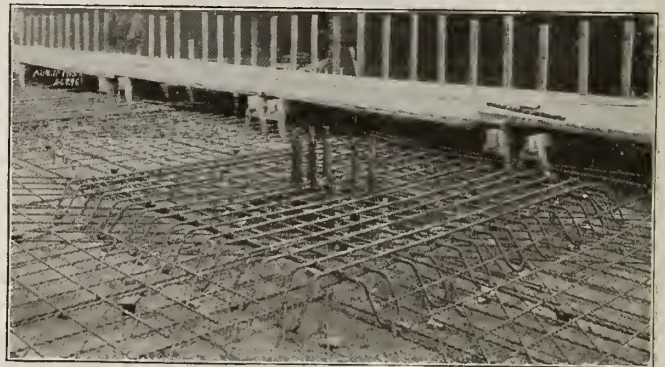
The patents owned by the BARTON SPIDER-WEB SYSTEM are:

United States, No. 1145462, July 6, 1915; No. 1155461, Oct. 5, 1915; No. 1217645, Feb. 27, 1917. French, No. 480920, July 15, 1916. Cuban, No. 3580, Nov. 4, 1916. British, 100457, May 25, 1916. Canada, 179882. Other patents pending.

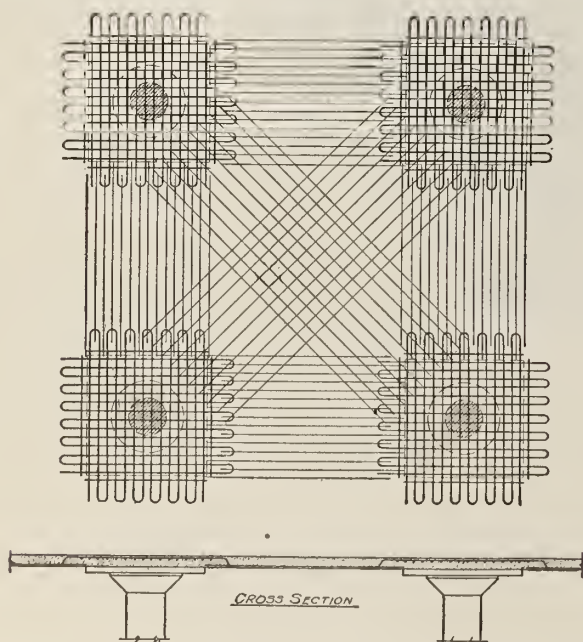
In flat slab construction a four-way slab of the two general types shown below is designed. One of the features of these patents is the combination of four-way reinforcement in the bottom of slab with two-way reinforcement over supporting columns.

Special Announcement.

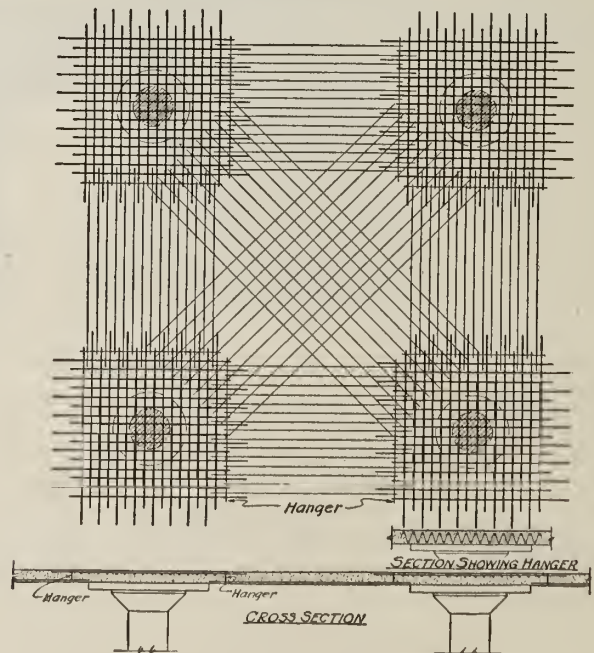
This company wishes to announce that by the time this issue comes to the engineers, it will have completed a fabricating shop and warehouse at 35th and Kedzie Streets, Chicago, Ill. This plant will be equipped to make shipments from stock of all classes of reinforcing steel and to handle all types of fabrication. The company will also put on the market a full line of the more practical accessories in its field, announcement of which will be made from time to time.



VIEW OF MAT (TYPE A)



Type "A," (Patented)



Type "B," (Patented)

PLANS AND CROSS SECTIONS BARTON SPIDER-WEB SYSTEM

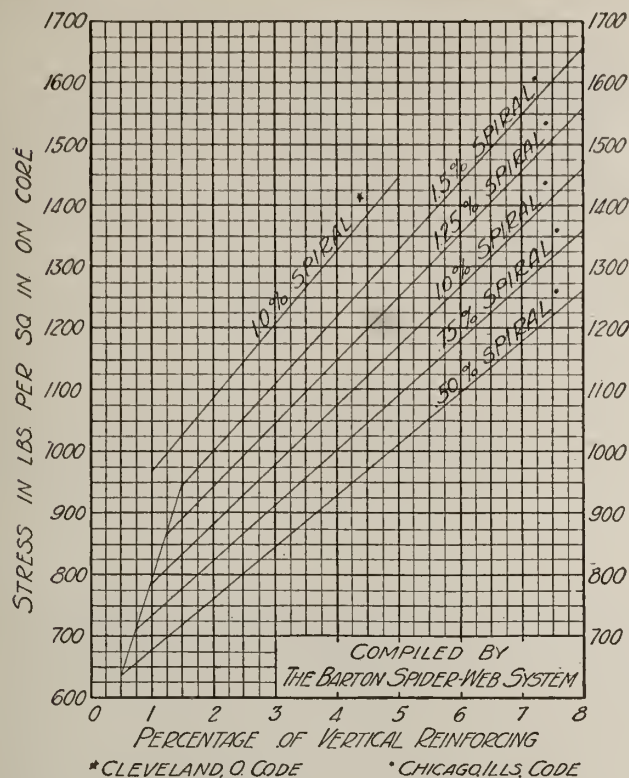


DIAGRAM OF WORKING LOADS

Diagram gives working loads for column reinforced with both spiral and vertical steel. The two sets of values shown are those required by the Chicago and Cleveland ordinances. The economical stresses in the Chicago ordinance lie between 800 and 1000 lbs. per sq. in. inside of spiral and in the Cleveland ordinance between 1000 and 1200 lbs. per sq. in.

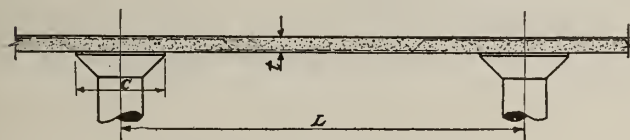


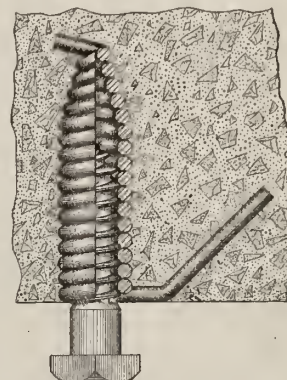
DIAGRAM FOR FLAT CEILINGS



PLANT OF LIBBY, McNEIL & LIBBY, BLUE ISLAND, ILL.

Steel Spiral Sockets.

The socket here illustrated is manufactured by this company in $\frac{1}{2}$ -in., $\frac{5}{8}$ -in., and $\frac{3}{4}$ -in. sizes. They are made of special drawn wire, so coiled that the threads of a standard lag bolt mesh with them. This socket is patented. It is the most economical insert on the market. Its carrying capacity has been thoroughly demonstrated by repeated use and by R. W. Hunt tests. Samples and prices on request. When writing for quotations please state the size and number required.

SOCKET WITH LAG BOLT
IN POSITION

With each socket is furnished a wooden plug, which sets in bored holes in forms and holds socket firmly in position while pouring in concrete

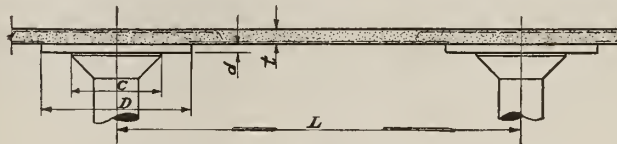


DIAGRAM FOR DROP PANEL CEILINGS

TABLE OF DIMENSIONS FOR FLAT CEILINGS (DIAGRAM TO LEFT)

L	C	40 Lbs. Roof		100 Lbs. L.L.		150 Lbs. L.L.		200 Lbs. L.L.		250 Lbs. L.L.		300 Lbs. L.L.		400 Lbs. L.L.		500 Lbs. L.L.	
		t	Wt., lbs. per sq. ft.	t	Wt., lbs. per sq. ft.	t	Wt., lbs. per sq. ft.	t	Wt., lbs. per sq. ft.	t	Wt., lbs. per sq. ft.	t	Wt., lbs. per sq. ft.	t	Wt., lbs. per sq. ft.	t	Wt., lbs. per sq. ft.
ft.	ft. in.	in.		in.		in.		in.		in.		in.		in.		in.	
16	3 9	6	75	7	85	7 3/4	95	8 1/2	106	9	113	9 3/4	122	10 3/4	134	11 1/2	144
18	4 0	6 1/2	81	7 3/4	95	8 3/4	109	9 1/2	119	10 1/4	128	10 3/4	134	12	150	13	163
20	4 6	7	85	8 3/4	109	9 1/2	119	10 1/2	131	11 1/4	141	12	150	13 1/2	166	14 1/2	181
22	5 0	7 3/4	95	9 1/2	119	10 3/4	134	11 3/4	147	12 1/2	156	13 1/4	166	14 3/4	184	16	200
24	5 6	8 3/4	109	10 3/4	131	12	150	12 3/4	159	13 3/4	172	14 3/4	184	16 1/4	203		
26	6 0	9 3/4	122	11 1/2	144	13	163	14	175	15	188	16	200				

TABLE OF DIMENSIONS FOR DROP PANEL CEILINGS (DIAGRAM TO RIGHT)

L	D	C	40 Lbs. Roof				100 Lbs. L.L.				150 Lbs. L.L.				200 Lbs. L.L.				250 Lbs. L.L.				300 Lbs. L.L.				400 Lbs. L.L.				500 Lbs. L.L.			
			t	d	Wt., lbs. per sq. ft.	t	d	Wt., lbs. per sq. ft.	t	d	Wt., lbs. per sq. ft.	t	d	Wt., lbs. per sq. ft.	t	d	Wt., lbs. per sq. ft.	t	d	Wt., lbs. per sq. ft.	t	d	Wt., lbs. per sq. ft.	t	d	Wt., lbs. per sq. ft.	t	d	Wt., lbs. per sq. ft.					
ft.	ft.	in.	ft.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.					
16	5	7	3	9	6	4	78	6	4	80	6	4	80	6½	4	87	7	4	94	7½	4	100	8	6	108	9	6	121						
17	6	0	4	0	6	4	78	6	4	80	6	4	80	6½	4	88	7¼	6	98	7¾	6	105	8½	6	115	9½	6	127						
18	6	4	4	0	6	4	78	6	4	80	6¼	4	84	7	6	94	7½	6	101	8	6	108	9	6	122	10	6	134						
19	6	8	4	3	6	4	78	6½	4	85	6¾	4	91	7¼	6	98	8	6	108	8½	6	115	9½	6	128	10½	8	140						
20	7	0	4	6	6	4	78	7	4	91	7¼	6	98	7½	6	102	8½	6	114	9	6	122	10	6	135	11	8	148						
21	7	4	4	9	6¼	6	84	7¼	6	96	7½	6	101	8	6	108	9	6	121	9½	6	129	10½	8	142	11½	8	155						
22	7	8	5	0	6¾	6	91	7½	6	99	8	6	107	8½	6	114	9½	6	128	10	6	135	11	8	149	12	8	162						
23	8	1	5	3	7¼	6	96	8	6	105	8¼	6	111	9	6	121	10	6	134	10½	8	142	11½	8	156	12½	8	169						
24	8	5	5	6	7½	6	100	8¼	6	109	8½	6	115	9½	8	128	10¼	8	138	11	8	148	12	8	162	13	10	176						
25	8	9	5	9	8	6	107	8½	6	113	9	6	121	9¾	8	131	10½	8	142	11¼	8	152	12½	8	169	14	10	188						
26	9	2	6	0	8¼	6	110	9	6	122	9½	6	130	10¼	8	138	11	8	148															
28	9	10	6	3	8½	6	116	9½	6	130	10	8	135	10¾	8	145	11½	10	156															
30	10	6	6	9	9	6	122	10½	6	140	11	8	150	11½	10	156	12¼	10	166															
32	11	3	7	3	9½	6	130	11	8	150	11½	10	156	12	10	163	13	10	180															

Tables give slab thickness, etc., for average loading and spans, and may be profitably used by any one laying out a flat slab job. These tables are drawn from the Chicago Building Department Ruling and represent conservative design. One table covers the case where drop panels are used around the column head, and the other where the ceiling is flat. The latter is used principally for cold storage warehouses, where insulation is suspended from ceilings.

Inquiries on special cases answered in detail.

THE FOUNDATION COMPANY

Woolworth Building
NEW YORK, N. Y.

CABLE ADDRESS:
"UNDERFOUND"

CHICAGO, Rookery Building
DETROIT, Dime Savings Bank
PITTSBURGH, Fulton Building

BRANCH OFFICES
NEW ORLEANS, Maison Blanche
ATLANTA, Third National Bank
MONTREAL, Bank of Ottawa Building

SEATTLE, L. C. Smith Building
SAN FRANCISCO, Holbrook Building
VANCOUVER, Standard Bank Building

Services.

THE FOUNDATION COMPANY is experienced in the construction of industrial plants, steam and hydro-electric power plants, water supply and sewer systems, and other types of engineering work. The company

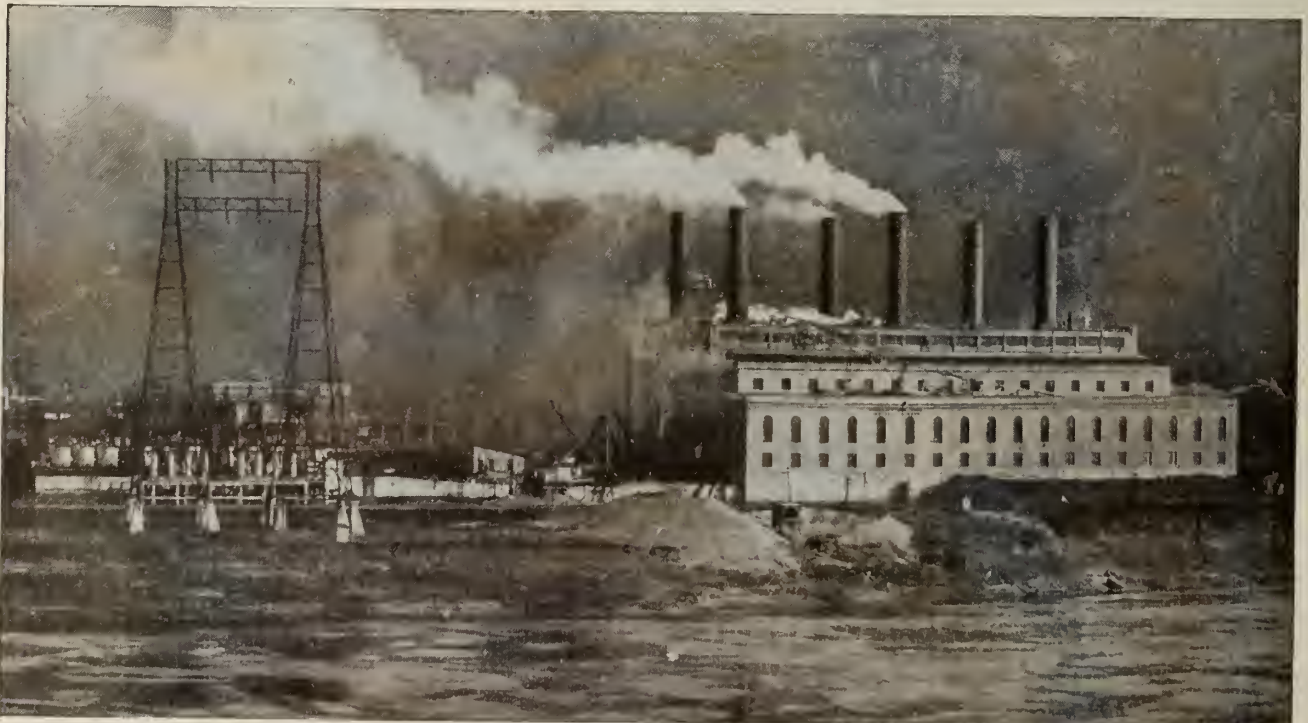
specializes in the design and construction of difficult subaqueous work such as deep foundations, bridge piers, mine shafts, etc., involving the use of either pneumatic or open caissons.



UNITED STATES GOVERNMENT CHLORINE PLANT, EDGEWOOD ARSENAL, MD.

This plant was designed to furnish 100 tons of dry chlorine gas per day for the manufacture of various poison gases and oils which were loaded into shells in another part of the reservation. In addition to the process buildings, the plant includes a 20,000-Kv-a generating station, a substation, and a complete water supply system.

Construction was started by THE FOUNDATION COMPANY in April, 1918, and gas was being produced on July 1st. The plant itself was completed in six months, the power house in eight months, and the water works in three months. The entire contract amounted to approximately \$7,000,000.00



180,000-KV-A STEAM TURBINE GENERATING STATION, AMERICAN GAS AND ELECTRIC COMPANY, WINDSOR, W. VA.

Both the substructure and the superstructure of this plant were built by THE FOUNDATION COMPANY from the designs by Messrs. Sargent & Lundy. The present installation consists of 16 water tube boilers and four 30,000-kv-a, 11,000-volt turbine driven alternating current generators

C. L. INSLEE

W. G. HUDSON

EDWARD BURNS

W. W. RICKER

GUARANTEE CONSTRUCTION COMPANY

Consulting, Designing and Contracting Engineers

144 Cedar Street
NEW YORK, N. Y.

BRANCH OFFICE: CHICAGO, ILL., Old Colony Building

Products and Services.

MILL, POWER PLANT and FACTORY DESIGN and CONSTRUCTION.

This company specializes in construction work of a difficult nature, which requires a maximum of engineering skill in design, and demands high class workmanship in the field.

An engineering department, skilled in difficult design and the proper use of materials, is maintained and is at the service of engineers and architects.

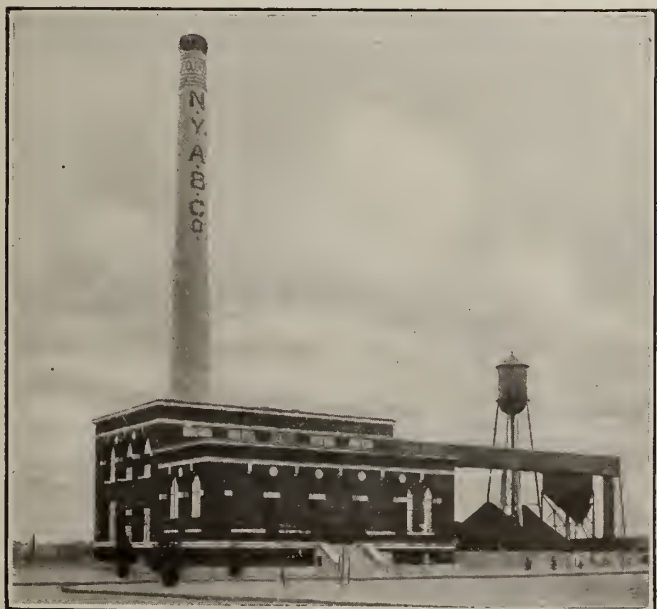
The company undertakes contracts for complete installations, from foundations to equipment, and carries on the work with its own forces and equipment.

This work is done on any form of contract—percentage, fixed fee or lump sum. Entire responsibility is assumed for the designs and workmanship.

For Coal, Ash, and Materials Handling Equipment, Storage Bins and Bunkers, Pneumatic Conveyors, see pages 898-99.



ELECTRIC FURNACE PLANT FOR FERRO-SILICON, DESIGNED AND ERECTED FOR SHAWINIGAN ELECTRO PRODUCTS CO., BALTIMORE, MD.



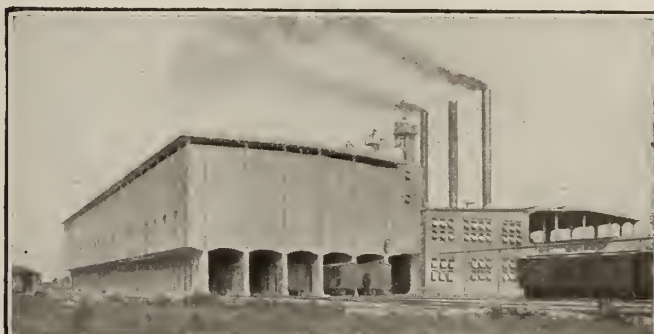
POWERHOUSE FOR NEW YORK AIR BRAKE CO., WATERTOWN, N. Y.



POWERHOUSE OF A COMPLETE INDUSTRIAL PLANT ERECTED FOR THE AFTON DEVELOPMENT CO., AFTON, N. Y.



REINFORCED CONCRETE FACTORY FOR LOCKE STEEL CHAIN CO., BRIDGEPORT, CONN.



35,000-TON STORAGE AND DRYING PLANT, DESIGNED AND ERECTED FOR PHOSPHATE MINING CO., NICHOLS, FLA.

INDUSTRIAL ENGINEERING CO.

Constructing Engineers

30 Church St.
NEW YORK, N. Y.

Products.

REINFORCED CONCRETE BUILDINGS.

Reinforced Concrete Buildings.

A growing business, and a management studying and planning for new buildings, are inseparable factors. The outcome should be a building that will fit the business.

Duplication is almost unheard of in building operations. The geography of the site, the nature of the product, and the many conditions that surround its manufacture dominate the problem of design and construction. One fact is certain—if the building is to be an asset to the business, it will differ from other buildings. A study of conditions will reveal many shortcomings in the present plant, and kinks in method of manufacture that are peculiar to the business.

Theoretically these problems may be solved by any engineering contractor. But why conduct an experiment of the magnitude of a building operation when a word to INDUSTRIAL ENGINEERING CO. will insure the services of a permanent and experienced organization for the construction of industrial concrete buildings?

Cost.

Of course the cost is a vital consideration to anyone who is contemplating the erection of a new building. The two government storehouses and machineshop, shown on the opposite page, are striking examples of efficiency and low cost. Their combined floor space amounted to 29 acres and their total cost was \$3,100,000.00. They were built under lump sum contracts in war times, when of necessity all building was handicapped and conditions were trying, not the least being the competition for demoralized labor brought on by percentage contracts of enormous magnitude. This cost represents a saving of \$400,000.00 over lowest tenders received in competitive bidding on government



TRADE-MARK

designs. In addition to this INDUSTRIAL ENGINEERING Co. built substantially within their estimates.

Speed.

As an example of what the INDUSTRIAL ENGINEERING Co. has accomplished in the matter of speed, the following is briefly stated:

The Ingersoll-Rand Company asked for 3 months delivery under a heavy penalty and bonus. The nearest competitor asked 5 months. This company guaranteed 11 weeks, and agreed to a \$500.00 per day penalty and bonus clause in the contract.

When the contract was let April 13th, 1917, the plans were not even made. Almost "overnight" these working plans and preliminary estimates of materials were made up. Within 3 days the job was laid out, equipment on the ground, materials being unloaded, and excavators at work. The schedule given below shows how this organization made good, and in spite of labor and material shortages, embargoes and general transportation troubles, earned a substantial bonus and Ingersoll-Rand's satisfaction.

Personal attention and absolute dependability and co-operation of each workman, saved time.

Finish.

Cost is an item of great interest before building, speed is highly desirable after beginning, but finish is a permanent source of satisfaction and profit, remembered when all else is forgotten.

Every ambitious construction company aims for economy and speed of construction. The INDUSTRIAL ENGINEERING Co. gives both, supplemented by high class workmanship, which is a sure indication of its exceptional experience and permanent organization. And owing to its highly specialized and trained organization, it can produce these results as a standard product.

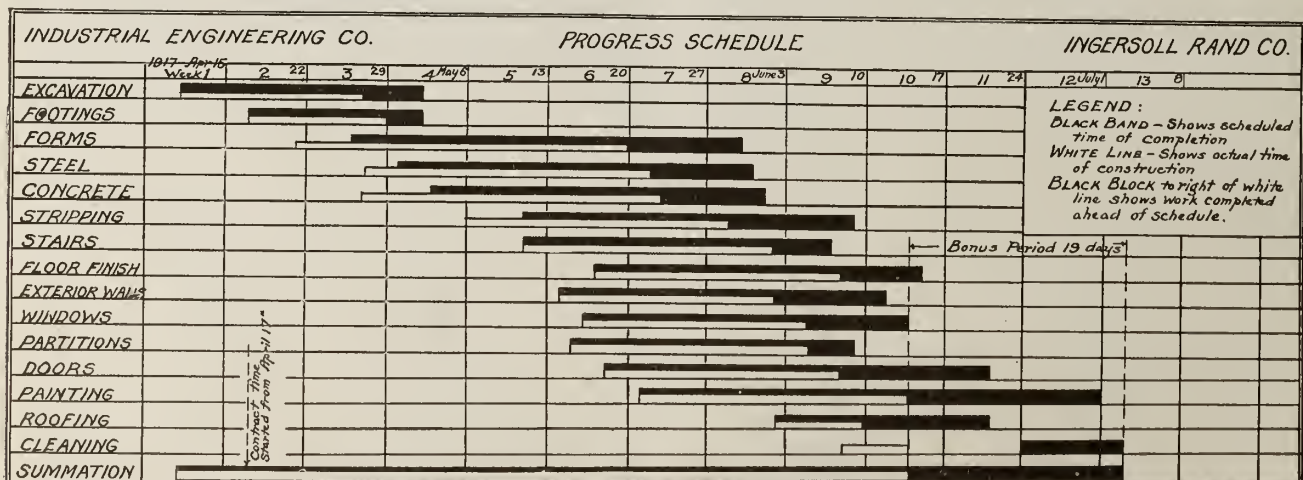


CHART SHOWING PROGRESS OF WORK ON INGERSOLL-RAND CO.'S BUILDING, PHILLIPSBURG, N. J.

The Ingersoll-Rand Co. asked completion of their building in 72 working days, INDUSTRIAL ENGINEERING Co. promised it in 66 working days. They occupied it in 50 working days.

• Black band shows contract time allowance; white bands, actual time of operations; and difference, time saved over guarantee



STOREHOUSE ERECTED UNDER GUARANTEED COST IN WAR TIMES

Contains 12¼ acres of floor space. Saving was \$250,000.00 over lowest bid based on government design



BUILDING CONSTRUCTED FOR McKESSON & ROBBINS, INC.,
MANUFACTURING CHEMISTS, BROOKLYN, N. Y.
WM. HIGGINSON, Architect



Progress of Work May 27, 1917; Contract Signed April 13, 1917

TWO VIEWS OF INGERSOLL-RAND CO.'S BUILDING, PHILLIPSBURG, N. J.



REAR VIEW OF U. S. NAVY DEPARTMENT GENERAL STOREHOUSE

Saving in time, 82 days; saving in steel, 106 tons; saving in cost, \$44,000.00, as compared with lowest bid on government design



LARGEST SINGLE MACHINESHOP IN THE WORLD

Building is 503 ft. by 163 ft., 5 stories high, containing a floor area of 9½ acres. Built at a saving of more than \$100,000.00 from lowest tenders received on steel designs



CONCRETE BUILDING OF E. R. DURKEE & CO., ELMHURST,
L. I., N. Y.

RUSSELL G. CORY, Architect



Building Completed in 50 Days

ROBERT W. HUNT

JOHN J. CONE

JAS. C. HALLSTED

D. W. McNAUGHER

ROBERT W. HUNT & COMPANY

Engineers

Bureau of Inspection, Tests and Consultation

90 West Street
NEW YORK, N. Y.2200 Insurance Exchange Building
CHICAGO, ILL.Monongahela Bank Building
PITTSBURGH, PA.ST. LOUIS, MO., Syndicate Trust Building
DALLAS, TEX., Busch Building
KANSAS CITY, MO., Orear-Leslie Building
NEW ORLEANS, LA., Hibernia Bank Building
LONDON, ENGLAND, Norfolk House, Cannon Street, E. C.SAN FRANCISCO, CAL., 251 Kearney Street
VANCOUVER, B. C., Standard Bank Building
TORONTO, ONT., Traders Bank Building
MONTREAL, QUE., 905 McGill Building**General Engineering.**CONSULTATION SERVICES in all ENGINEERING FIELDS
—MECHANICAL, CIVIL, HYDRAULIC, ELECTRICAL and
CHEMICAL.The SUPERVISION and DETAIL INSPECTION of CON-
CRETE CONSTRUCTION, including EXAMINATIONS and RE-
PORTS upon the suitability of aggregates.REPORTS on EXISTING CONDITIONS of BUILDING and
other structures.**Testing, Physical and Chemical.**Duty and efficiency tests of entire plants—Engines,
boilers, pumps, compressors and other machinery.Strength tests of materials and systems of con-
struction—Steel, iron, cement, brick; columns, beams,
floor slabs, partitions and other members.Chemical tests of all building materials, including
steel, iron, cement, paints, oils, slags, limestones, marls
and clays.**Structural Steel Inspection.**The inspection of structural material at the mills
and foundries, including the identifications and wit-
nessing of physical tests.The supervision and inspection of workmanship,
checking the sections, dimensions and detail connec-
tions during the course of fabrication at the shops, re-
sulting in the proper handling of the material, first class
workmanship, accurate construction, thorough painting
and distinct marking, and thus facilitating the erection
at the site.Estimation of weights from detail drawings, and
checking shipped weights of finished work.The supervision and detail inspection of the struc-
ture during erection.**Cement Inspection.**The testing of cement, including the sampling in
car load or bin lots at the mills or warehouses, or when
delivered on the work.Complete cement and chemical laboratories at prin-
cipal offices.**Locomotives and Cars.**Car and locomotive inspection service includes in-
spection and testing at point of manufacture of certain
important materials, and supervision of the entire con-
struction of equipment. Careful attention is given to
the quality of material and workmanship, and applica-
tion of safety appliances required by the Interstate Com-
merce Commission. All locomotives are operated and
tested under steam during final inspection before ac-
ceptance.Such thorough inspection assures receipt of cars
and locomotives in accordance with specifications.Complete reports of inspection and tests are furnished
for record.**Miscellaneous Materials and Equipment.**All classes of engineering materials, including cast
iron water and gas pipe, oil pipe, creosoted paving
blocks, relaying rails, etc., are inspected under standard
and thorough methods by competent inspectors. In-
spection and testing of locomotive cranes, pile drivers,
steam shovels, gas engines, pumps, ballast spreaders
and other miscellaneous equipment is given special
attention.**Motive Power Materials.**Wheels, axles, couplers, springs, hose, castings,
journal bearings, and brasses, boiler plates, tubes and
staybolts, and all important locomotive and car materials
are inspected, tested and identified at the manufacturing
plants, where there are facilities for making the proper
inspection and tests promptly, efficiently and economi-
cally. Inspectors engaged only in the inspection of such
materials are assigned to this work.**Rails and Track Materials.**RAILS—Thoroughly experienced and competent rail
inspectors, engaged only in inspection of rails, are sta-
tioned at all rail mills. In consideration of safety alone
rails must be as free from injurious defects as possible;
consequently too much attention can not be given in-
spection of the rail in every phase of manufacture.“Special Inspection” inaugurated by this com-
pany affords a complete progressive inspection of the
steel from time of melting until shipment of finished
rail. Specialized inspectors are assigned to the various
departments of the mill. From data recorded by in-
spectors a complete history and the results of tests of
each heat are furnished clients for permanent record.The large yearly tonnage of rails inspected by this
company has made possible a low standard tonnage rate.TRACK MATERIALS—Tie plates, angle bars, joints,
spikes and bolts can be inspected at the mills with a
result of decreased installation and maintenance charges.
With the advent of heat treated and oil quenched angle
bars, joints, bolts and spikes, an intelligent and practical
inspection has been demanded. The experienced in-
spectors of this company are exceptionally efficient in
securing delivery of proper tie plates, angle bars, joints,
bolts and spikes.**Standard Specifications.**Booklets containing standard specifications of the
American Society for Testing Materials, for construc-
tion materials, for buildings, highway bridges, cement,
etc., and other standard specifications, as well as book-
lets describing engineering and inspection service, will
be promptly furnished upon request of general office
at Chicago.

THE RUST ENGINEERING COMPANY

Engineers and Contractors

DISTRICT OFFICE

Jenkins Arcade
PITTSBURGH, PA.

BRANCHES

CHICAGO, ILL.
MONTREAL, QUE., CAN.
SEATTLE, WASH., L. C. Smith Building

DISTRICT OFFICE

District Bank Building
WASHINGTON, D. C.

BRANCHES

BOSTON, MASS., 10 High Street
CHARLOTTE N. C., 1150 Realty Building
NEW YORK, N. Y., 21 Park Row
PHILADELPHIA, PA., Girard Building

DISTRICT OFFICE

Woodward Building
BIRMINGHAM, ALA.

BRANCHES

ATLANTA, GA., 1521 Candler Building
NEW ORLEANS, LA., 533 Baronne Street

Services.

DESIGN and CONSTRUCTION of Industrial and Power Plants, Tanks, Reservoirs, Mine Shafts, Foundations, Furnaces, Kilns, Ovens, Chimneys and Boiler Settings, Linings for Blast Furnaces, Stoves, Chimneys and Flues; all kinds of work involving the use of REINFORCED CONCRETE and BRICK.

THE RUST ENGINEERING COMPANY offers exceptional service in the design and construction of above classes of work.

Its organization includes the highest grade of engineering talent; insuring designs which give maximum efficiency in operation, and are at the same time economical both in first cost and maintenance. Competent field superintendents are in charge of all construction, and the methods followed insure minimum construction costs. Offices and equipment are maintained at dominating points throughout the United States; and the requisite field force and equipment for the rapid completion of any project, can be placed in the minimum of time and expense, at any location in the United States, Canada and Cuba. The value to the owner of the above service, where large sums of money are tied up in real estate and construction, is too obvious to require comment. Further,



the past success enjoyed by THE RUST ENGINEERING COMPANY in this field of service is a guarantee of practical, not merely theoretical results.

Correspondence invited.

For Radial Brick and Reinforced Concrete Chimneys, see page 639.



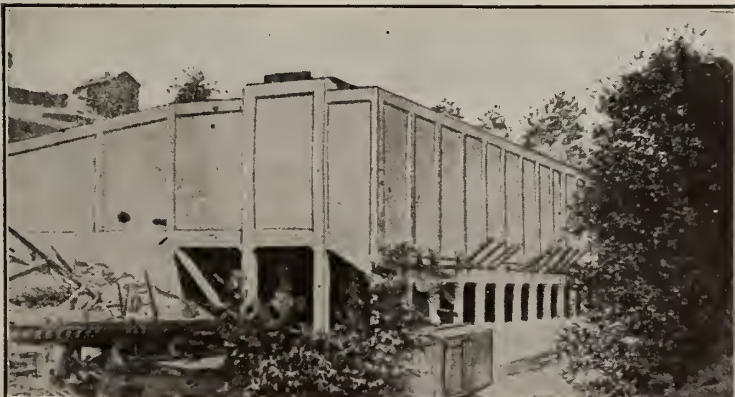
Blast Furnace Plant, Marietta, Pa.



REINFORCED CONCRETE RESERVOIR, BADEN, N. C.
Capacity, 1,000,000 gals.



Boiler Settings for 10 Water Tube Boilers,
Charleston, S. C.



REINFORCED CONCRETE COAL BUNKER, HOLT, ALA.
Capacity, 6,000 tons



Railroad Water Tank, Frankfort, Ind.



Acid Tower, Lyons Falls, N. Y.

REINFORCED CONCRETE STRUCTURES

ESTABLISHED 1902

TURNER CONSTRUCTION COMPANY

Contractors in Reinforced Concrete Construction

TELEPHONE:
VANDERBILT 4500244 Madison Avenue
NEW YORK, N. Y.

BRANCH OFFICES

BUFFALO, N. Y., Pru-
dential BuildingPHILADELPHIA, PA.,
1713 Sansom StreetBOSTON, MASS., 178
Tremont StreetATLANTA, GA., Chamber
of Commerce Building**Services.**Contractors in REINFORCED CONCRETE BUILDING
CONSTRUCTION FOR INDUSTRIAL PURPOSES.REINFORCED CONCRETE BUILDINGS, either all con-
crete, or structural concrete combined with brick, tile,
terra cotta or stone.**Slogan.**

"Turner for Concrete."

Experience.

For 17 years the TURNER CONSTRUCTION COMPANY has specialized in reinforced concrete industrial buildings and has handled 751 contracts for 270 different concerns, an excellent percentage of repeat orders. During the war, work directly for the Government amounted to \$45,000,000.00, principally on the Navy and War Office Buildings, Washington, D. C., with 1,885,000 sq. ft. of floor space or 42 acres; the U. S. Navy Fleet Supply Base, Brooklyn, N. Y., with 2,275,000 sq. ft. of floor space, or 52 acres (shown on this page) and U. S. Army Supply Base, Brooklyn, N. Y., with 5,470,000 sq. ft. of floor space, or 125 acres, including the largest piers in New York harbor—said to be the largest building operation in the world. All of reinforced concrete except the piers.

Organization.

The 14 executive officers and responsible department heads have an average of 13.9 years of service with this organization; 39 superintendents, 5.7 years, and 207 foremen, in several different trades, 7.0 years.

Speed.

Turner has never paid a penalty for failure to complete on time.

Winter Weather Work.

Winter weather construction covers 13% of the company's work—all completed on time.

Forms of Contract.

The TURNER CONSTRUCTION COMPANY works under any form of contract—lump sum, cost-plus-fixed fee, or cost-plus-percentage. 49.2% of its business has been on a cost-plus-percentage basis.

Co-operative Service.

The company's engineers will gladly render assistance to architects and engineers in the preparation of estimates or plans. A system of unit costs—based on data obtained from the execution of 751 contracts—enables it to give accurate estimates promptly, even from plans prepared for steel or mill construction.



UNITED STATES NAVY FLEET SUPPLY BASE, BROOKLYN, N. Y.

2 storehouses, 8 stories 700 by 200 ft. (one solid for storage, one with court for manufacturing purposes)

2 warehouses, 1 story 355 by 300 and 355 by 361 ft.

Powerhouse, 3000 h.p., 10 miles of tracks, 2 float bridges

Contract signed March 5, 1918. A total of 2,275,000 sq. ft. of floor space ready for occupancy October 24, 1918—or in 7½ months. Partial occupancy given in about 4 months.

Powerhouse authorized June 22nd, 1918, steam turned on November 12th, or less than 5 months.

THE ALADDIN COMPANY

Manufacturers of Standardized Houses

GENERAL OFFICES
BAY CITY, MICH.

MILLS AND DISTRIBUTING POINTS: MICHIGAN, FLORIDA, LOUISIANA, OREGON

Product.

ALADDIN READI-CUT HOUSES.

Description.

Aladdin houses or the Aladdin Read-cut system of construction are by no means new or impracticable. This method of erecting houses has been in successful operation for the last 12 years.

The two basic principles of the Aladdin system of construction are standardization of parts and substitution of machine for hand labor.

An Aladdin house is identical in construction, designs and sizes of material to the very highest type of frame construction erected anywhere. Only the method differs—method of preparing the materials.

Every piece of material is cut to fit by machinery in the mill, marked and numbered, ready for erection and nailing in place when it reaches its job. This permits standardization of parts, elimination of the usual 18% waste and the substitution of machine for hand labor.

As regularly listed and priced in catalogue, an Aladdin house includes all lumber, millwork, hardware, plaster, paints, nails, etc., above the foundation.

Erection of Houses.

Erection is quick and economical. To ship the complete material in a single car for 1, 2 or 3 houses, and to have it all on the ground at the same time is a tremendous advantage. It eliminates all delay incident to purchase of the many items entering the construction and it insures the quickest possible consummation of the entire project.

Back of each shipment is this company's qualified agreement of sufficient material for the completion of each house.

Types of Buildings.

Standard Aladdin designs from standard materials have been furnished for all of the following types of buildings:

Houses, 1- and 2-story, all sizes and prices; barns, garages, dormitories, guard houses, dining halls, bath-houses, hotels, office buildings, commissaries, store buildings, schools, churches, railway stations, section houses, flag stations, dance halls and pavilions, public rest rooms.



TRADE-MARK

References.

Some of the corporations having purchased and erected Aladdin Read-cut homes in quantities up to 500:

A. J. Julliard & Co.	Interstate Water Co.
Acme Cement & Stone Co.	Ironquit Coal & Supply Co.
Aetna Chemical Co.	Kelleys Creek Colliery Co.
Aetna Explosives Co.	Kent Mfg. Co.
Alan Wood, Iron & Steel Co.	Littlefield Realty Co.
American Zinc & Chemical Co.	Lukens Iron & Steel Co.
Atlantic Elevator Co.	La Belle Coke Co.
Atlantic Mills, Inc.	Louisville Coal & Coke Co.
Atlas Powder Co.	Lowe-Moor Iron Co.
Bristol Brass Co.	Meyers-Crump Stone Co.
Barnes King Development Co.	Monarch Coal Co.
Bay City Homebuilders Co.	M. A. Hanna Mining Co.
Blue Mountain Mining Co.	Manhasset Mfg. Co.
Bridgeport Homes Co.	Manufacturers Gas Co.
British Government	Mark Mfg. Co.
Buchanan River Coal Co.	Moshannon Collieries Co.
Calumet and Hecla Mining Co.	Mt. Vernon Ladies' Association of the Union
Casparis Stone Co.	National Acme Mfg. Co.
Climax Coal Co.	National Vaccine & Antitoxin Institute
Coale Co., Wm. L.	Oneida Community Co.
Consolidation Coal Co.	Pearl Ridge Realty Co.
Cuyahoga Shale Brick Co.	Potter Gas Co.
Central Land Co.	Potter Coal & Coke Co.
Cochran Coal Co.	Postal Hotel Co.
Coghlin & Gray	Pennsylvania Coal & Coke Corp.
Corry Development Co.	Pennsylvania Railroad Co.
Cudahy Refining Co.	Pere Marquette Railroad Co.
Dominion Coal Co.	Pittsburgh Plate Glass Co.
Dow Chemical Co.	Rich Creek Coal Co.
Ellsworth Colliers Co.	Robinson Construction Co.
Federal Fruit & Cold Storage Co.	Rattlesnake Jack Mine
First National Bank of San Jacinto	Solvay Process Co.
Ford Co., J. B.	State of Michigan
Forest Hill Elevator Co.	Sheboygan Valley Land & Lime Co.
Frick & Son	Standard Oil Co.
Goodwin - Gallagher Sand & Gravel Corp.	Standard Silk Co.
G G G Metal Stamping Co.	Tide Water Pipe Co., Ltd.
Wm. Galloway Co.	Thompson Connellsville Coke Co.
General Refractories Co.	Tropical Plantation Co.
Golden Fairview Brick Clay Co.	Tonapah Placers Co.
Gratiot Coal & Lumber Co.	Union Powder Corp.
Haverhill Cement Stone Co.	United States Government
Hazelton Oil Co.	United States Aluminum Co.
Helmar Coal Mining Co.	Valley Mould & Iron Co.
H. E. Bell & W. G. Zoller	Warren Axe & Tool Co.
H. L. Barber & Co.	Western New York Water Co.
Hercules Powder Co.	Willis Coal & Mining Co.
Investment Realty Co.	Wisconsin Zinc Co.
International Powder Co.	Wyoming Sand & Stone Co.



ALADDIN HOUSES

Over 300 were erected by this company in 6 months for the Dupont Powder Co.

SWEET'S CATALOGUE



A GROUP OF ALADDIN HOUSES RECENTLY ERRECTED FOR FORD COLLIERIES CO. IN PENNSYLVANIA.

THE H. K. FERGUSON COMPANY

Engineers and Builders

Designers and Builders of Standard and Special Factory Buildings

TELEPHONE:
ROSEDALE 6854

6523 Euclid Avenue
CLEVELAND, OHIO

NEW YORK, N. Y., 41 West 43d Street

BRANTFORD, ONT., Temple Building

Products.

FERGUSON STANDARD FACTORIES.

Factories complete with Power Plants and Equipment.

Services.

THE H. K. FERGUSON COMPANY designs, builds and equips complete factories, whether of standard or special design. Ferguson standard factory buildings are permanent, well lighted brick-and-steel structures which can be erected in record time at moderate cost, because pre-fabricated steel and other materials are carried in stock or on order.

The systematic methods perfected in standard construction operate also to shorten the time and reduce the cost of special buildings.

PRELIMINARY WORK FREE—Plans and data for Ferguson standard factories are ready and on file. If a special building is indicated, the Ferguson engineers will make estimates and preliminary sketch plans free, without obligation of any kind. These sketch plans will clearly indicate the adaptation of the building to the owner's requirements, and the best way of meeting special conditions.

ENGINEERING CONTRACT—When the preliminary suggestions are approved, the next step is to enter into a Ferguson engineering contract, under which THE H. K. FERGUSON COMPANY furnishes complete plans and specifications.

COMPETITIVE BIDS—Plans and specifications furnished under a Ferguson engineering contract are suitable for the owner to use in securing competitive bids if he so desires.

AWARDING THE JOB—If the building contract is awarded THE H. K. FERGUSON COMPANY at a lump sum price, the builder absorbs the cost of drawings and specifications.

If the building is awarded to THE H. K. FERGUSON COMPANY under some form of commission contract, or to another builder, or does not proceed at once, the owner pays the actual cost of engineers' and draftsmen's time and expenses, plus agreed percentages for overhead and profit.

FORM OF CONTRACT—It is usually desirable to build



TRADE-MARK

standard factory buildings under a lump sum contract, because this method entails less delay and bookkeeping than any form of commission contract.

The Ferguson lump sum and commission contracts are standard forms of proved worth and fairness. The Ferguson participating profit contract is preferred by many owners because it combines the advantages of lump sum and cost plus contracts without the disadvantages of either. Under this form, the owner's cost and the builder's fees are limited,

while all savings are shared by owner and builder.

Any form of Ferguson contract may include a penalty for delay, providing it also includes a bonus for anticipation.

Ferguson Standard Factories.

Some of the types of Ferguson standard factory buildings are shown on the opposite page. They embody the generally accepted features of modern industrial design, and represent the thought and suggestions of the engineers of many of the country's largest and best industrial plants as well as of THE H. K. FERGUSON organization.

They offer the great advantages of quick construction at moderate cost, because, being thoroughly standardized, pre-fabricated steel and other materials can be kept in stock or on order, ready for immediate shipment; yet they are so flexible that they can be expanded laterally or lengthwise or arranged in many different combinations to meet the owner's individual requirements.

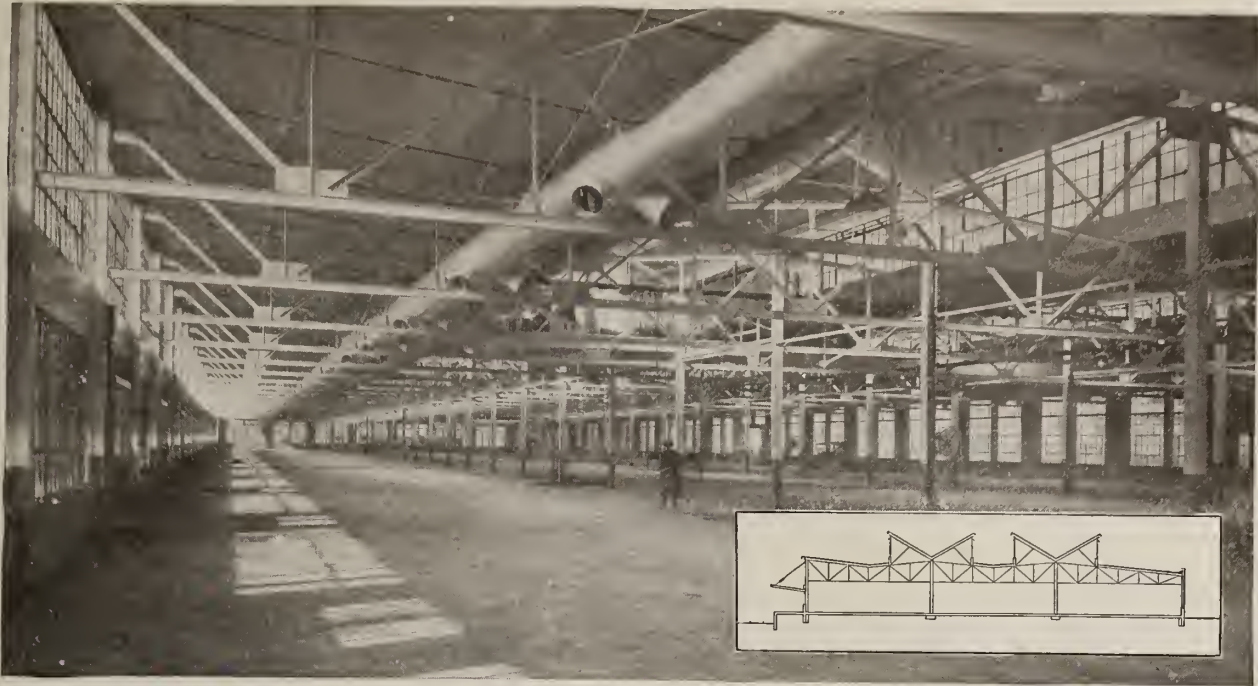
Factories Complete with Power Plants and Equipment.

Most of the construction and equipment work in any factory proposition, whether of standard or special design, can be handled by THE H. K. FERGUSON COMPANY'S own men.

There is very little subletting, which means that the owner can hold one organization responsible for his results.

Ferguson men are experienced in good factory construction and equipment and in quick deliveries as well.

THE H. K. FERGUSON COMPANY is organized and equipped to handle any industrial project from start to finish.



INTERIOR OF EXPANDED FERGUSON STANDARD NO. 3

150 ft. wide by 540 ft. long. A typical example of the ease with which Fergusson standard factory buildings can be expanded laterally as well as lengthwise. Compare the superimposed cross section with the basic cross section below. Note the excellent and evenly distributed daylight

Fergusson Standard No. 1.

Light machine shop or warehouse; 60 ft. wide; any length, in multiples of 20 ft.; steel columns and roof beams; continuous steel sash; brick walls below sills; concrete floor; interior downspouts preventing ice-clogged drainage and damage from falling icicles.

Fergusson Standard No. 2.

Machine shop or light foundry; 90 ft. wide; any length in multiples of 20 ft.; duplex sawtooth monitor giving excellent daylight and thorough ventilation without cross-drafts; steel columns and roof beams; center aisle columns can be reinforced for craneway; continuous steel sash; brick walls below sills; concrete floor; interior downspouts.

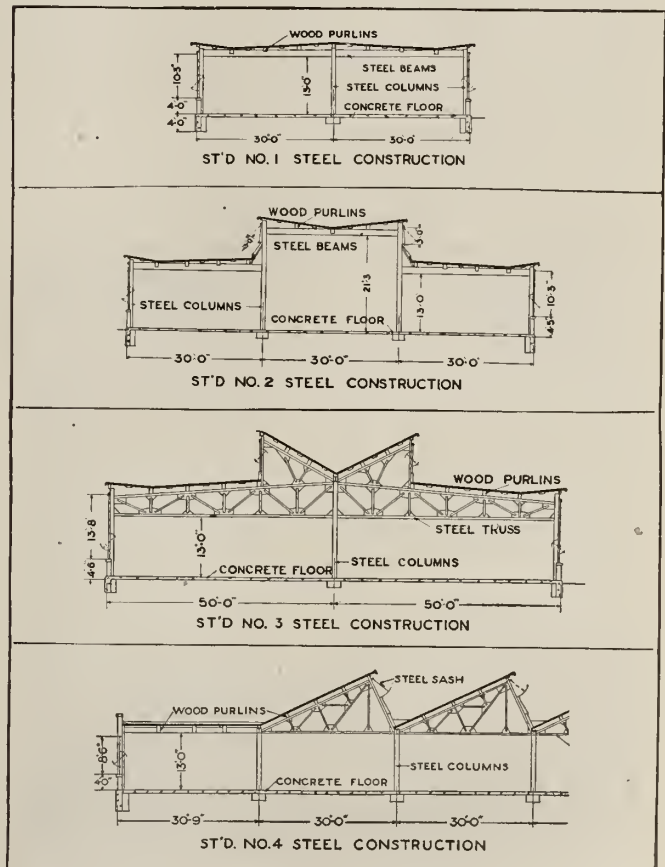
Fergusson Standard No. 3.

Universal type for light manufacturing and warehouse uses; 100 ft. wide; any length in multiples of 20 ft. with only one column to every 2000 sq. ft. of floor space; duplex sawtooth monitor; steel columns and roof trusses composed of 2 channel irons with 1 in. interval between them, forming a strong and convenient support for shafting; trusses will carry monorail of 2-ton capacity; continuous steel sash or brick pilasters; brick walls below sills; concrete or wood block floor; interior downspouts.

Fergusson Standard No. 4.

Sawtooth building; any width in multiples of 20 ft.; any length in multiples of 30 ft.; excellent daylight and ventilation uniformly distributed; steel columns

and roof trusses; shafting (and monorail if desired) may be suspended from roof trusses; continuous steel sash or brick pilasters in side walls; brick walls below sills; concrete floor; interior downspouts.



CROSS SECTIONS OF FOUR FERGUSON STANDARD FACTORIES

C. T. CLACK, PRESIDENT

J. E. JENNINGS, VICE-PRESIDENT and SECRETARY

J. L. WATTS, TREASURER

MILLIKEN BROTHERS MFG. CO., INC.

Manufacturer of Steel Buildings and Towers

TELEPHONE:
BARCLAY 8860Woolworth Building
NEW YORK, N. Y.CABLE ADDRESS:
"MILLIKBROS, NEW YORK"**Products.**MILLIKEN BUILDINGS (Standardized All-steel);
STEEL TRANSMISSION TOWERS; STEEL RADIO TOWERS;
STEEL POLES.**Guarantee.**

Since 1857 this company has been actively engaged in the manufacture of steel buildings and structural steel. It constructed the famous Singer Tower Building, New York, and many other steel structures in all parts of the world.

Milliken Buildings.

Milliken buildings are special all-steel, permanent fireproof structures, of interest to owners, builders, engineers, architects, etc. They are designed to meet a wide range of industrial service.

The distinctive economy of these buildings comes from their standardization; they are manufactured on a quantity basis, and kept in stock for prompt shipment.



TYPICAL UNIT OF A MILLIKEN BUILDING

Milliken buildings are made under the Standardized Truss Unit System; this consists of a special framework of structural steel members, each of which is alike and interchangeable. This system of construction is of particular advantage when future service is considered—if the owner finds it necessary to remove or dismantle a building, it can be re-assembled in the same form or in an entirely different shape. There is no loss of material.

These buildings are clear span structures, no interior columns. They have been designed for rapid erection with a minimum amount of labor and tools.

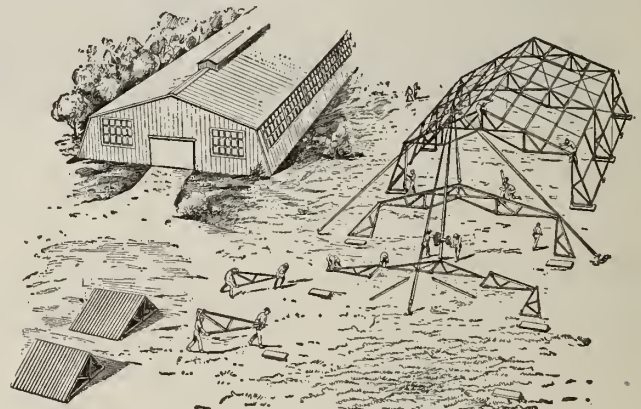
Milliken buildings have met with decided favor in all parts of the world. During the war their advantage was quickly recognized, and hundreds were erected for government and industrial use.

These structures are distinctly valuable where one-story buildings are required, whether for single series or group buildings, either in separate units or directly connected.

ADAPTABILITY—Milliken buildings are suitable for a wide variety of industrial purposes, among these being: textile and silk mills; cottonseed storage; cotton bale storage; general storage buildings; cement, tobacco, sugar and other warehouses; petroleum and oil buildings; paint and dye works; grinding mills, sawmills,

etc.; stock houses, and light manufacturing plants of all kinds; dairy and farm buildings; power and boiler plants; machineshops; foundries, garages; hangars, and so on.

ERECTION—Buildings of this type are very simple to erect. A gin pole, hand winch, hoisting rope and a few wrenches are all that is necessary. All connections are bolted, no riveting is required. Bolts are furnished with the material. Erection can be handled readily by local labor, and the unit members are of such size and weight that every piece can be carried easily by two men.



METHOD OF ERECTION

Material is laid out on ground, units bolted together to form roof trusses and columns, and this framework raised into place by a gin pole. Complete instructions for assembling and erecting are always sent to purchasers.

TYPES AND STYLES—Milliken buildings are manufactured in 12 different types. Each type in turn has been developed in 6 styles, and in various lengths. The different combinations give a choice of a wide variety of buildings—it is a "choice of a thousand buildings."

The 12 basic types of buildings are shown on the following page. Such miscellaneous features as large or small doors, single or continuous sash, etc., are practically optional with the purchaser.

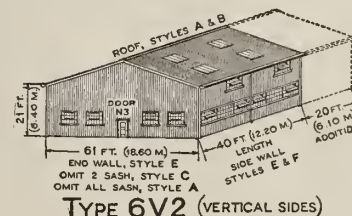
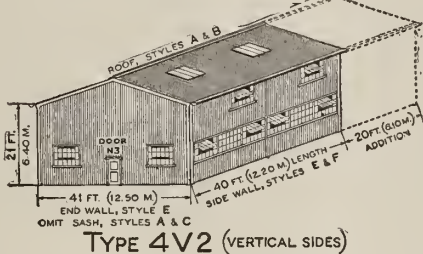
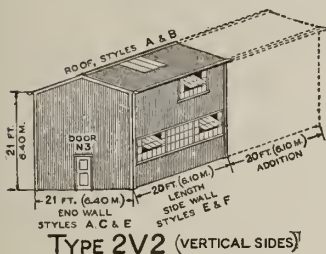
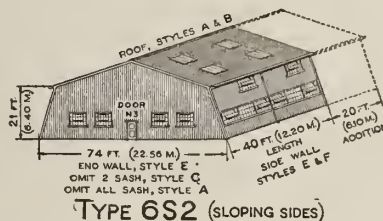
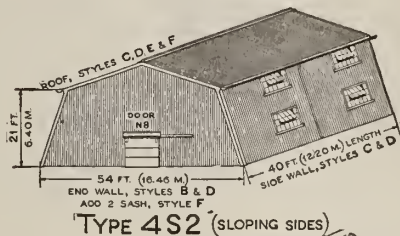
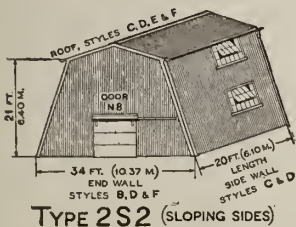
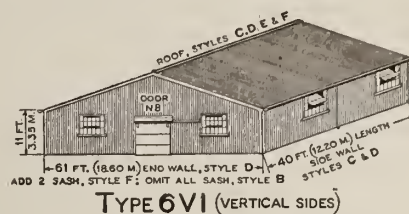
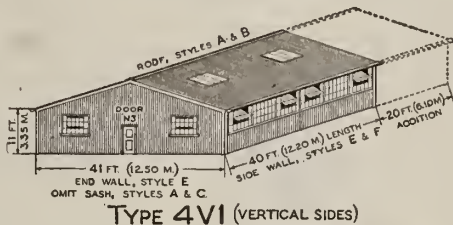
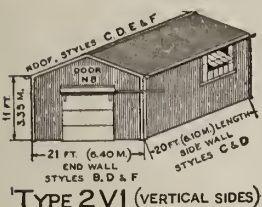
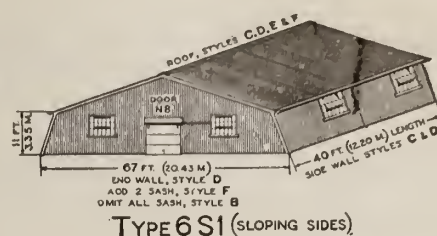
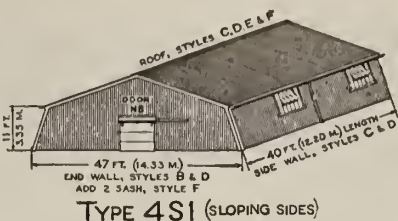
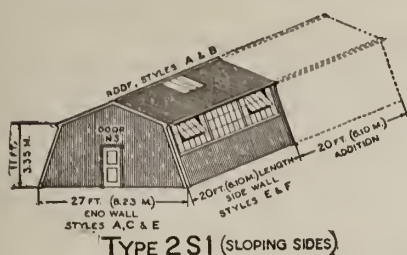


BUILDING ERECTED IN SOUDAN



TYPE 4V1 MILLIKEN BUILDING

CATALOGUE—New catalogue No. 10—Choice of a Thousand Buildings—gives complete details, illustrations and price lists of the standard types, styles and sizes of Milliken buildings. Copy free on request.



TYPES OF MILLIKEN BUILDINGS

Made in 2 heights—11 and 21 ft., with either vertical or sloping side walls. Vertical side wall buildings have clear floor widths of 20, 40 and 60 ft. Sloping side walls have floor widths of 27, 47 and 67 ft., respectively, for buildings 11 ft. high; and 34, 54 and 74 ft., for buildings 21 ft. high.

Building lengths are standardized on a basis of 20-ft. panels, making possible any multiple of this length, such as 20, 40, 60, 80 and 100 ft., etc. Structural steel framework is made entirely of standardized truss units. Sloping side wall buildings have standard unit columns. Vertical side wall buildings have vertical channel bar columns. Painting consists of 1 shop coat.

All buildings furnished complete with sash and doors; painted or galvanized corrugated side and end walls and roof; galvanized gutters, leaders, ridge roll, eave flashing, gable flashing, and corner trim, and all necessary clips, bolts and washers for fastening. Foundation anchor bolts also are furnished.

Steel Transmission Towers.

Milliken steel transmission towers are built of open hearth structural steel, galvanized, and have high resiliency and maximum strength. They are constructed in types to meet any transmission line condition, and both for high and low voltage service.

Used throughout the United States.

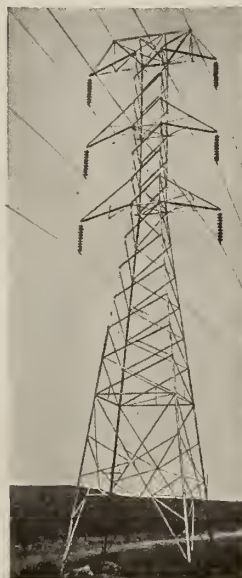
Radio Towers.

Milliken steel self-supporting radio towers are built of structural steel angle bars, providing ample rigidity against wind pressure and aerial pull. Made in 2 types, one in heights from 66 to 165 ft.; the other in heights of 200, 225, 250 and 300 ft. The towers of the first group are galvanized, while those of the second group can be galvanized or painted, as desired.

Used throughout the United States.

"Pinlock" Poles.

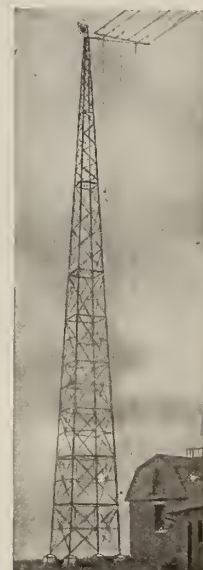
Milliken "Pinlock" poles (patented) are galvanized steel latticed poles, especially suited for the support of single trolley wires or catenary construction, telephone and telegraph lines, electric lights and signs. They have ample strength and require a minimum of ground space.



TRANSMISSION TOWER



MILLIKEN "PINLOCK" POLE (Patented)



RADIO TOWER

THE HYDRAULIC STEELCRAFT CO.

OF THE HYDRAULIC STEEL COMPANY

Standardized Steel Buildings, Steel Forms and Concrete Reinforcing Materials

TELEPHONE:
BROADWAY 2480

CLEVELAND, OHIO

CABLE ADDRESS:
"HYDRAULIC"

BRANCH OFFICES

NEW YORK, N. Y., Singer Building

CHICAGO, ILL., Fisher Building

DETROIT, MICH., Book Building

Products.

The "HYDRAULIC SYSTEM" of STANDARDIZED PRESSED STEEL PORTABLE BUILDINGS and STEEL BUILDING MATERIALS is a series of Construction Units which increase the speed and accuracy in erecting steel and concrete structures.

The System includes: Standardized PRESSED STEEL PORTABLE BUILDINGS; PRESSED STEEL FORMS; METAL LATH; REINFORCING BARS: Round, Square and Spiral; Concrete Conveyors.



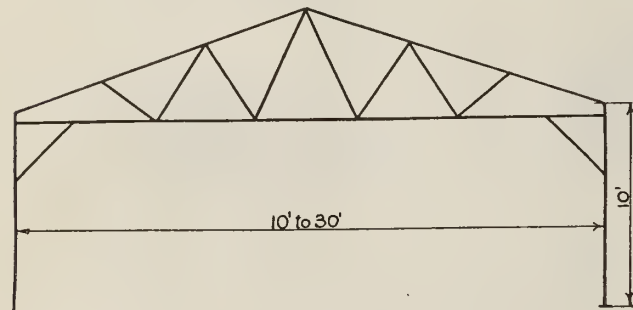
TRADE-MARK

Hydraulic Standardized PRESSED STEEL Portable Buildings.

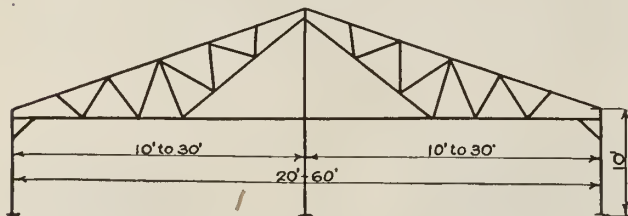
For shop restaurants, warehouses, power substations, railway waiting rooms, freight and section houses, garages, farm and dairy buildings, contracting and mining bunk houses, and temporary factories, schools and hospitals.

Design.

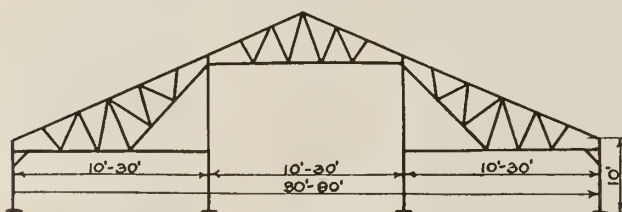
Allowable stresses and loading in conformity with standard engineering practice.



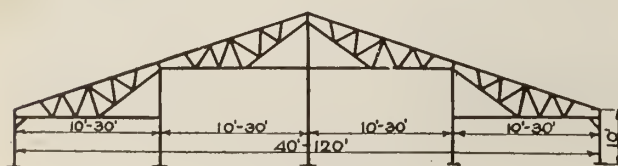
TYPE A



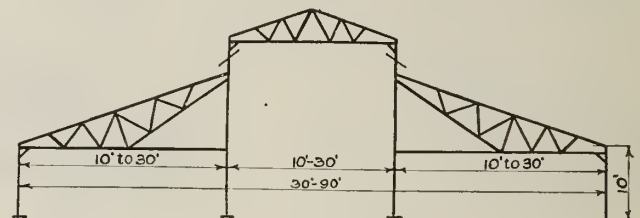
TYPE B



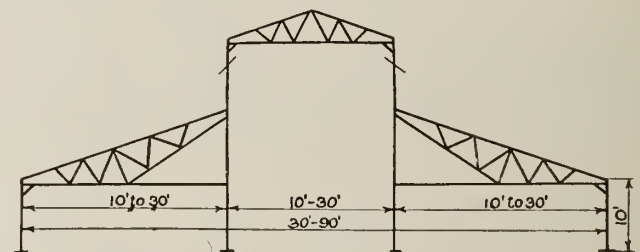
TYPE C



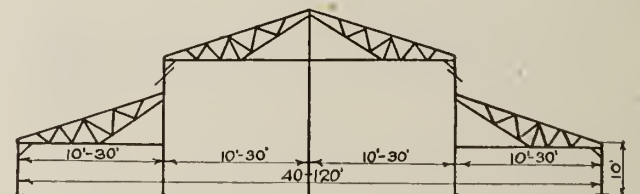
TYPE D



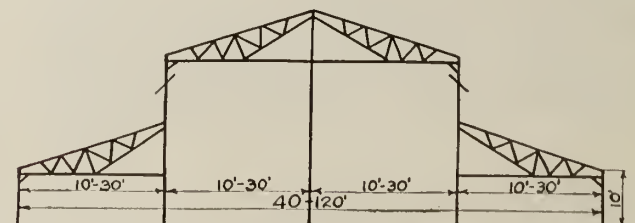
TYPE E



TYPE F



TYPE G



TYPE H

TYPES OF STANDARDIZED PRESSED STEEL PORTABLE BUILDINGS

Construction.

Steel trusses with riveted connections. Trusses supported by columns independent of wall plates. Standard solid steel sash. Roof sheets and wall plates of standard pressed steel construction (galvanized or painted).

Types.

Any types shown by cross-sectional sketches.

Sizes.

Length may be any multiple of $2\frac{1}{2}$ ft.

Width may be any multiple of $2\frac{1}{2}$ ft.

Height at eaves, 10 ft. Standard.

Flexibility.

Size and type may be altered after completion—windows and doors inserted or removed.

Portability.

May be dismantled and re-erected in new location with no additional material required.

Delivery.

All parts completely standardized, insuring quick delivery from warehouse stock.

Proof Against the Elements.

No joints open—absolute protection from rain and snow.

Appearance.

Uniform paneling in walls, producing a pleasing effect.

No exposed raw edges.

No protruding rivet heads or bolts.

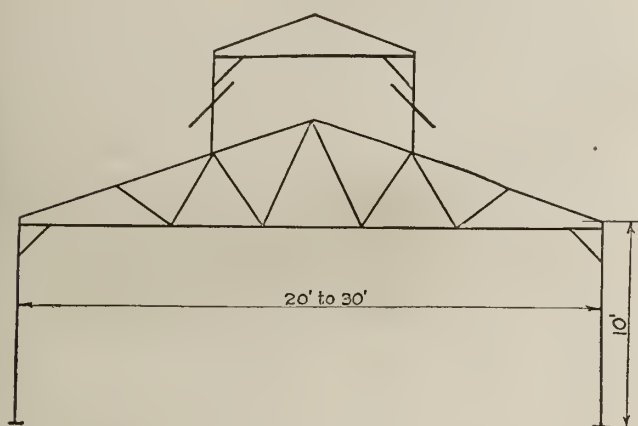
No unsightly corrugated sheets.

Erection.

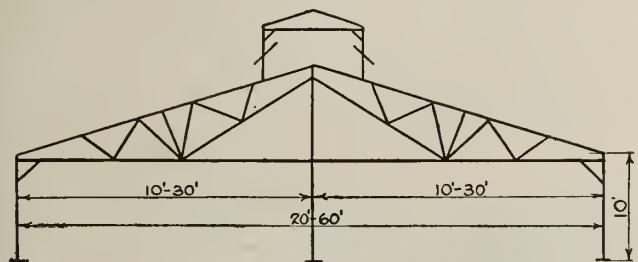
Building is easily and quickly erected by unskilled labor without special tools.

Service.

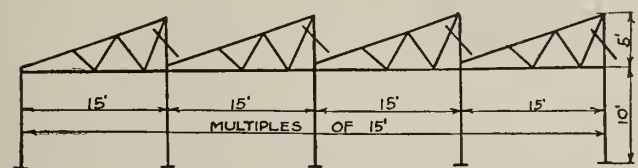
If desired, this company's Service Department will erect these buildings. The Engineering Department of this company is willing to co-operate in the solution of any building problem.



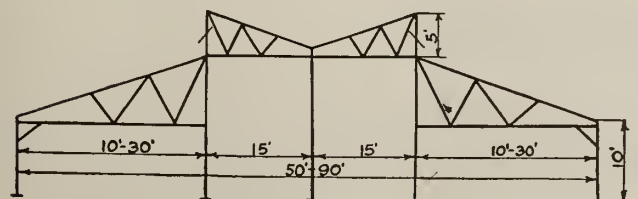
TYPE I



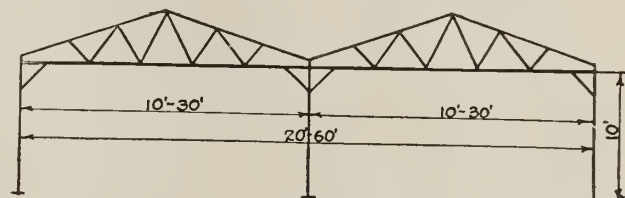
TYPE J



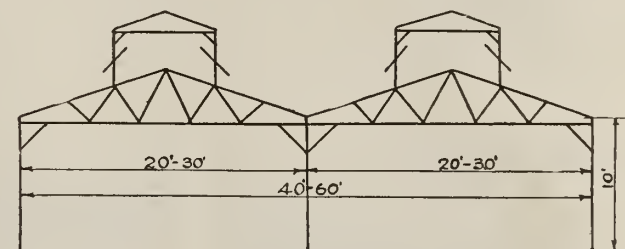
TYPE K



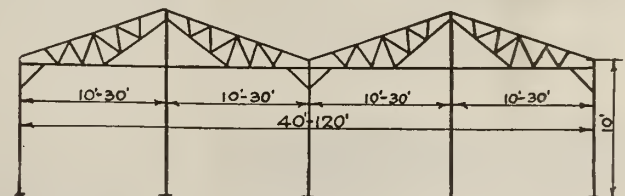
TYPE L



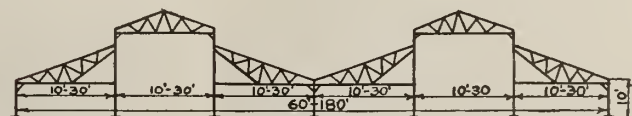
TYPE M



TYPE N



TYPE O



TYPE P

TYPES OF STANDARDIZED PRESSED STEEL PORTABLE BUILDINGS

TRUSCON STEEL COMPANY

(TRUSSED CONCRETE STEEL COMPANY)

Manufacturers of Standard Steel Buildings

YOUNGSTOWN, OHIO

Representatives in principal cities—for list, see page 184

Product.

TRUSCON STANDARD STEEL BUILDINGS, both Portable and Permanent.

For Reinforcing Steel and Metal Lath, see pages 184-86; for Steel Windows, see pages 352-54.

Truscon Standard Steel Buildings.

Truscon standard steel buildings are built of heavy steel standard units, of uniform size, interchangeable, and assembled by means of a simple locking device consisting of a slotted bolt and wedge. This construction furnishes a strong, permanent, fireproof structure that can be rapidly taken down and re-erected when necessary in a new location, without any deterioration to the building itself.

The walls of these buildings are formed of panels, that are interchangeable as they are of uniform width. The walls are of heavy gage steel—rigid and substantial. The windows, also of steel, are welded into the steel panels, affording maximum daylight and ventilation. The steel doors are furnished either single or double, and are equipped with Yale locks and Stanley hinges. The steel roof trusses support steel roof plates, tilelike in appearance and absolutely weatherproof. The building is strongly braced throughout and extremely rigid.

Truscon standard buildings, completely equipped, present a very pleasing appearance, and are ideal where daylighted, fireproof construction is desired and where quick expansion is necessary. They can be furnished in all sizes, and are adapted for use as factories, warehouses, schools, churches, hospitals, garages, dining halls, tool sheds, contractors' houses, etc.

Truscon standard buildings are furnished in any

length; widths up to 100 ft., and of various types (see illustrations). Any height of wall is secured by the two heights of panels and varying curb heights. As panels are interchangeable, any desired arrangement of wall, windows and doors can be obtained.

Buildings can be taken down and re-erected, rearranged, enlarged or reduced as required.

Monitor and Sawtooth Buildings.

The monitor type 3-M is especially adapted for use where additional headroom, light and ventilation are required, such as in foundries, erecting shops, etc. Provision is easily made for traveling crane in central bay.

The sawtooth type is adapted for machine shops and manufacturing generally, assuring maximum lighting and ventilation. Trusses are designed to support 1000 lbs. at any panel point.

Further Information.

For complete information, specifications, etc., write for the Truscon Standard Building Catalogue.



TRUSCON STANDARD BUILDINGS 80 FT. AND 60 FT. WIDE



TYPE 3M (MONITOR) TRUSCON STANDARD BUILDING



INTERIOR OF 80-FT. WIDE TRUSCON STANDARD BUILDING

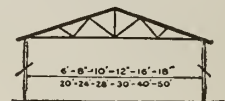


50 x 500-FT. SAWTOOTH TYPE TRUSCON STANDARD BUILDING

TRUSCON STANDARD BUILDINGS

Any Length of Building varying by 2 ft.
Heights, curb to eave, 7'-10" or 11'-6"

CONTINUOUS LANTERN 12'-0" WIDE
CAN BE PROVIDED AT RIDGE



TYPE 1



TYPE 2



TYPE 3

Widths—50'-52'-56'-60'-64'-68'-70'-74'-78'-80'-84'-90'



TYPE 3M

Widths—60'-64'-68'-70'-74'-80'-84'-90'



TYPE 4

Widths—80' (4 Bays @ 20')
100' (5 Bays @ 20')



SAWTOOTH TYPE

Widths—Any Multiple of 26'-0" lengths. Add or Subtract 2'-0" from multiples of 16'-0"

TRUSCON STANDARD BUILDINGS

HAGGARD & MARCUSSEN COMPANY

Manufacturers of Steel Bunks and Berths

1121 West 37th Street
CHICAGO, ILL.

Products.

"TIGER" BOLTLESS STEEL BUNKS; CANTONMENT or HOSPITAL COTS; HOSPITAL RECLINING CHAIRS.

Also, "Tiger" Steel Ship Berths.

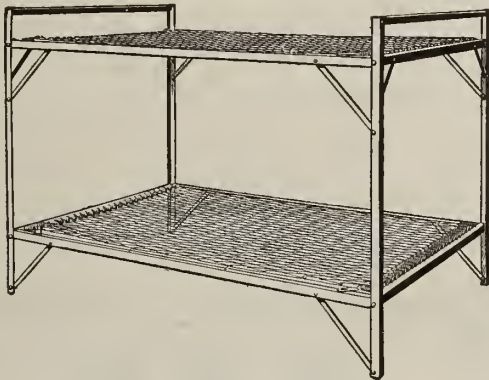
"Tiger" Boltless Steel Bunks.

ADAPTABILITY—These indestructible bunks meet every requirement for lumber camps, construction camps, etc., and are designed especially for use in bunk-houses and barracks, hospitals, and sanitariums.

LOCKING DEVICE—These bunks are equipped with a locking device, which is exclusively used in the "Tiger" bunks, dispensing with bolts or loose parts.

The importance of this feature can not be overemphasized, enabling the bunk to be set up in two minutes without tools. Produces a perfectly tight joint which can not work loose.

CONSTRUCTION—Frame is "hard angle" steel. Sleeping surface is diamond shape wire link fabric with high carbon, oil tempered helical springs. The diamond shape of the link distributes tension diagonally and affords elasticity crosswise, dispensing with the need of small helical springs for fastening fabric to side rails, so common when straight link fabrics are used, and which easily become overstretched.



NO. 1585 "TIGER" BOLTLESS DOUBLE DECK BUNK
Height, 57 ins.; floor to first bunk, 14 ins.; to second bunk, 36 ins.; head rail, 7 ins.

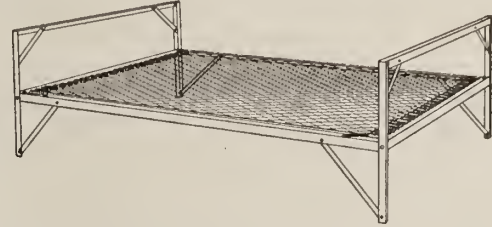
SIZES AND WEIGHTS "TIGER" BOLTLESS STEEL BUNKS

No. 1585 DOUBLE DECK		No. 1586 SINGLE DECK	
4 ft. 6 ins. x 6 ft. 5 ins.	142 lbs.	4 ft. 6 ins. x 6 ft. 5 ins.	75 lbs.
3 ft. 0 ins. x 6 ft. 5 ins.	93 lbs.	3 ft. 0 ins. x 6 ft. 5 ins.	49 lbs.
2 ft. 6 ins. x 6 ft. 5 ins.	85 lbs.	2 ft. 6 ins. x 6 ft. 5 ins.	45 lbs.

Also furnished in triple deck
Frames: Side rails and head and foot sections, $1\frac{1}{2}$ x $1\frac{1}{2}$ x $\frac{1}{8}$ -in. angle steel. Braces, $\frac{3}{4}$ x $\frac{1}{8}$ ins. Fabric, wire link.



BUNK KNOCKED DOWN FOR SHIPMENT



NO. 1586 "TIGER" BOLTLESS SINGLE DECK BUNK
Height, 20 ins.; from floor to bed, 14 ins.; head rail, 6 ins.

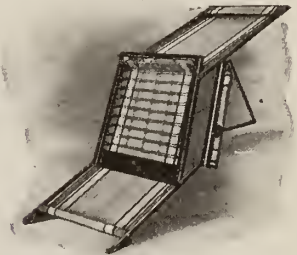
Hospital Reclining Chair.

Especially suitable for hospital convalescents and tuberculosis sanitariums. Automatic adjustment makes the chair follow every change of posture without requiring a thought. It works on its own standard, taking up little space.

No. 28 has double steel spring seat and adjustable strap support across the back, for comfort. A pair of helical springs at the top keeps the khaki cover drawn snugly.

The construction is such that it is opened or closed by simply pressing the head and foot parts together. To set up the chair requires the insertion of only two small bolts, taking but a minute or two.

Framework and standard are of steel, riveted and well braced, and finished in black enamel *baked on to stay*. The chair folds down flat for crating.



REINFORCED SPRING SEAT
Patent applied for



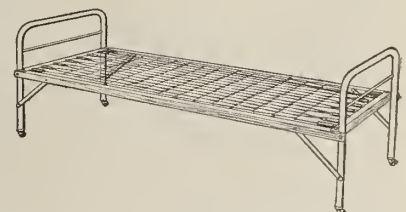
HOSPITAL RECLINING CHAIR

Cantonment or Hospital Cot.

This is the standard type of cot adopted by the United States Government and installed in the army cantonments all over the country.

The head and foot parts fold under, and the cot is equipped with locking device to prevent it from folding when in use.

The head and foot units are made of $1\frac{5}{16}$ -in. outside diameter tubing, and the spring frame is made of 2 by $1\frac{1}{2}$ by $\frac{1}{8}$ -in. tubing.



NO. 1052 CANTONMENT OR HOSPITAL COT

LOWELL WRENCH CO.

Manufacturers of Reversible Ratchet Wrenches

54 Commercial Street
WORCESTER, MASS.

Products.

REVERSIBLE RATCHET WRENCHES of several styles for constructors, etc.

Uses.

These tools are arranged so that a nut can be turned in either direction without wrench being removed. The saving in labor soon equals their cost.

Tools are guaranteed to give satisfaction in every respect.

Types.

The principal types made and carried in stock are the 1916 Pattern, the Bridge Builders', the Lag-Screw and the Steel Socket Bridge Wrench, and others, with gears and sockets to fit standard bolt heads and nuts.

Special reversible ratchet wrenches, gears or sockets built to order.

1916 Pattern Wrench.

Can be changed into a ratchet drill by removing the cap and replacing the gear by a drill socket. Changed to a right-hand or left-hand motion at pleasure by rotating the knurled nut at the end of the handle.



1916 PATTERN WRENCH

LIST OF WRENCHES

- No. 0. 7-in. lever with any one gear on No. 0 list.
- No. 1. 10-in. lever with any one gear on No. 1 list.
- No. 2. 12-in. lever with any one gear on No. 2 list.
- No. 3. 15-in. lever with any one gear on No. 3 list.
- No. 3½. 18-in. lever with any one gear on No. 3 list.
- No. 4. 18-in. lever with any one gear on No. 4 list.
- No. 4½. 24-in. lever with any one gear on No. 4 list.

LIST OF GEARS

- No. 0. ¼, ⅜, ½ in. square.
- No. 1. ⅝, ⅞, 1 in. square, ⅝, ¾ in. hexagon opening.
- No. 2. ⅞, 1, 1¼ in. square, ¾, 1 in. hexagon opening.
- No. 3. 1, 1¼, 1½ in. square, 1, 1¼, 1½ in. hexagon opening.
- No. 4. 1, 1½, 1¾, 1½ in. square, 1¼, 1½, 1¾ in. hexagon opening.

NOTE—In ordering wrenches state size and shape (square or hexagon) of hole wanted.

Bridge Builders' Wrench.



BRIDGE BUILDERS' WRENCH

LIST OF WRENCHES AND GEARS

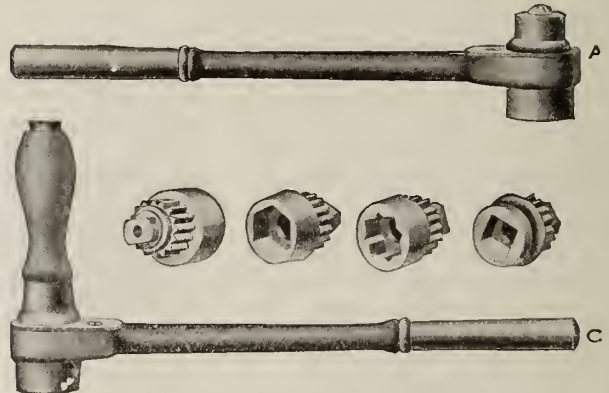
- No. 1. Length of handle, 3 ft. Weight, about 11 lbs. Handle will take gears 1, 1½, 1¾ in. square openings; 1¼, 1½, 1¾ in. hexagon openings.
- No. 2. Length of handle, 3 ft. Weight, about 14 lbs. Handle will take gears 1½, 1¾, 1½ in. square openings; 1½, 2, 2½ in. hexagon openings.
- No. 3. Length of handle, 3 ft. Weight, about 23 lbs. Handle will take gears 2, 2¼, 2½ in. square openings; 2, 2¼, 2½, 3 in. hexagon openings.

Lag-Screw Wrench.

Designed for turning coach screws, nuts or bolts,

for street railway builders, telephone, telegraph and electric light companies.

Easily changeable for various sizes by means of the different sockets.



LAG-SCREW WRENCH

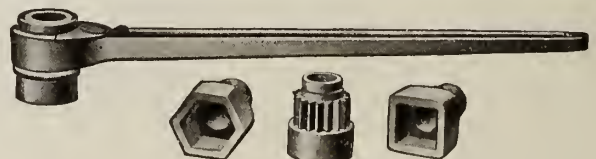
LIST OF WRENCHES AND SOCKETS

- No. 1. 12-in. handle, as shown in A.
- No. 1. 12-in. handle, as shown in C. Sockets will turn nuts measuring (smaller outside diameter) ½, ⅝, ⅞, 1, 1¼, 1½, 1¾, 1½ in. square; 1½, 1¾, 1½, 1½ in. hexagon.
- No. 2. 16-in. handle, either style A or C. Style A has 1½-in. hole for bolt to pass through socket. These sockets for nuts (smaller outside diameter) 1, 1½, 1¾, 1½, 1½ in. square; 1½, 1½, 1½, 1½ in. hexagon.
- No. 3. 20-in. handle, either style A or C. Style A has 1½-in. hole for bolt to pass through socket. With sockets to fit nuts (smaller outside diameter) 1, 1½, 1¾, 1½, 1½, 1½ in. square or hexagon.

Special sockets made to order.

Steel Socket Bridge Wrench.

Range of nuts handled by these wrenches is from ⅝ to 3¼ in. bolt diameter, or 1½ to 5 in. smaller outside diameter of nut.



STEEL SOCKET BRIDGE WRENCH

LIST OF WRENCHES AND SOCKETS

- No. 1. Length of handle, 2 ft. Clear hole through socket for 1½-in. bolt. Weight, about 10 lbs. Handle will take sockets with 1, 1½, 1¾, 1½, 1½, 2 in. square or hexagon openings.
- No. 2. Length of handle, 3 ft. Clear hole through socket for 1¾-in. bolt. Weight, about 23 lbs. Handle will take sockets with 2, 2½, 2¾, 2¾, 2½, 3 in. square or hexagon openings.
- No. 3. Length of handle, 3 ft. Clear hole through socket for 2½-in. bolt. Weight, about 50 lbs. Handle will take sockets with 3½, 3¼, 3¾, 4¼, 4½, 5 in. square or hexagon openings.

Please order by size of nut, small diameter, rather than by size of bolt. Odd sizes made to order.

Prices.

All prices on application.

ESTABLISHED 1882

KEYSTONE DRILLER CO.

Manufacturers of Well Drills and Deep Well Pumps

MAIN OFFICE AND FACTORIES
BEAVER FALLS, PA.

NEW YORK, N. Y., 170 Broadway

BRANCH OFFICES
JOPLIN, MO.

CHICAGO, ILL., Monadnock Building

Products.

PORTABLE and TRACTION WELL DRILLING MACHINES for Water Wells, Artesian and Non-flowing; Mineral Prospecting for lead, zinc, copper, coal, fire clay, etc.; Placer Gold Testing in advance of dredging operations; Blast Hole Boring in cement and limestone quarries and heavy excavations; Deep Wells for petroleum or natural gas.

"Downie" DEEP WELL PUMPS.

For Excavators, see page 41.



if required. Sills, beams, derrick are of seasoned fir. Boilers, A.S.M.E. code Non-tractions, to be hauled with horses, made in sizes No. 1 to 5½. These machines are of the double beam type and excel in "spudding" or shallow drilling.

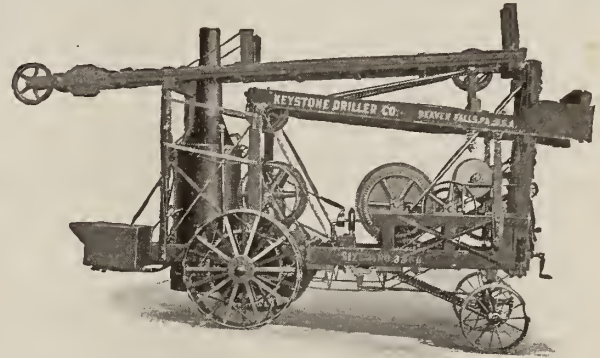
Portable oil rigs, with improved friction tool hoist, sizes No. 27 and No. 32, are offered for deep wells. Have steel sills, babbitted bearings, mounted oil country (locomotive type) boilers on separate truck. Strongest and most efficient construction, maximum portability.

Keystone Drills.

The Keystone traction, self-moving, well drills are made in sizes No. 3 to No. 5½. They are complete, self-contained with motive power on one truck; generally furnished with vertical fire tube boiler and steam engine, but can be equipped with gas or electric motor



PORTABLE DEEP WELL RIG
Sizes No. 27, No. 32 and No. 35



TRACTION STEAM WELL DRILL
Sizes No. 1 to No. 5½

PRINCIPAL SIZES AND STYLES OF KEYSTONE WELL DRILLS

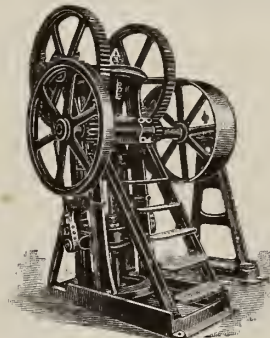
Size, No.	Style	Tool hoist	Power	Size boiler	H. p. of motor or engine	Depth capacity, ft.
1	Non-traction	Friction	Steam	30"x 60"	6	250
3	Non-traction	Cog.	Steam	34"x 66"	8	500
3	Traction	Cog.	Steam	34"x 66"	11	500
3	Traction	Friction	Steam	34"x 66"	11	350
3½	Non-traction	Cog.	Gas motor	34"x 66"	12	400
3½	Traction	Cog.	Electric	34"x 66"	15	400
3½	Traction	Cog.	Electric	34"x 66"	15	400
4	Non-traction	Cog.	Steam	34"x 66"	11	800
4	Traction	Cog.	Steam	34"x 66"	11	800
4½	Traction	Cog.	Gas motor	40"x 72"	18	800
5	Non-traction	Cog.	Steam	40"x 72"	14	1000
5	Non-traction	Cog.	Gas motor	40"x 72"	18	1000
5	Traction	Cog.	Steam	40"x 72"	14	1000
5½	Traction	Comb	Steam	40"x 72"	14	1000
27	Non-traction	Friction	Steam	25 h.p.	30	2500
32	Non-traction	Friction	Steam	25 h.p.	30	3000
35	Non-traction	Friction	Steam	30 h.p.	45	3500

PRINCIPAL SIZES AND STYLES OF KEYSTONE WELL DRILLS (Continued)

Size, No.	Shipping weight with tools, lbs.	Principal uses
1	9000	Shallow water wells, test holes
3	11000	Water wells, test and blast holes
3	14000	Water wells, test holes, blast holes
3	14000	Placer gold testing, water wells, blast holes
3½	11000	Blast holes, water wells, test holes
3½	14000	Blast holes, water wells, test holes
3½	12000	Blast holes, water wells, test holes
4	12000	Water wells, shallow oil wells, test holes
4	15000	Water wells, shallow oil wells, test holes
4½	14000	Water wells, test holes, blast holes
5	14000	Water wells
5	15000	Water wells
5	18000	Water wells, shallow oil wells
5½	18000	Special water wells, mineral test holes
27	26000	Oil wells, separate boiler
32	28000	Oil wells, separate boiler
35	32000	Oil wells, separate boiler

"Downie" Deep Well Pumps.

These pumps are offered for heavy, continuous service in deep water wells, to pump against total head of 50 to 600 ft.; direct steam driven or geared from power; single or double stroke heads and barrels. The type most commonly used is double stroke geared head, direct connected to electric motor with D.S. working barrel and "Downie" conical valves. Efficiency of 85% and maximum capacity with this type. Usable in wells 4½ to 10 in. in diameter with working barrels 2¾ to 8 in. diameter. A 6-in. well will admit a 4-in. double stroke barrel, producing 68 gals. per minute at 35 r.p.m. Catalogue No. 6 in English or Spanish.



DOUBLE STROKE GEARED
PUMP HEAD



DOUBLE STROKE
STEAM PUMP
HEAD

CHICAGO PNEUMATIC TOOL COMPANY

Hammers, Drills and Hoists

GENERAL OFFICES

1002 Chicago Pneumatic Building
NEW YORK, N. Y.

SALES AND SERVICE BRANCHES

DOMESTIC

BIRMINGHAM
BOSTON
BUFFALO
CHICAGO

CINCINNATI
CLEVELAND
DETROIT
EL PASO

HOUSTON
JOPLIN
LOS ANGELES
MILWAUKEE

MINNEAPOLIS
NEW ORLEANS
PHILADELPHIA
PITTSBURGH

PORTLAND, ORE.
RICHMOND
SALT LAKE CITY
SAN FRANCISCO

SEATTLE
ST. LOUIS
TUCSON

FOREIGN

BARCELONA
BERLIN
BOMBAY
BRUSSELS

BUENOS AIRES
CADIZ
CHRISTIANIA
FRASERBURGH

HAVANA
HONOLULU
JOHANNESBURG
LISBON

LONDON
MADRID
MILAN
MONTREAL

OSAKA
PARIS
SEOUL
TOKYO

TORONTO
VANCOUVER
WINNIPEG

Products.

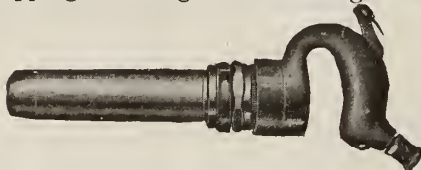
PNEUMATIC TOOLS, including CHIPPING, CALKING and RIVETING HAMMERS, AIR DRILLS, REVERSIBLE REAMING and TAPPING MACHINES, WOOD BORERS, and "CLOSE QUARTERS" DRILLS, SELF-ROTATING HAMMER DRILLS, ROCK DRILLS, ELECTRIC DRILLS and GRINDERS.

PNEUMATIC GEARED HOISTS and WINCHES.

Also, Sinkers, Stopers, Hand Drills, Plug and Feather Drills, for use in mines, quarries and contract jobs generally.

For Air Compressors and Semi-Diesel Oil and Gas Engines, see pages 784-85.

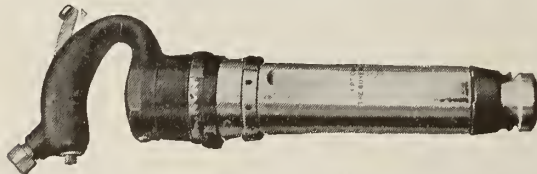
Boyer Chipping, Calking and Riveting Hammers.



BOYER CHIPPING AND CALKING HAMMER

Size	Diam. piston, in.	Length stroke, in.	Blows per min.	Cu. ft. free air per min.	Net wgt., lbs.
BK-1	1 1/8	1	3200	10	11 1/2
BK-2	1 1/8	2	2800	12	13
BK-3	1 1/8	3	2400	13	14 1/2
BK-4	1 1/8	4	1600	14	15 1/2

BK-1 Light chipping or medium calking.
BK-2 Average chipping and calking.
BK-3 Heavy chipping or calking and heading small hot or cold rivets.
BK-4 For heaviest chipping and light riveting.



BOYER RIVETING HAMMER

Type	Size No.	Diam. piston, in.	Length stroke, in.	Capacity rivets, in.	Blows per min.	Cu. ft. free air per min.	Shipping wgt., lbs.
Type H...	H-3	1 1/8	3	3 1/2	1542	20	15 1/2
	H-4	1 1/8	4	1 1/2	1272	22	16
	50	1 1/8	5	3 1/4	1000	25	24
	60	1 1/8	6	2 1/2	760	25	29
Standard.	80	1 1/8	8	1 1/8	700	25	32
	90	1 1/8	9	1 1/4	620	25	33
	80-X	1 1/8	8	1 3/4	800	28	32

May be equipped with safety device for preventing accidental shooting out of piston or rivet set.

"Little Giant" Air Drills.

Of the balanced piston type, and consist of four single acting cylinders arranged in pairs, each pair of



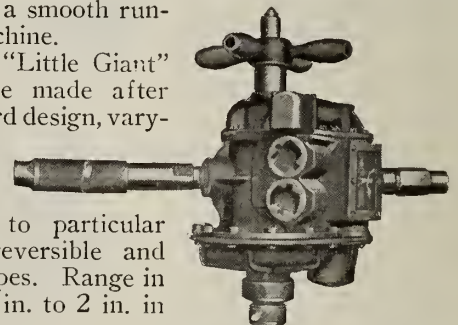
TRADE-MARK

pistons being connected to opposite wrists of a double crank shaft. Pistons of each pair travel in opposite directions at all parts of the stroke, insuring a smooth running machine.

All "Little Giant" drills are made after a standard design, vary-

ing only in size and construction necessary

to adapt them to particular uses; and in reversible and non-reversible types. Range in drilling from 1/4 in. to 2 in. in steel.



"LITTLE GIANT" AIR DRILL

"LITTLE GIANT" DRILLS, REVERSIBLE AND NON-REVERSIBLE

Size	Diam. piston, in.	Length stroke, in.	Free air consumption per min., 80 lbs.	Speed light r. p. m.	Size socket	Drilling capacity, in.	Net wgt., lbs.
No. 10F	1 1/8	1 1/8	11	2400	No. 00 Chuck	1/4	8
No. 10S	1 1/8	1 1/8	7	1200	No. 0 Chuck	3/8	8 3/4
No. 3	1 1/4	3/8	15	1050 2025	No. 0 Chuck or No. 1 M. T.	1/2	12
No. 4	1 1/2	1 1/4	20	700	No. 2 M. T.	7/8	22
No. 2	1 1/8	1 1/8	25	480	No. 3 M. T.	1 1/4	40
No. 1	2	1 1/8	35	340	No. 4 M. T.	2	58

No. 10F fitted with pistol grip handle; the others fitted with feed screw or spade handle, as desired. Nos. 10S, 3 and 4 may be fitted with breastplate.

Nos. 3, 4, 2 and 1 "Little Giant" drills may be furnished in reversible style and known as 3R, 4R, 2R and 1R. Specifications practically the same. They reverse by means of a reversing handle at the side.

"LITTLE GIANT" REVERSIBLE REAMING AND TAPPING MACHINES

(Also used for flue rolling)

Size	Speed light, r. p. m.	Wgt., lbs.	Capacity, in.		
			Ream- ing	Tap- ping	Flue rolling
10	1200	8			3/4
12	310	44	1	1	2
11	240	60	2	2	2 1/2

"LITTLE GIANT" WOOD BORERS

Size	Speed light, r. p. m.	Wgt., lbs.	Capacity, in.
10	1200	8	3/4
3	750 and 1400	12	1
5	650	24	2

LITTLE GIANT "CLOSE QUARTERS" DRILLS

Size	Size socket	Capacity drilling, in.	Air consumption per min.	Speed light, r. p. m.	Wgt., lbs.	Distance side to center of spindle, in.
81	No. 3 M. T.	1 1/4	25	315	45	1 1/8
91	No. 4 M. T.	2	35	190	50	1 1/2

"Hammer" Self-rotating Hammer Drills.

"Hammer" self-rotating hammer drills are used for mining, shaft sinking, tunneling, drifting, bench work, block holing, breaking boulders, hitch cutting,

quarrying, coal mining, road building, trench work, ore drilling. They are made in two sizes, designated by the symbols A-86 and B-86. The machine can be furnished for either dry or wet work. The change from dry to wet, or vice versa, can be made without any trouble.

These drills are equipped with independent mechanical rotation. The operation of the machine is accomplished by compressed air being first admitted into a rotary motor located in the back head of "Hummer" drills, and, after serving its purpose, is exhausted into the valve chamber of the striking mechanism, where it is utilized again; thus the compressed air performs a double duty without increasing its consumption in any way, and thereby conserving energy.

Motion of the rotary motor is communicated to the drill chuck by suitable transmission, providing "Hummer" drills with independent rotation and its incidental advantages.

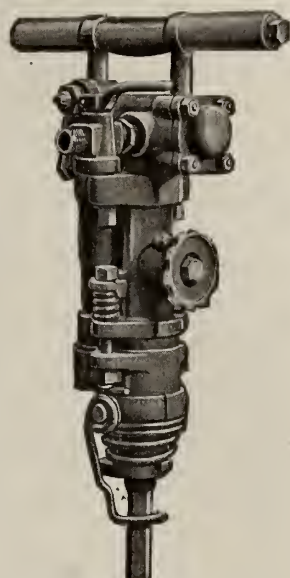
This design results in a sturdy, well balanced and compact structure throughout. By locating the rotation motor at the upper end, it is farthest removed from the strains and shocks of the hammer blows at the front end of the drill, and the distribution of the parts is such as to permit each part being made simple and strong and well calculated to stand up under the severe conditions to which the rock drill is ordinarily subjected.

For further information write for Bulletin 345.

GENERAL SPECIFICATIONS "HUMMER" DRILLS

With Independent Mechanical Rotation

Designating symbol	A-86	B-86
Diam. cylinder, in.	2 ¹ / ₈	2 ¹ / ₄
Length stroke, in.	3 ¹ / ₄	3 ¹ / ₄
Wgt., lbs.	45	58
Length over all, in.	18 ³ / ₄	21 ¹ / ₄
Size hose to use, in.	3 ³ / ₄	3 ³ / ₄
Size steel (hollow hex.), in.	7 ⁷ / ₈	1
Code word	Rezaba	Rezax



A-86 "HUMMER" SELF-ROTATING HAMMER DRILL.
Fastest drilling; easiest to operate; lowest in upkeep

Chicago "Gatling" and "Slogger" Rock Drills.

"GATLING" DRILL—A one-man drill; weighs 145 lbs. and easily drills up to 8 ft. It strikes a very rapid blow—800 per minute on the long stroke—which accounts for its quick drilling capacity.

Write for Bulletin 346.

"SLOGGER" DRILL—Strikes a hard, rapid blow. Made in 4 sizes. Distinctive features are improved valve motion, adjustable shell, positive lubrication, release rotation, bushed front head with taper sleeve and chuck for taking unshanked steels.



C-22 IMPROVED TYPE "GATLING" DRILL
With patented cushion device, mounted on column
Most powerful "one-man" drill on the market

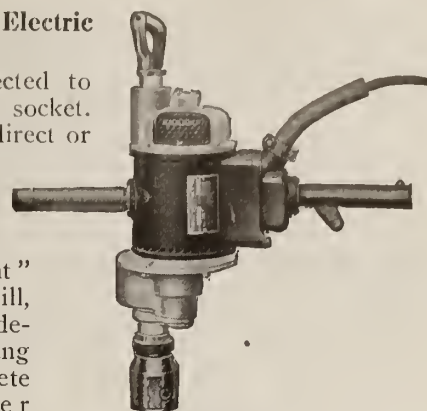
DATA, CHICAGO "GATLING" AND "SLOGGER" ROCK DRILLS

Code	Symbol	Diam. cylinder, in.	Length stroke, in.	Depth vertical hole will drill, ft.	Diam. supply inlet, in.	Wgt., unmounted, lbs.
Rebueno	C22 Gatling	2 ³ / ₄	6 ¹ / ₂	8	3 ¹ / ₄	145
Rebsieb	C2 Slogger	2 ³ / ₄	6 ¹ / ₂	10	1	285
Rebstock	D2 Slogger	3	6 ¹ / ₂	14	1	295
Rebucous	E2 Slogger	3 ¹ / ₄	6 ¹ / ₂	16	1	330
Rebudiar	F2 Slogger	3 ³ / ₄	7 ¹ / ₂	20	1	400

"Little Giant" Electric Drills.

Can be connected to ordinary lamp socket. Operate on either direct or alternating current (of 60 cycles or less) single-phase.

"Little Giant" electric hammer drill, Universal type, designed for drilling in stone or concrete where a hammer blow is necessary to do effective work.



"LITTLE GIANT" ELECTRIC DRILL
Size No. 1 BSS

CAPACITIES OF "LITTLE GIANT" ELECTRIC DRILLS Capacity (in metal) in inches

Size	*Universal Electric Drills for 110 and 220 volts	Heavy Duty D.C. for 110 and 220 volts	** Heavy Duty A.C. for 2-phase and 3-phase	Heavy Duty D.C. for street railway work 600 volts
000	3 ¹ / ₈	..	..	..
000X	1 ¹ / ₄	..	..	..
00	1 ¹ / ₄	..	..	..
0	3 ³ / ₈	3 ³ / ₈	3 ³ / ₈	..
1B	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂
2B	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂	1 ¹ / ₂
3B	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄
4B	..	2	2	1 ¹ / ₂

*For connection to ordinary lamp socket. D. C. or A. C. of 60 cycles or less, single-phase, interchangeable.

**Furnished in side spindle style only. Standard windings are for 60 cycles, 110 or 220 volts. Nos. 2, 3 and 4 can be wound for 440 volts.

"Little Giant" Portable Electric Grinders.

For use in foundry, machine and structural shops. Built in 2 sizes for 110-220-600 volts direct current, and 110-220 volts, 2-phase or 3-phase, alternating current. No. 5 BP carries 5 by 3 ³/₄-in. wheel; No. 8 BP carries 6 by 1 ¹/₄-in. wheel.

"Little Giant" Geared Air Hoists.

Great hoisting power; unusually rugged steel construction; economy of air; absolute safety. Simple, valveless air motor operates equally well in either direction and has repeatedly demonstrated its power and air economy advantages. Automatic air brake makes slippage impossible. "Limit" stop device supplies infallible protection against jam-ups from overhoisting. All gears cut from solid stock, accurately machined and case hardened. Lubrication of the "splash" type. Made in 5 capacities from 1 to 10 tons as follows:



"LITTLE GIANT" GEARED AIR HOIST

CAPACITIES AND LIFTING SPEEDS OF "LITTLE GIANT" AIR HOISTS

Size, No.	Capacity, tons	Height of lift, ft.	Speed of lift per min., ft.	Net wgt., lbs.	Shipping wgt., lbs.	Shortest distance between hooks, in.	Cu. ft. of free air consumed per ft. lift, 80 lbs. pressure	Code
10	1	9	28	355	480	39	3	Accrescent
11	1 ¹ / ₂	9	16	360	485	39	4	Accretion
12	3	11	10	465	600	45	8	Accroach
13	5	12	7	820	970	53 ¹ / ₂	15	Accroire
14	10	12	4	1080	1250	61 ¹ / ₂	27	Accrue

When desired, can be supplied with trolleys designed to operate freely on I-beams or channels, facilitating quick transportation of load. 3 types of trolleys—plain trolley, single track geared trolley, or double track geared trolley. Specify type trolley in addition to capacity of hoist.

SULLIVAN MACHINERY COMPANY

Manufacturers of Rock Drills and Air Compressors

ESTABLISHED 1850

84 East Adams Street
CHICAGO, ILL.

SALES OFFICES

BIRMINGHAM	CLEVELAND	DULUTH	JUNEAU	PITTSBURGH	SAN FRANCISCO
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WORKS: CLAREMONT, N. H., CHICAGO, ILL.

Products and Services.

ROCK DRILLS and HAMMER DRILLS of many types for use in mines, quarries and on engineering construction; DRILL BIT SHARPENING MACHINES; "AIR LIFT" WELL PUMPS; AIR COMPRESSORS.

Diamond Core Drills for mineral prospecting and test borings, Coal Mining Machines, Forge Hammers, Drill Steel Furnaces, Stone Channeling Machines and Quarrying Machinery.

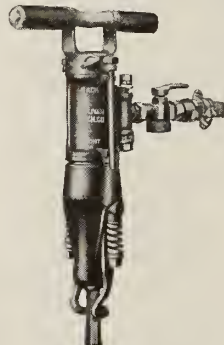
CONTRACTORS for ENGINEERS TEST BORINGS with Sullivan Diamond Drills, and for Mineral Land Prospecting.

Rock Drills and Hammer Drills.

Sullivan rock drills are available in numerous types for any demand of rock removal. Types include:

Rotator Hammer Drills—Bulletin 1670-F. "DR-6" Water Jet Drifters—Bulletin 1670-H. "Dry" and "Wet" Simple and Self Rotating Air Feed Stoppers—Bulletin 1670-M. "Plug" and "Foot-Hole" Granite Tools—Bulletin 1670-B. Hyspeed and Liteweight Reciprocating Rock Drills—Bulletin 1670-D. Submarine Rock Drills—Bulletin 1670-E. Water Jet Rock Drills—Bulletin 1670-D.

ROTATORS—6 types; average 38 lbs. The hollow piston and air tube rotators are particularly adapted for shaft or open cut drilling, having a capacity of 12- to 15-ft. holes. (They have drilled to 36 ft.) Water tube and "Pneufed" rotators are rapid mine drifters and adaptable for light tunneling. Two types of mounting available. A steam rotator can also be had. All "one-man" drills, powerful and rapid.

SULLIVAN ROTATOR
HAMMER DRILLSULLIVAN TRIPOD
DRILL

SULLIVAN WATER HAMMER DRILL "DX-61"

Made of drop forgings, and tool steel throughout.

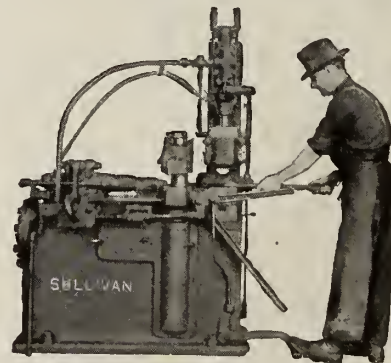
For heavier rock drilling, on tripods, quarry bars or gadders, select Hyspeed drills, especially designed and built for quarry and open cut service.

Hitting power, pulling strength, air and repair economy are "Hyspeed" features that mean low drilling cost. Sizes, 2¾, 3, 3¼, 3½ and 4¼ in.

For tunneling and underground drilling in general, requiring a mounting, select "DR-6" or "DX-61" all steel "Water Jet" hammer drills, using 1¼-in. round hollow steel. Holes to 14 ft.

Sullivan Drill Sharpener.

Embodies all the elements necessary for proper care of hammer drill steel. Does its work, both upsetting and swaging, by gradual hammering; does not require injurious temperatures for proper handling of steel. Sharpens both solid and hollow bits and forms shanks accurately and rapidly. Economical of compressed air, which is the motive power; safe and easy to use, and is a substantial, durable machine. Occupies a floor area of 5 by 2½ ft.; is 6 ft. high; weighs 4000 lbs. Write for bulletin 1672C.



SULLIVAN DRILL SHARPENER

SULLIVAN "AIR
LIFT" PUMP**Sullivan "Air Lift" Well Pump.**

Secures more water from the same wells than by any other means; secures cooler water, which means a saving in horsepower in condensing; secures purer and softer water, due to aeration; greater simplicity and reliability (there are no moving parts in the well). Apparatus is always in working order; not affected by sand or mud. Efficiency kept up to original point at all times and after long use; a scattered group of wells can be pumped as readily as one well. Ask for bulletin 1671-D.

Test Boring Service.

The Sullivan Diamond Drill Contract Boring Department, organized in 1884, specializes in testing the proposed sites of bridges, dams, tunnels and docks. The

cores secured show the exact location and character of the bed rock. Work is taken in any part of the United States or Canada, on a price-per-foot or cost-plus-percentage basis. Booklet—16, 113.

Types of Sullivan Compressors.

STEAM DRIVEN—"WC," Tandem Compound Corliss Steam Cylinders—Two-stage air cylinders; capacities 1000 to 3150 ft. Bulletin 1675-U.

"WB-3," Simple Steam—Two-stage air cylinders, straight line; capacities 250 to 950 ft. Bulletin 1675-E.

"WA-6," Simple Steam—Simple air cylinders, straight line; capacities 100 to 400 ft. Bulletin 1675-P.

POWER DRIVEN—"WJ-3," "WN-3," Angle Compound—Belt or direct motor drive; capacities 400 to 1100 ft. Bulletin 1675-S.

"WJ-4," "WN-4," Twin Angle Compound—For direct synchronous motor drive or belt pulley; capacities 900 to 2600 ft. Bulletin 1675-S.

"WH-6," Belted—Two-stage, enclosed frame; capacity 300 ft. Bulletin 1675-R.

"WG-6," Belted—Single-stage, enclosed frame; capacities 50 to 350 ft. Bulletin 1675-R.

"WK-2," Direct Motor Driven—Portable mine car type, single-stage; capacities 100 to 250 ft. Bulletin 1675-I.

"WK-31," Direct Gas Engine Driven—Portable horse truck type, single-stage, for road work, etc.; capacity 150 ft. Bulletin 1675-T.

ANGLE COMPOUND COMPRESSORS, "WJ-3"—Small floor space and foundation cost; flexibility of driving arrangement; power economy, due to accurate balance between vertical and horizontal reciprocating masses, and to unloading apparatus on both high and low pressure members; end rolling "finger" plate valves; large intercooler area and automatic lubrication. Twin units available for larger capacity, provide flexible air supply with maximum power economy, and eliminate peak loads.

TANDEM COMPOUND CORLISS STEAM DRIVEN COMPRESSORS, "WC"—Unite high fuel economy characteristic of the best Corliss engine design with excellent air end efficiency, secured by two-stage air cylinders, ample intercooling area, and close speed and pressure regulation. Tandem design permits important economies in weight, house room and foundations. Five unit sizes: 1000, 1500, 2000, 2500 and 3150 ft.

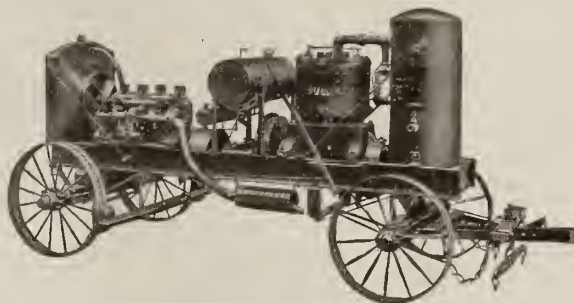
SULLIVAN BELT DRIVEN SINGLE-STAGE COMPRESSORS, "WG-6"—Provide continuous, reliable air power service. Design is simple,



SULLIVAN DIAMOND DRILL TESTING A BRIDGE SITE ON THE ST. LAWRENCE RIVER

substantial; materials and workmanship of all working parts the best. Automatic, "wafer" type plate air valves; water jacketed cylinder and heads; enclosed frame and splash lubrication. Automatic inlet valve unloader provided to save power.

SULLIVAN "WK-31" PORTABLE, GASOLINE ENGINE DRIVEN AIR COMPRESSORS—Mounted on all-steel trucks, with canopy top for protection. For operating drills for street or highway rock removal. Capacity, 150 cu. ft.; 32 h.p.; weight, 4500 lbs. Two-cylinder vertical compressor operated by gear and pinion from four-cylinder, four-cycle, tractor type gasoline engine, complete with receiver, gasoline tank and radiator, on steel wagon truck. Bulletin 1675-T.



SULLIVAN "WK-31" PORTABLE AIR COMPRESSOR

"WJ-3" AIR COMPRESSORS, ANGLE COMPOUND, BELT DRIVEN

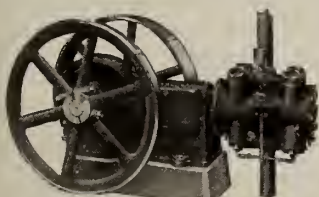
Cylinder sizes		Stroke, in.	Displacement, cu. ft. per min.	R.p.m.	I.h.p. at 100 lbs. pressure	Overall dimensions			Belt pulley		Piping
Diam. in.						Length, ft.-in.	Width, ft.-in.	Height above bottom of bed plate, ft.-in.	Diam. in.	Face, in.	
L.p.	H.p.										
14	8 3/4	10	445	250	72	8-10	4-0	7-1 1/2	5-10	10	3
16	9 3/4	12	628	225	103	9-11 1/2	5-11 1/2	7-11 1/2	6-4	15	3 1/2
17	9 3/4	12	709	225	116	9-11 1/2	5-11 1/2	7-11 1/2	6-4	15	3 1/2
18	11	14	928	225	152	11-2 1/2	7-6 1/2	7-7 1/2	6-8	19	3 1/2
20	12	14	1146	225	188	11-4 1/2	7-10 1/2	9-9	6-8	23	4
22	13	14	1388	225	229	11-7	8-1	9-9	7-2	24	4 1/2

SULLIVAN "WC" AIR COMPRESSORS, TANDEM CORLISS STEAM AND TANDEM TWO-STAGE AIR

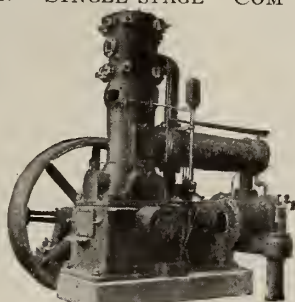
Cylinder sizes				Stroke, in.	Cu. ft. air per min.	R.p.m.	I.h.p. at 100 lbs. air pressure	Boiler h.p. required		Lbs. steam per l.h.p. per hr.		Over all dimen- sions		Fly wheels		
Diam., in.								Condensing	Non-con- densing	Condensing	Non-con- densing	Length, ft.-in.	Width, ft.-in.	Diam., ft.-in.		
Steam		Air														
H.p.	L.p.	H.p.	L.p.													
14	24	12½	20	20	1000	138	182	120	149	18	5	23	5	24-6	6-0	7-0
16	28	14½	24	24	1500	120	268	164	211	17	5	22	5	28-6½	6-7	8-4
18	30	16½	26	30	2000	108	341	197	256	16	5	21	5	33-2	7-7	9-6
20	34	18	30	30	2500	100	430	233	307	15	5	20	5	33-2	7-7	10-0
22	38	20	34	30	3150	100	552	279	375	14	5	19	5	37-0	8-6	10-0

SULLIVAN POWER DRIVEN AIR COMPRESSORS, CLASS "WG-6," BELT DRIVEN

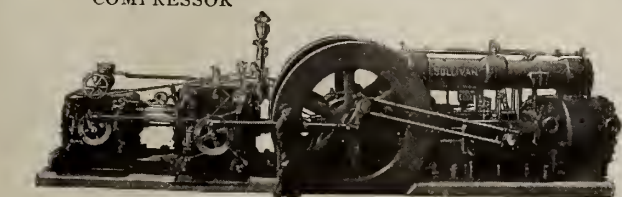
Size cylinder		Stroke, in.	Displacement, cu. ft. per min.	R.p.m.	Maximum working pressure	H.p. at maximum pressure	Over all dimensions			Flywheels	
Diam. in.							Length, ft.-in.	Width, ft.-in.	Height above bottom of bed plate, ft.-in.	Diam. in.	Width pulley face, in.
6	6	58	300	120	11.5	4-10 1/2	1-10 1/2	2-0	30	4 1/2	
7	6	80	300	100	14.5	5-0	1-10 1/2	2-0	30	4 1/2	
8	6	104	300	50	13.5	5-5 1/2	1-10 1/2	2-0	30	4 1/2	
8	8	121	260	120	24	6-3	2-4 1/2	2-8	40	7	
8	8	152	260	100	7	6-4	2-4 1/2	2-8	40	7	
10	8	188	260	50	24.5	6-4	2-4 1/2	2-8	40	7	
10	10	213	235	120	42	7-5	3-0	3-4	50	10 1/2	
11	10	258	235	100	47	7-6	3-0	3-4	50	10 1/2	
12	10	307	235	100	55	7-7	3-0	3-4	50	10 1/2	
14	10	418	235	50	52	7-7	3-0	3-4	50	10 1/2	
12	12	345	220	120	71	8-10	3-11	3-10 1/2	60	14 1/2	
14	12	470	220	90	85	8-10	3-11	3-10 1/2	60	14 1/2	
16	12	614	220	50	76	8-11	3-11	3-10 1/2	60	14 1/2	



SULLIVAN "WG-6" SINGLE-STAGE BELT DRIVEN COMPRESSOR



SULLIVAN "WJ-3" ANGLE COMPOUND COMPRESSOR



SULLIVAN "WC" TANDEM COMPOUND CORLISS COMPRESSOR

ATLAS POWDER CO.

Manufacturers of High Explosives, Blasting Powder and Blasting Supplies

140 North Broad Street
PHILADELPHIA, PA.

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CHICAGO, ILL.
KNOXVILLE, TENN.
NEW YORK, N. Y.
ST. LOUIS, MO.

DES MOINES, IOWA
McALESTER, OKLA.
PHILADELPHIA, PA.
WILKES-BARRE, PA.

Products.

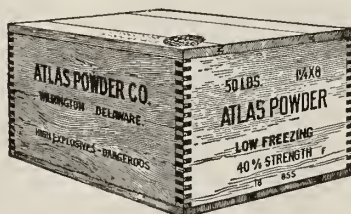
ATLAS BLASTING SUPPLIES and EXPLOSIVES, which include: Chemicals, Blasting Caps, Electric Blasting Caps, Blasting Batteries, Galvanometers, Rheostats, Leading and Connecting Wire, Thawing Kettles, etc.



TRADE-MARK

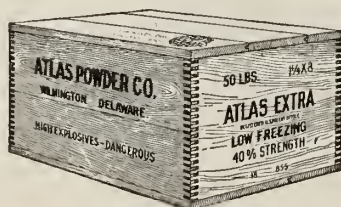
Dynamite.

ATLAS NITROGLYCERINE DYNAMITE, STRENGTHS 20% to 60%—A high explosive similar to the original dynamite. Exceedingly quick in action, it develops a great disruptive and shattering force, and should be used only where such an effect is desired. It is low freezing and may be used in open work in cold weather without thawing, if charges are fired promptly. Recommended for mud-capping rock, blasting ditches in wet ground, breaking old machinery and castings, etc. An Atlas No. 6 blasting cap or electric blasting cap should be used to detonate this explosive.



ATLAS POWDER

ATLAS EXTRA DYNAMITE, STRENGTHS 20% to 60%—For general blasting in mining, quarrying, railroad construction, road building, Atlas Extra is superior to Atlas nitroglycerine dynamite. Particularly suited to underground work as its fumes are not as objectionable as those given off by nitroglycerine dynamite. It exerts more of a heaving and lifting force, than a rending and shattering one. Atlas Extra is not recommended for very wet work, but is used to best advantage in comparatively dry operations where the material to be blasted is not unusually hard. It is low freezing and will not require thawing except in very severe weather.



ATLAS EXTRA

ATLAS LOW FREEZING GELATIN DYNAMITE, STRENGTHS 30% to 90%—Has all the advantages of ordinary gelatin dynamite, such as being waterproof, absence of objectionable fumes, etc.,



ATLAS GELATIN

and, in addition, does not freeze and become insensitive above 10° Fahr. Unequalled for blasting in mines and tunnels where the temperature is low and ventilation poor. Nothing weaker than a No. 6 blasting cap or electric blasting cap will properly explode it.

ATLAS Low Powder, STRENGTHS 5% to 20%—This is a low grade, granular high explosive which may be said to rank between blasting powder and dynamite. It is made in four grades: RRP, F, FF and FFF. RRP is the lowest grade and is usually put up in paraffined paper bags and packed in wood cases. Will run freely into bore holes and crevices. Other grades packed in cartridges like dynamite. Of great value in open work, such as quarries, railroad cuts, mine strippings, etc., when material to be blasted is comparatively soft and no great amount of water is present. Also used in blasting large stumps. Should be detonated with a primer of nitroglycerine dynamite of not less than 40% strength.



ATLAS RRP

Atlas Permissible Explosives.

A permissible explosive should be used in all gassy or dusty coal mines. When used according to Bureau of Mines' regulations they will not ignite coal dust or gas mixtures. Atlas permissible explosives are made in three kinds and twelve grades to meet the various conditions of coal mining and have all passed the tests demanded by the United States Government Bureau of Mines.

"MINERS FRIEND"—Made in 5 grades: No. 1, No. 2, No. 3, No. 5 and No. 6. It is practically fumeless and is very effective in quarries as well as coal mines, as it can be used without thawing. A No. 6 detonator should be used to fire this explosive.

"VIGORITE"—Particularly effective in wet mines. Is low freezing and does not give off objectionable fumes. Made in 3 grades: No. 1, No. 5 and No. 6. Use a No. 6 blasting cap or electric blasting cap with this explosive.

"COALITE"—Made in 4 grades: No. 1, No. 2D, No. 2MLF and "Coalite" Y. All "Coalites" are strong, slow acting permissibles used at their best in dry mines. They are not water resisting.



COALITE, NO. 1

Atlas Farm Powder.

Especially adapted to agricultural blasting. It is a low freezing dynamite of moderate strength, intended for stump blasting, subsoiling, tree planting and ditching. Practically never requires thawing in weather in which a farmer would ordinarily use it. Requires a No. 6 or stronger detonator.



ATLAS FARM POWDER

U.S. Standard Blasting Machines.

Generates electric current for firing electric blasting caps. Made in five sizes:

No. 2 for stump and boulder blasting, quarrying and mining where it is not necessary to fire more than 10 charges at any one time.

No. 3 will fire 30 electric blasting caps simultaneously. For quarrying, mining and blasting ditches.

No. 4 for use in quarrying and mining. Capacity, 50 copper wire electric blasting caps.

No. 5 for quarry and contracting work where a large number of charges are to be fired at once. Capacity, 100 copper wire electric blasting caps.

No. 6, extra powerful. Will fire 150 copper wire electric blasting caps.

Complete information about blasting machines sent on request.



BLASTING MACHINE

Little Giant Blasting Machine.

A light weight machine especially made for coal mining and other operations where it is not necessary to fire more than one or two charges at a time. It has a capacity of 5 copper wire electric blasting caps and weighs 4½ lbs. It is operated by a removable key or handle which when kept in the possession of the blaster prevents the operation of the machine by any other person. This is an important safety feature.



LITTLE GIANT BLASTING MACHINE

Atlas Electric Blasting Caps.

Detonators containing electric wires embedded in the explosive charge and connected by a platinum bridge of high resistance.

When an electric current is passed through one of these the charge is exploded.

They are made in two strengths, No. 6 and No. 8 and furnished with insulated copper wires of the following lengths: 4, 6, 8, 10, 12, 14, 16 ft. Longer lengths to order.

The No. 6 electric blasting cap contains 1 gram of explosive charge and the No. 8 contains 2 grams.

All Atlas electric blasting caps are packed in pasteboard cartons, enclosed in



BLASTING CAP

heavy wood cases. Cartons contain either 25 or 50 depending on the length of wires. Waterproof electric blasting caps for submarine blasting are furnished in all lengths.

ADVANTAGES OF ELECTRIC BLASTING—It is possible to fire two or more shots exactly together. The shots may be fired at the exact instant desired.

The blaster is in a safe place when he fires the shot. Hang-fires are practically eliminated.

There are no sparks or flame as from a lighted fuse or squib.

It is more reliable in wet work.

Atlas Blasting Powder.

Blasting powder is a slow acting, granular explosive, composed of charcoal, sulphur, sodium nitrate or potassium nitrate (saltpetre).

Two grades are manufactured: "B" blasting powder and "A" blasting powder. "B" blasting powder is usually used in coal mining and for blasting shale, earth and dimension stone. "B" blasting powder is manufactured in 7 granulations: FFFF, the finest, to CCC, the coarsest. The finer granulations are quicker in their



BLACK BLASTING POWDER

action and exert a greater breaking and shattering effect on the material blasted; while the slower granulations have a tendency to lift and heave it out in large lumps. A mixed granulation consisting of FF, FFF and FFFF is used in railroad construction work. Blasting powder does not freeze, but must be kept dry. It is useless when wet and when damp it loses its efficiency. Damp powder when exploded gives off much more smoke than dry powder. Blasting powder is packed and shipped in sheet steel kegs containing 25 lbs.

Atlas Blasting Gelatin.

This gelatin is the most powerful explosive of Atlas manufacture. Comparing it with other explosives it may be said to be 100% in strength.

Like gelatin dynamite, it is water resisting and may remain under water for hours without losing its effectiveness.

It is used in bottoms of "cut holes" in tunnels, and in the bottoms of quarry holes where the rock is exceptionally hard, and in submarine blasting.

Atlas blasting gelatin should be used sparingly at first. Use a minimum rather than a maximum charge. It is so much stronger than all other blasting explosives in common use that an overcharge may do considerable damage.

Blasting gelatin is packed in standard size cartridges and shipped in 50-lb. cases.



ATLAS BLASTING GELATIN

HERCULES POWDER CO.

OFFICES

CHICAGO, ILL.
DENVER, COLO.
HAZLETON, PA.

JOPLIN, MO.
KNOXVILLE, TENN.
CHATTANOOGA, TENN.
WILMINGTON, DEL.

NEW YORK, N. Y.
PITTSBURG, KANS.
PITTSBURGH, PA.

ST. LOUIS, MO.
SALT LAKE CITY, UTAH
SAN FRANCISCO, CAL.

Products.

EXPLOSIVES of all kinds and BLASTING SUPPLIES which include: Blasting Machines, Galvanometers, Rheostats, Blasting Caps, Squibs, Victor Delay Electric Igniters, Leading Wire, Connecting Wire, Fuse, Cap Crimpers, Storage Magazines, Thawing Kettles, Blasting Paper, Tamping Bags, etc.

Explosives and Blasting Powders.

NITROGLYCERIN DYNAMITE—Hercules nitroglycerin dynamite is manufactured on both the regular and low freezing formulas in strengths from 15% to 60%.

This dynamite is suitable for work requiring strength and quickness, and gives the best results where a shattering effect is desired. Packed in standard cartridges, 50 lbs. to the case.



NITROGLYCERIN
DYNAMITE

EXTRA (AMMONIA) DYNAMITE—Hercules extra dynamite is made on both the regular and low freezing formulas in strengths from 15% to 60%. The extra grades may be considered as the explosive best adapted for general all around work.

Extra dynamite has the same strength, grade for grade, as nitroglycerin dynamite. It is, however, less expensive, and gives a more heaving than shattering action. It is recommended for mining, quarrying, digging wells, road and railroad construction, clay blasting, mudcapping, and most agricultural work. Packed in standard cartridges, 50 lbs. to the case.

HERCULES GELATIN DYNAMITE—Hercules gelatin dynamite is distinguished by plasticity, high density, imperviousness to water, and freedom from noxious fumes. It is made on the regular formula in strengths from 35% to 75% and the low freezing formula in strengths from 30% to 75%. Hercules gelatin is good for wet work. Its plasticity enables it to be loaded easily and effectively in holes having an upward slant, and the density and plasticity make it extremely well adapted for tight blasting in hard rock. It is packed in standard cartridges, 50 lbs. to the case.



HERCULES GELATIN
DYNAMITE

BLASTING GELATIN—Hercules blasting gelatin is the strongest, quickest, most waterproof and fumeless explosive manufactured for commercial purposes, having a strength of 100%. It is especially adapted for

HERCULES



POWDER
TRADE-
MARK

use in cut holes, hard rock tunnel rounds and submarine blasts in hard rock. Packed in standard cartridges, 50 lbs. to the case.

RED H—Red H Permissible explosives belong to the ammonia nitrate class. The weight for weight strength of Red H powders approximates very closely that of 60% dynamite. On account of their bulkiness, they average about one-third more cartridges of a given size to the case than is found in a similar case of regular dynamite having the same sized cartridges; but each cartridge is equal to a cartridge of 35% dynamite. This makes Red H a very good substitute for the low grades of ammonia and nitroglycerin dynamite.

Red H Nos. 1 and 6 are the quickest in their action; Nos. 2 and 4 are of the intermediate quickness. Nos. 3 and 5 are the slowest and usually best adapted for blasting coal down in good lump form. Nos. 1, 2, 3, and 7 are high freezing; Nos. 4, 5 and 6 are low freezing. Nos. 1 and 2 can be used in a frozen condition, providing the cartridge receiving the blasting cap is loosened up by rolling before it is inserted. Red H is packed in standard cartridges, 50 lbs. to the case.



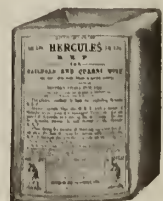
RED H

XPDITE—Xpdite belongs to the nitroglycerin class of permissibles. While the fumes given off are not always as good as those from Red H, this dynamite will stand water better and is recommended for wet work. Nos. 1 and 2 are the strongest, quickest and best adapted for blasting coal that is desired in a well-broken condition. Nos. 3 and 6 are weakest and the latter is low freezing and gives the best results in blasting thin coal that has been undercut. Packed in standard cartridges, 50 lbs. to the case.



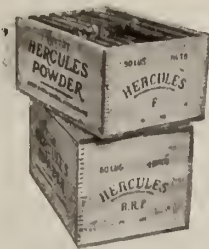
XPDITE

R. R. P.—Hercules R. R. P. belongs to the class known as granular dynamite, often called Judson. R. R. P. is best adapted for use in soft, seamy material, tunnel blasts in hard rock, and heavy blasts where it is necessary to fire them in fairly hard material. Packed in paraffined paper bags containing 12½ lbs. The standard case holds 4 of these bags, making a net weight of 50 lbs.



R. R. P.

"F" POWDERS—The Hercules "F" powders are similar to R. R. P., but contain a small amount of nitroglycerin, which is as follows: F, 10%; FF, 15%; FFF, 20%. (Do not confuse these powders with blasting powder having the "F" granulation markings.) "F" powders are packed in cartridges like ordinary dynamite, 50 lbs. to a case.



"F" POWDERS

BLASTING POWDERS—The Hercules Powder Co. manufactures two high grade blasting powders: "A" blasting (or saltpetre powder), and "B" blasting (or soda powder).

"A" blasting powder is for use in dimension stone, slate and granite quarries.

"B" blasting powder is for use in non-gaseous coal mines, coal stripping, quarry, and construction work. It is manufactured in all sizes of grains, glazed and unglazed. From FFFF, about $\frac{1}{16}$ in. diameter, to CCC, about $\frac{1}{2}$ in. diameter. A special granulation called R. R. is made for large blasts. Packed in kegs containing 25 lbs. net.



BLASTING POWDERS

Hercules Blasting Machines.

An apparatus for generating electric current used in firing electric blasting caps, squibs and igniters; made in 6 sizes with capacity for detonating from 3 to 150 shots in series, as follows:

Size	Capacity, Electric Blasting Caps Copper Wires
Model	3
No. 2	10
No. 3	30
No. 4	50
No. 5	100
No. 6	150



HERCULES BLASTING MACHINES

Electric Blasting Caps.

These are used to detonate charges of high explosives by means of electricity. They are made in two strengths, No. 6 and No. 8. These are connected with insulated copper wires from 4 to 30 ft., or with iron wires from 2 to 8 ft. Packed 25 or 50 to the carton, 10 cartons to the case.



ELECTRIC BLASTING CAP

Electric Squibs.

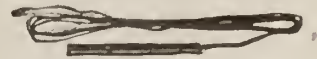
Hercules electric squibs are similar in appearance to electric blasting caps, except that a paper shell is used instead of copper, and are used to fire charges of blasting powders. The advantages of electric squibs are that more than one shot may be fired at one time, resulting in a saving of both powder and time. Electric squibs are made with 4- to 8-ft. iron wires and 4- to 30-ft. copper wires. Packed 25 and 50 to the carton, 10 cartons to the case.



ELECTRIC SQUIBS

Victor Delay Electric Blasting Caps.

These are made in two delays. Three different periods can be obtained by using regular electric blasting caps in the same circuit. Delay electric blasting caps are made with copper wires 4 to 30 ft. Packed 25 and 50 to the carton, 10 cartons to the case.



VICTOR DELAY ELECTRIC BLASTING CAP

Leading Wire.

Hercules leading wire is an insulated copper wire (No. 14 B. & S. gage) used for connecting electric blasting cap circuits to the blasting machine. It is furnished in coils from 200 to 500 ft.



LEADING WIRE

Connecting Wire.

Hercules connecting wire is used to join the wires of electric blasting caps. It is a high grade insulated copper wire (No. 20 or No. 21 B. & S. gage), and is put up in 1- and 2-lb. spools.

Blasting Caps.

Blasting caps are used to detonate charges of high explosives. As the efficiency of any high explosive depends on the initial shot, this company does not recommend caps smaller than Hercules No. 6. Standard sizes Nos. 6 and 8. Packed 100 in a box, 5 to 100 boxes in a case.



BLASTING CAPS

Miner's Squibs.

Squibs are used for firing charges of blasting powder. "Artificial Straw" and "Rocket" squibs burn with a flame. "Chinese" or "Gas" squibs burn with an ember no flame. Packed 100 to the box, 100 boxes in a case.



MINER'S SQUIBS

Safety Fuse.

The HERCULES POWDER CO. carries all standard brands of fuse. All brands have definite burning speeds, and are packed in coils of 100 ft. Cases contain from 5 to 60 coils.



SAFETY FUSE

Storage Magazines.

The HERCULES POWDER CO. carries a complete line of sidewalk and steel storage magazines.



STORAGE MAGAZINES

E. I. DU PONT DE NEMOURS & CO., INC.

Explosives and Blasting Accessories

GENERAL OFFICES
WILMINGTON, DEL.

BRANCH OFFICES

BIRMINGHAM, ALA.
BOSTON, MASS.
BUFFALO, N. Y.
CHICAGO, ILL.
COLUMBUS, OHIO

DENVER, COLO.
DULUTH, MINN.
HUNTINGTON, W. VA.
JOPLIN, MO.
JUNEAU, ALASKA

KANSAS CITY, MO.
NEW YORK, N. Y.
PITTSBURGH, PA.
PORTLAND, ORE.
SAN FRANCISCO, CAL.

SCRANTON, PA.
ST. LOUIS, MO.
SEATTLE, WASH.
SPOKANE, WASH.
SPRINGFIELD, ILL.

Products.

EXPLOSIVES and BLASTING ACCESSORIES, which include:

Red Cross Extra, Gelatin and Straight Dynamites.

Du Pont Extra, Gelatin and Straight Dynamites; Du Pont Blasting Gelatin; Repauno Gelatin; Low Explosives; Blasting Powders.

BLASTING ACCESSORIES for detonation or deflagration of explosives: Electric Blasting Caps, Blasting Caps, Galvanometers, Rheostats, Thawing Kettles, Blasting Machines, Fuse, Cap Crimpers, Connecting Wire, Leading Wire, Tamping Bags.

For Paints and Varnishes, see pages 204-205.

Quality.

Since 1802, the Du Pont Company has been engaged in the making of explosives. In this century of activity, the company has introduced many new explosives and improved its methods of manufacture. Today its products are recognized as the standard by which other explosives are rated.

The extensive manufacturing, storage and shipping facilities of the Du Pont Company insure ample production and prompt shipments.

The specifying of Du Pont explosives insures highest efficiency and the accomplishment of maximum results with a minimum expenditure for material, time and labor.

Red Cross Straight Dynamite.

This is a quick acting, powerful, water resisting, low freezing explosive especially recommended for open work in hard, tough material where a shattering action is desired, such as breaking boulders and general construction work.



RED CROSS STRAIGHT DYNAMITE

Red Cross Extra Dynamite.

The "extra" dynamites are not so quick nor shattering as "straight" dynamite, but have a more heaving and lifting effect.

Red Cross Extra is suited to soft rock; also hard rock where shattering is unnecessary; and excavating clay, earth and shale. It is a low freezing, all-year-round explosive. The cartridge wrappers should not be slit nor should the charge remain in water very long.



RED CROSS EXTRA DYNAMITE



Du Pont Gelatin.

This brand is a dense, plastic, highly water resisting, low freezing explosive. It is especially recommended for very wet work, under water, and in close work where ventilation is deficient. Du Pont Gelatin gives best results when thoroughly confined, but is not suitable for mudcapping.

Blasting Accessories.

As the largest manufacturers of explosives and with an extensive experience the Du Pont Company is competent to devise and introduce detonation apparatus especially suited to explosives. Insist upon the use of these Du Pont dependable detonating supplies to insure complete detonation.

Blasting Machines.

Several sizes of blasting machines are made having capacities of 1 to 150 No. 6 electric blasting caps fitted with copper wires. The most popular sizes are the pocket size and Nos. 2 and 3.

The pocket size fires from 1 to 3 electric blasting caps. It has a removable handle to prevent firing the charges by anybody other than the shot-firer.

Blasting machines Nos. 2 and 3 fire 10 to 30 copper wire electric blasting caps, and weigh 15 and 25 lbs., respectively. They are thoroughly made and can be relied upon to generate current to fire the number of charges specified. The machines are compact in form, easy to operate and portable.



DU PONT BLASTING MACHINE

Du Pont Electric Blasting Caps.

Nos. 6 and 8 electric blasting caps are made according to specifications determined by long connection with the manufacture and use of explosives. The selection of materials, manufacturing, assembling and inspecting of parts receives the most careful attention to insure a blasting cap capable of causing complete detonation.

Special Information Available for Users of Explosives.

A century of experience as explosives makers has enabled this company to acquire a practical knowledge of explosives.

This company has a series of books and folders containing valuable data concerning the selection of explosives and the best methods to adopt to insure the most satisfactory results. State what is required of explosives and necessary information will be forwarded.

ESTABLISHED 1882

KEYSTONE DRILLER CO.

Manufacturers of Traction Excavators

BEAVER FALLS, PA.

For Branch Offices, see Page 31

Products.

TRACTION EXCAVATORS.

For Drills and Pumps,
see page 31.**SPECIFICATIONS**

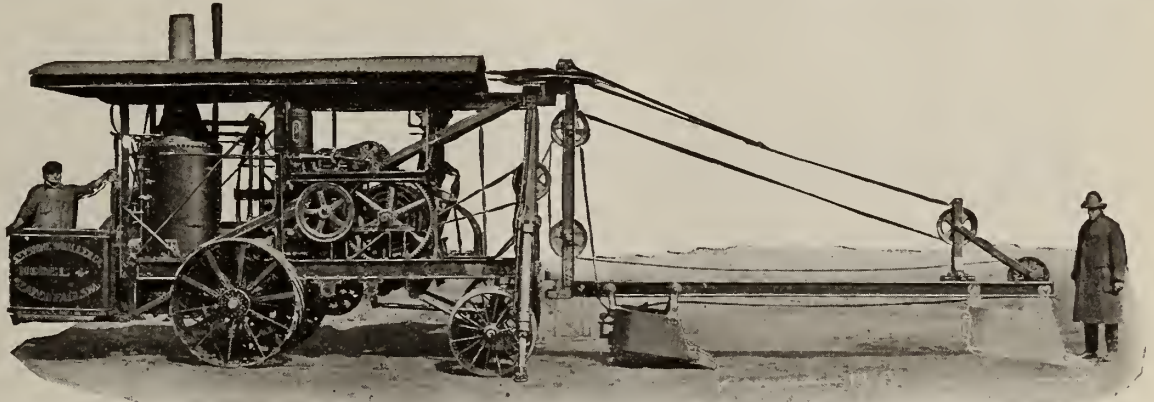
Model (size).....	3	4	6
Weight, tons.....	10	12	15
Construction.....	wood, steel	all steel	all steel
Type, engine.....	single-cylinder	two-cylinder	two-cylinder
H.p. of engine.....	18	32	32
Size of boiler, in.....	36 x 69	36 x 69	40 x 72
Length of boom, ft.....	16	18	18
Horizontal crowd, ft.....	11	14	14
Size, skimmer, yd.....	1/2	1/2	3/4
Size, dipper, yd.....	1/2	1/2	3/4
Size, clamshell, yd.....	1/2	1/2	3/4
Width, ditcher, in.....	12 to 36	12 to 36	16 to 36
Depth ditching, ft.....	16	16	18

Keystone Excavators.

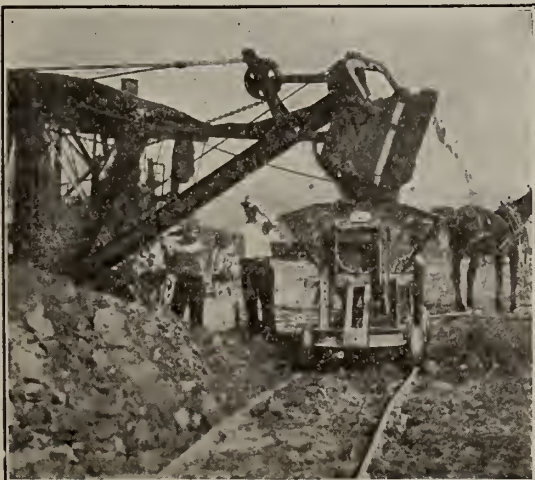
The Keystone excavator is a light, traction steam shovel for contractors' general use. Three sizes: model 3, 10 tons; model 4, 12 tons; model 6, 15 tons. All have long wheel base, about 10 ft. Two traction speeds, 1½ and 3 miles per hour. Equipped with 4 readily interchangeable buckets—skimmer, dipper, drag-ditcher and clamshell, it can be used on a wide variety of work—road grading, stripping, ditching, backfilling, cellar digging and unloading cars. Has long horizontal crowd—11 ft. and 14 ft. (see table) and powerful thrust. Will lift old macadam, etc., without rooting. Used most for road work and ditching, with skimmer and drag-ditcher. Model 3 has wood sills, 18-h.p. single-cylinder engine, 16-ft. boom, 11-ft. horizontal crowd. Models 3 and 6 are all-steel, have double engines and 18-ft. booms. Model 4 has hydraulic side jacks. Boom swings through half circle. Clamshell attachment gives boom length of 26 ft.; 18-ft. radius; bucket clears 13 ft. above ground. With drag-ditcher attachment bucket reach is 26 ft.



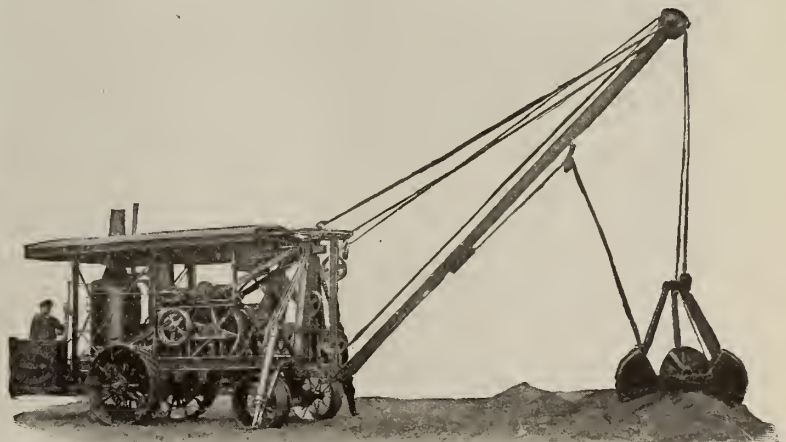
DRAG-DITCHER SCOOP, USED IN DITCHING, BACKFILLING AND CELLAR DIGGING, (MODEL 3)



SKIMMER SCOOP, FOR ROAD GRADING AND GENERAL EXCAVATION (MODEL 4)



DIPPER SCOOP, FOR SIDE HILL DIGGING (MODEL 3)



CLAMSHELL, FOR UNLOADING CARS, DEEP DITCHING, ETC. (MODEL 4)

S. FLORY MFG. CO.

Cableways and Mine and Contractors' Hoisting Engines

BANGOR, PA.

NEW YORK, 95 Liberty Street

PITTSBURGH, First National Bank Building

CHICAGO, Monadnock Block

SALES AGENTS IN PRINCIPAL CITIES OF THE UNITED STATES

Products.

SUSPENSION CABLEWAYS and all Accessories; Improved CONTRACTORS', MINE and other kinds of HOISTING ENGINES: Steam, Electric, Gasoline and Belt.

Also, Slate and Stone Working Machinery: Rubbing Beds, Planers, Saws, Groovers, etc.

Marine Machinery: Marine Railway Engines, Steering Engines, Capstans, Pile Driving Engines, Lighterage, Dredge and Swinging Engines, Dock and Derrick Hoists, Winches, etc.

Flory Suspension Cableways.

Flory cableways are adapted for operating quarries, stripping coal veins, dredging rivers, building concrete walls, locks, dams and bridges, making trenches, sewers and sewage disposal plants, and for general transportation of materials in almost every class of work.

Several hundred cableways, built by this company—both inclined and horizontal types—are in successful

use today, with spans varying from a few hundred feet to 2000 ft. in length and in capacities ranging up to the individual 15-ton load.

Cableways have proved practical and economical up to 2000 ft. in length and 15-ton capacity. The S. FLORY MFG. Co. has been engaged in building and installing these cableways during the past 40 years, and claims to furnish a simple and least expensive outfit, with efficient and satisfactory service.

CO-OPERATIVE SERVICE—Flory cableways are constructed to meet all requirements, and the engineering department is at the disposal of prospective purchasers when such outfits are under consideration.

The Flory cableway catalogue will be sent on request.

REFERENCES—Lists of satisfied users of permanent cableway installations at home and abroad, for quarrying purposes, also temporary cableways for building bridges, dams, sewage plants, etc., sent on application.



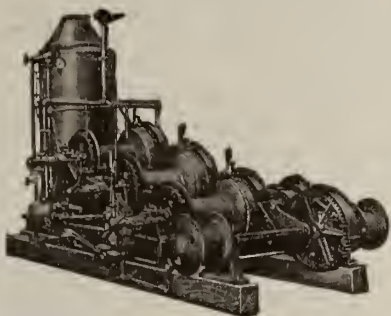
FLORY CABLEWAYS INSTALLED BY THE ASBESTOS CORPORATION OF CANADA

View looking over quarry pit toward head towers

Four 800-ton capacity cableways replaced eight of local manufacture and saved two-thirds of the cost of handling one ton of rock

Flory Steam, Electric and Gasoline Hoists.

These apparatus are built to meet every requirement, and are especially adapted for contractors' work, mines and general hoisting purposes. Hoists are made to gage, permitting correct interchangeability of parts. All castings are of selected material and made in the company's plant, metal being properly distributed to protect those parts where greatest strains occur.



DOUBLE CYLINDER, THREE-FRICTION DRUM ENGINE FOR BOOM SWINGING, ETC.

TYPES—Flory hoisting engines are constructed in many types, to cover existing conditions throughout the industrial field, wherever hoisting duties are required to be performed. A few styles may be mentioned.

Stationary; portable; single cylinder, with single or double friction drum; double cylinder—single, double, treble or four-tandem friction drums, single or compound geared, 6-spool erecting, link motion, reversible, non-reversible, swinging, dredging, quarrying or other special type. Flory hoists are built to meet each particular case.

Write for full particulars.

USES—For contracting, mining, pile driving, bridge building, logging, dredging, and any other exceptionally heavy duty, etc.

WERNER BAND FRICTION (PATENTED)—Used exclusively on Flory hoists. It never slips; the friction

without end thrust; distributes strains equally throughout; no counter friction; perfect balance; operated by hand, steam or air.

This band friction transmits its load directly from gear to friction ring on drum, thus eliminating all torsional stress in drum shaft; and it remains "locked" when friction is in or out of contact, causing no strains in bearings or operating mechanism. It consists of a series of levers, double-toggle connected, which actuate rocker shafts (extending through gear and susceptible of motion) to which the bands are coupled. These bands are kept in adjustment by means of turnbuckles.



WERNER PATENTED BAND FRICTION

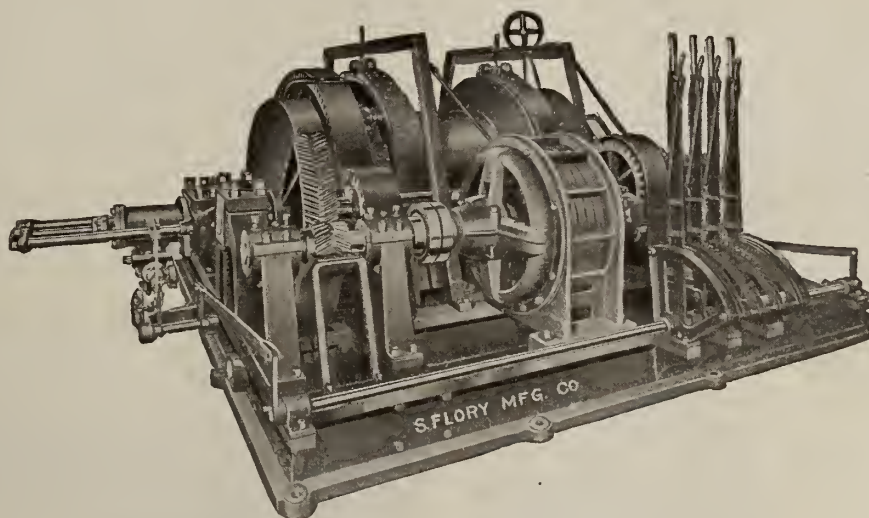
The method of operation may be either hand or mechanical. If operated by hand a lever is provided in the battery. If mechanical an air or steam

cylinder is mounted on the end of the bearing.

Full particulars sent on application.

CATALOGUE—The hoisting engine catalogue illustrates many types of hoists, giving sizes, capacities, specifications and other useful information desired by the general contractor or engineer.

REFERENCES—Interested persons can be referred to many customers who have during many years used Flory hoists with economy and success.



FLORY SINGLE DRUM, COMPOUND, TWO-SPEED ELECTRIC HOIST

Especially adapted for slopes in mines with variable grades. Equipped with two Werner patent band frictions operated by air and two "Vitabestos" brakes and indicator

SAUERMAN BROS.

Cableway Excavators, Power Scrapers and Fittings

Monadnock Block
CHICAGO, ILL.

Products.

Manufacturers of CABLEWAY EXCAVATORS, POWER SCRAPERS.

Cableway Fittings.

Dragline Cableway Excavators.

USES—The following is a partial list of the classes of work for which Sauerman dragline cableway excavators have been installed:

Excavating sand and gravel from under water and from dry pits.

Loading ballast direct from pits to cars.

Backfilling retaining walls.

Reclaiming ore and coal from stock piles.

Deepening river beds. Building levees and dams. Handling road material. Stripping clay beds and removing overburden.

Removing sand bars, islands and earth dams from rivers. Reservoir construction and cleaning.

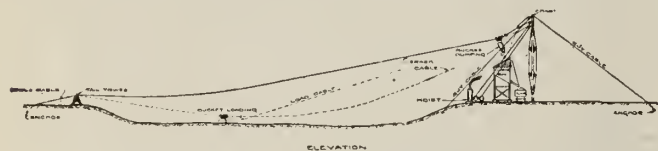


FIG. 2. FORWARD DUMP DRAGLINE CABLEWAY EXCAVATOR

DESCRIPTION—The construction and operation of the dragline cableway excavator is as follows:

A bucket and carrier mounted on a slack track cable. This track cable is supported at the power end by a mast or tower, and at outboard end is anchored to the ground or suitable support, so as to form a proper incline for gravity return of the bucket. The track cable is not directly attached to the mast, but to a set of fall blocks at top of the mast, controlled by a lighter cable known as the tension line. The tension line is controlled by rear drum of double drum friction hoist. By letting out or taking in this line, the track cable is lowered or raised. The loading, conveying and dumping of the bucket is accomplished by load line attached to front of bucket and leading through sheave block at top of mast to front drum of hoist.



FIG. 3. DIGGING HARD MATERIAL



FIG. 1. DRAGLINE CABLEWAY AND GRAVEL WASHING PLANT

The operation is simple; the bucket runs back to digging point by gravity, is lowered into pit by letting out tension line, loaded, elevated, conveyed and dumped by taking in load and tension lines alternately. When digging at the mast end and dumping at foot of incline, operation as described above is reversed.



FIG. 4. DELIVERING GRAVEL TO STORAGE PILE

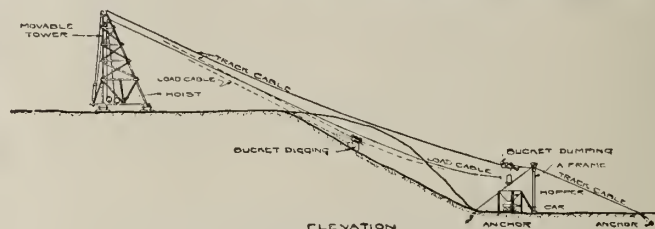


FIG. 5. DRAGLINE CABLEWAY EXCAVATOR DIGGING CLAY AND DUMPING INTO CARS AT LOW END

SIZES—Buckets are built in 6 standard sizes, in capacities of $\frac{1}{3}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$ and 2 cu. yds. Length of spans varies from 200 to 700 ft., the most common length span being from 500 to 600 ft.

Advantages of Sauerman Dragline Cableway Excavators.

Sauerman dragline cableway excavators will dig, elevate, convey the material over a span from 200 to 700 ft. and will dump the material at any point. The four operations, digging, elevating, conveying and dumping, are all performed in a continuous operation without the use of any intermediate machinery, and all operations are under the control of one man. The bucket takes a vertical position in dumping and the discharge is from the front end, which insures a clean and perfect discharge. These excavators will dig equally as well under water as they will in a dry pit.



FIG. 6. EXCAVATING GRAVEL FOR COUNTRY ROADS

SAND AND GRAVEL HANDLING—The cableway is generally installed so as to excavate and deliver all material within its radius direct to screens or bins. After this material has been exhausted the cableway is then



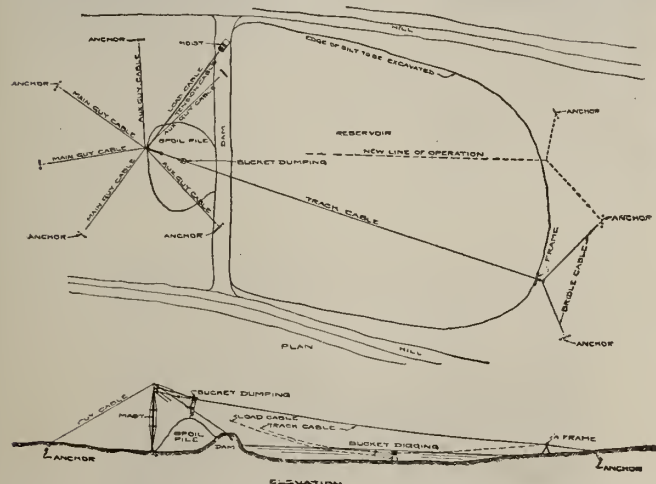
reset at a distance of 500 to 600 ft. from the plant, and a belt or other type of equipment is used to carry the material from the cableway to the screens (Figs. 1, 2 and 4).

The height above the levee and the point at which the material will be dumped from the bucket is under the positive control of the operator. The entire cableway can be moved quickly and easily as the progress of the work requires.



DAM AND RESERVOIR CONSTRUCTION—In dam or reservoir construction a stationary mast or movable tower can be used, depending on local conditions. The mast or tower is located behind the proposed dam. The dam is built up by depositing the material excavated from the proposed basin.

RESERVOIR CLEANING—The same method used in construction of dams and reservoirs is applied to the cleaning of reservoirs, sludge basins and slime basins. Deposit of material in these basins is such that cleaning by ordinary methods is prohibited by expense.



RECLAIMING FROM STORAGE PILES—This cableway is especially efficient in reclaiming old tailings piles, coal storage piles, etc.

USES—For making cuts and fills, rehandling material from storage piles, stripping overburden, and general excavation work.

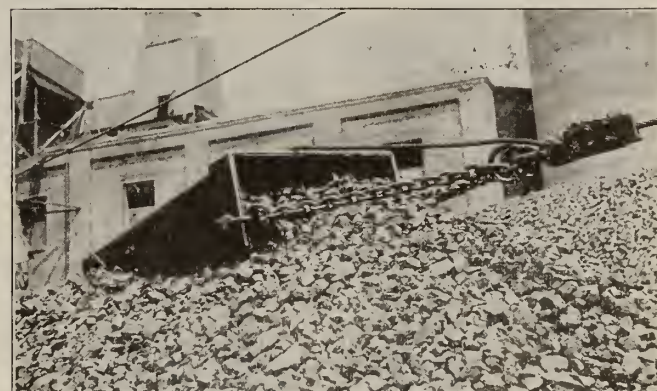
A cutter edge mounted on runner frame is pivotally and adjustably connected with these hinge plates. This cutter edge, being adjustable and pivoted, is readily adjusted for digging different kinds of soil or other material. When scraper is pulled forward, the runner frame and cutter edge are tilted to digging position automatically.

For light excavation work or rehandling material, the Type "C" scraper is usually employed.



OPERATION—Operated by double drum friction hoist. Front drum operates load cable; rear drum operates “pull back” cable. The load cable generally leads from front drum through a guide block to bridle chains on front of scraper. The “pull back” cable leads from rear drum through guide block to elevated guide block at the far end of the excavation directly back of scraper, and thence to bridle chains on runner frame of scraper.

To operate, scraper is simply pulled back and forth over material to be excavated. To change line of operation, tower can readily be moved on rollers and tail end shifted by moving guide block.



SIZES—The Sauerman power scraper is built in 6 standard sizes, namely, in capacities of $\frac{1}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$ and 2 cu. yds. Other sizes can be built to order as specified. The amount of material handled per hour will depend upon length of haul, speed of engine, capacity of scraper and kind of material. Cost of operation is necessarily low, as the actual operation requires generally only an engineer; or where steam is employed, an engineer and fireman.

PAWLING & HARNISCHFEGER CO.

Manufacturers of Excavators, Backfillers and Tampers
MILWAUKEE, WIS.

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CHICAGO, ILL., R. A. S. JOHNSON, Monadnock Block
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NEW ORLEANS, LA., T. W. WADDELL, Whitney Central Building
NEW YORK, N. Y., WALTER PRICE, 50 Church Street
PORTLAND, ORE., R. K. MORSE, Pittock Block

SALES REPRESENTATIVES

OMAHA, NEBR., O. B. AVERY, 914 Farnam Street
LOS ANGELES, CAL., ED. R. BACON Co., 350 Merrick Street
NEW YORK, N. Y., WM. J. CULLEN, 30 Church Street
VANCOUVER, B. C., BROWN, FRASER & Co., Ltd., 1150 Homer Street
SALT LAKE CITY, UTAH, LANDES & Co., Inc., corner 2nd West & South Temple
KANSAS CITY, MO., VICTOR L. PHILLIPS, 7th and Delaware Streets
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BUTTE, MONT., CONTRACTOR'S EQUIPMENT Co., Phoenix Building
WALLACEBURG, ONT., H. A. DICKSON, Box 56
CHATTANOOGA, TENN., ROBERT R. NIXON, Hamilton National Bank Building
HOUSTON, TEX., H. A. PAINE, 1302-12 Nance Street
ROCHESTER, N. Y., H. D. HUTCHESON Co., Sibley Block
MINNEAPOLIS, MINN., STANDARD SCALE & SUPPLY Co., Builders Exchange

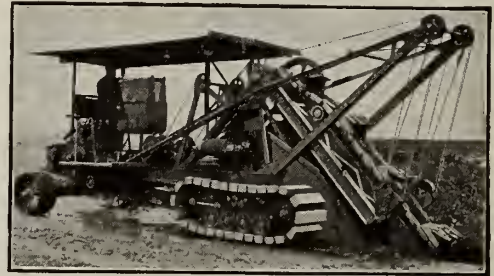
Products.

EXCAVATORS; BACKFILLERS; TAMPERS.
Grab Buckets, Drilling and Boring Machines.
For Travelling Cranes and Hoists, see pages 874-75.

Service.

P & H service is as vital and valuable to the man who uses P & H machinery as is the superior construction and design that are a part of every machine made by PAWLING & HARNISCHFEGER CO.

Wearing parts are easy to get at, and a complete stock of repair parts for every P & H machine is always on hand, ready to be shipped; these are important factors to be considered in the purchase of a machine.



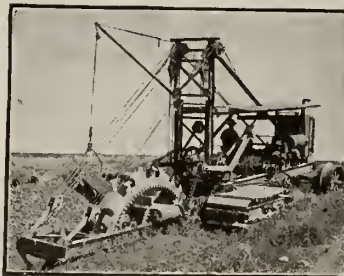
LADDER TYPE EXCAVATOR
(Bulletin 24X—S)

No. 151—21 to 31 ins. wide, 8 and 10 ft. deep. No. 152—27 to 39 ins. wide, 10 and 12 ft. deep. No. 153—27 to 42 ins. wide, 12 and 15 ft. deep. No. 154—27 to 76 ins. wide, 20 and 25 ft. deep.
4-cylinder gas-kerosene motor. Corduroy traction only



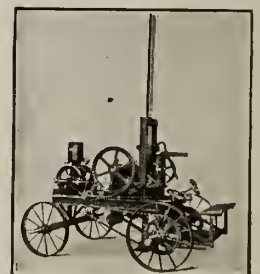
DRAGLINE EXCAVATOR
(Bulletin on request)

No. 205—30-ft. boom, $\frac{1}{2}$ -cu. yd. capacity.
No. 210—40-ft. boom, 1-cu. yd. capacity; 50-ft. boom $\frac{3}{4}$ -cu. yd. capacity. No. 220—50-ft. boom, $1\frac{1}{2}$ -cu. yd. capacity. No. 230—60-ft. boom, 2-cu. yd. capacity.
Steam, gasoline, and electric power. Wheel and corduroy traction. Also adapted for backfilling and may be used with clamshell. An excellent general purpose outfit



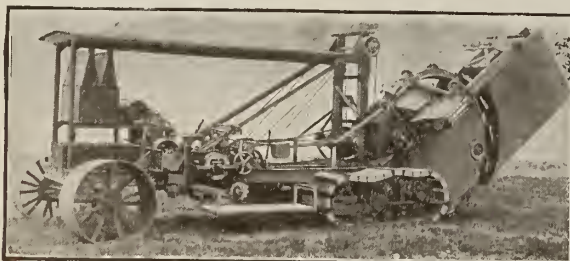
PIPE LINE EXCAVATOR
(Bulletin 1X—S)

Built for various trench dimensions.
No. 120—15 ins. wide by $4\frac{1}{2}$ ft. deep.
No. 121—20 to 24 ins. by $4\frac{1}{2}$ ft. deep.
No. 122—15 to 21 ins. by $5\frac{1}{2}$ ft. deep.
No. 123—20 to 24 ins. by $6\frac{1}{2}$ ft. deep.
No. 124—20, 24 and 28 ins. by $7\frac{1}{2}$ ft. deep.
4-cylinder gas-kerosene motor. Wheel and corduroy traction. Adapted to pipe line and conduit construction



POWER TRACTION
TAMPER
(Bulletin 8C—S)

Wheel base 5 ft. $11\frac{1}{4}$ ins.
3-h. p., 4-cycle gasoline engine.
40 to 45 150-lb. blows per minute
For conduit, gas and water pipe lines; sewer trenches



FARM DRAINAGE EXCAVATOR
(Bulletin 3X—S)

No. 101— $12\frac{1}{2}$ to 15 ins. wide, $4\frac{1}{2}$ ft. deep. No. 102—15 to 21 ins. wide, $5\frac{1}{2}$ ft. deep. No. 103—15 to 21 ins. wide, $6\frac{1}{2}$ ft. deep. No. 105—20 to 24 ins. wide, $7\frac{1}{2}$ ft. deep.
4-cylinder gas-kerosene motors. Corduroy traction only



POWER TRACTION BACKFILLER
(Bulletin 9X—S)

No. 201—Single drum. 6 h.p. Wheel traction. Without boom. Fresno scraper.
No. 202—Double drum. 10 h.p. Wheel and corduroy traction. 25-ft. swinging boom. Self-acting scraper

BUFFALO HOIST & DERRICK CO.

Manufacturers of Locomotive Cranes and Hoists

129 Erie Street
BUFFALO, N. Y.

NEW YORK OFFICE, 30 Church Street

Products.

LOCOMOTIVE CRANES, STEAM and ELECTRIC HOISTS.
Gasoline Hoists, Derricks, Tractocranes, Horse and
Hand Power Hoisting Machinery, Boom Swingers,
Sheave Blocks, Bull Wheels, Sheaves, Derrick Fittings.
For Clamshell Buckets, see page 72.

Locomotive Cranes.

10-ton, 4-wheel U. S. gauge or 15-in. face tracto-
crane wheels.

Designed for either hoisting operations (using block
and hook or magnet), or for operating a 2-line clam-
shell bucket of the grab bucket type. It will handle a
 $\frac{3}{4}$ -cu. yd. bucket of this type, at a radii of 39 ft. 6 in.
measured from the center of the track. This crane can
also be used for shifting cars as it has ample power to
push or pull a string of 3 or 4 heavily loaded freight cars.

All operations of hoisting, swinging, traveling, rais-
ing and lowering the boom or operating the grab bucket
are performed by power.

The crane has bronze bushed bearings throughout.
All gears and frames are steel casting.

Further information on request.



10-TON 4-WHEEL STANDARD BUFFALO LOCOMOTIVE CRANE
AND 1-CU. YD. BUFFALO STANDARD CLAMSHELL BUCKET
IN USE BY A LARGE BUFFALO STEEL COMPANY

Steam Hoists.

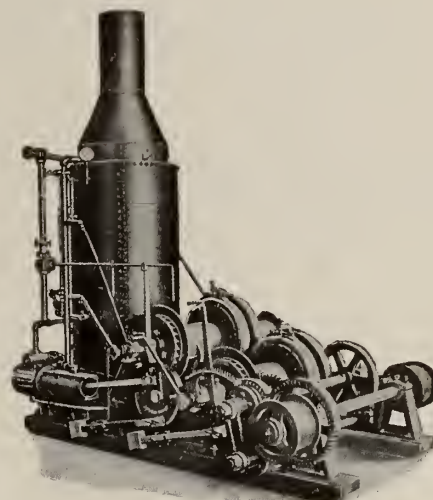
Improved type of engine for use in connection with
general hoisting designed with single, double or triple
drum, with or without boom swinger. Engines are the
modern short stroke type with large steam and exhaust
ports.

Lever is located so operator can handle both
drums without changing his position; foot brakes are
directly under operator.

Cylinders and guides are cast in one piece, being
rigid and strong. Cylinder and crosshead guide bored at
one setting, thereby insuring perfect alignment.

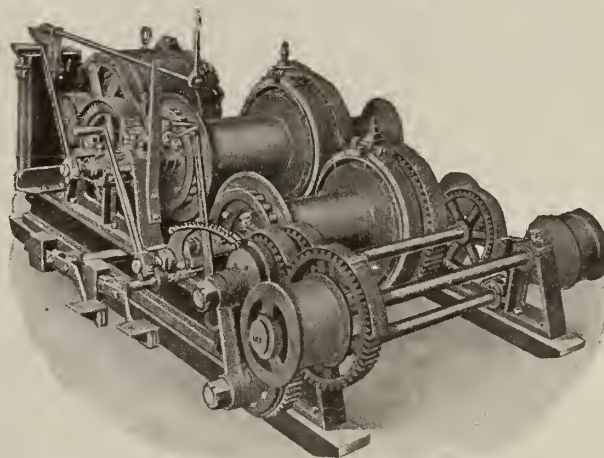
Electric Hoists.

The illustration represents the double drum elec-
tric hoist with the Buffalo latest and most improved
swinger. Hoist is especially designed with single, double
or triple drum and with or without swinger attached.



DOUBLE DRUM STEAM HOIST WITH SWINGER

Code word	Order No.	Nominal h.p.	Size of cylinders, bore and stroke, in.	Load hoisted, single rope, average speed	Drums		Boilers			Approx. shipping weight, lbs.
					Diam., in.	Length, in.	Diam., in.	Height, in.	No. of 2-in. tubes	
Emarate	20 $\frac{1}{2}$	10	5 $\frac{1}{2}$ x 8	3,000	12	23	36	78	68	9,000
Embalm	21 $\frac{1}{2}$	18	6 $\frac{1}{2}$ x 10 $\frac{1}{2}$	5,000	12	26	36	84	68	11,800
Emblem	22 $\frac{1}{2}$	25	7 $\frac{1}{2}$ x 10 $\frac{1}{2}$	6,000	12	26	42	87	92	12,800
Emerald	22 $\frac{3}{4}$	30	8 $\frac{1}{4}$ x 10	8,000	14	27	42	99	92	14,300
Emerge	23 $\frac{1}{2}$	35	9 x 10	9,000	16	32	48	102	128	25,000
Boom swinger drums					9 $\frac{1}{2}$	13				



DOUBLE FRICTION DRUM ELECTRIC HOIST AND BOOM SWINGER

Code word	Order No.	Motor h.p.	Drums		Hoisting capacity		Approx. shipping weight, lbs.
			Diam., in.	Length, in.	Weight hoisted single rope, lbs.	Speed in ft. per min.	
Frought	95	10	12	22	2,000	150	8,000
Frown	96	15	12	22	2,500	150	8,200
Froy	97	20	12	26	3,000	150	8,500
Fulcrum	98	25	12	26	4,000	150	9,800
Fulgert	99	30	14	26	5,000	175	10,500
Fuller	101	40	16	25	6,000	175	12,000
Fumble	102	50	16	25	8,000	175	13,500
Boom swinger drums			13	9 $\frac{1}{2}$			

THE BROWN HOISTING MACHINERY CO.

Manufacturers of Locomotive Cranes

CLEVELAND, OHIO

BRANCH OFFICES

NEW YORK, N. Y., 50 Church Street

CHICAGO, ILL., 208 South La Salle Street

EUROPEAN REPRESENTATIVE, H. E. HAYES, 12 Rue de Phalsbourg, PARIS, FRANCE

PITTSBURGH, PA., Oliver Building

SAN FRANCISCO, CAL., Monadnock Building

Products.

BROWNHOIST LOCOMOTIVE CRANES.

Bridge Tramways; Fast Plants; Cantilever Cranes, Overhead Traveling Cranes, Work Car Cranes, Jib Cranes, Pillar Cranes, Bridge Cranes; Electric Hoists; Tramrail Systems; Trolleys; Crabs; Winches; Tubs; Furnace Hoists; Pig Iron Breakers, and Coal and Ore Dumping Machines; Transfer Cars; Floating, Gantry and Portal Cranes; Dragline Excavators; Monorail Hoists; Grab Bucket Trolleys; Car Loaders and Unloaders.

For Grab Buckets, see pages 64-65; for Coal and Ash Handling Machinery, see page 891.

BROWNHOIST

TRADE-MARK

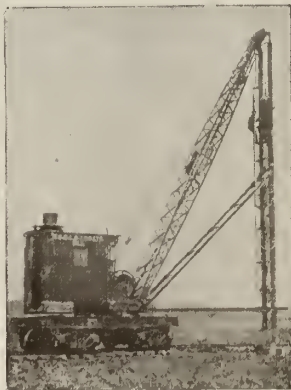
CAPACITIES—Capacities vary for the different types, and in the table below are given capacities at various radii for one type of crane of each size. Larger and smaller capacities are obtained with different type cranes and different length booms. The cranes can be overloaded anywhere from 15% to 60% of the figures given below before the crane will tip. With outriggers the overload is a still greater percentage of the rated capacity given below.

Brownhoist Locomotive Cranes.

TYPES—These cranes are made in the following sizes: Nos. 1, 3, 4 and 6, and there are several types of each size. They can be operated by steam, electricity or gas engine. The No. 1 and No. 3 sizes are equipped with 4 wheels and the larger sizes are mounted on two M. C. B. standard 4-wheel trucks. Various lengths of booms can be used on the various types.

USES—The cranes can be used for practically all kinds of hoisting work and for handling materials. Some of the uses are handling coal, ore, coke, cinders, gravel, crushed stone, etc., with grab bucket; excavating with dragline or orange peel buckets; driving piles; pulling piling; handling materials with lifting magnet; and with bottom block for handling tubs and miscellaneous loads; and switching cars.

SPEEDS—The cranes are equipped with a pair of high speed engines of large diameter and short stroke. Locomotive crane service requires almost constant starting and stopping of the engines, and the engines on Brownhoist cranes develop full power much quicker than the small diameter engines with longer stroke. Under working conditions the engine speeds run from 100 to 700 r.p.m. On a No. 4 steam crane with fully loaded bucket, the hoisting speed is approximately 200 f.p.m. Hoisting or lowering empty hook on one part line on this crane is about 500 f.p.m. Maximum rotating speed with full load is about 3 to 4 r.p.m. Travel speed with full load on straight level track is approximately 600 f.p.m. Speeds under various conditions will be given on request.



No. 4 CRANE EQUIPPED WITH LEADS AND STEAM HAMMER FOR DRIVING PILES



No. 4 CRANE EQUIPPED WITH DRAGLINE BUCKET

CAPACITIES, WEIGHTS AND WHEEL LOADS

Crane	Radius, ft.	Capacities, lbs.		Total weight of crane, lbs.		Max. wheel loads, boom at right angle to tracks, lbs.	
		Without outriggers	With outriggers	With block and full load	With bucket and full load	With block and full load	With bucket and full load
No. 1 26-ft. boom	12	9100	38300	33500	18000*	16000*
	15	7100	.....			
	26	3600	.....			
No. 3 Type G 35-ft. boom	12	28000	122000	101500	58000*	48500*
	20	16300	.....			
	30	9600	.....			
	39	6700	.....			
No. 4 Type J 40-ft. boom	13	39300	40000	160500	136500	38000	32500
	20	23000	27300				
	30	13500	17300				
	40	9500	12300				
	44	8300	8800				
No. 4 Type A 40-ft. boom	13	42000	44600	170500	138500	40500	33000
	20	24400	27800				
	30	14400	17300				
	40	9700	12100				
	44	8000	8000				
No. 6 45-ft. boom	12	60000	90000	231000	181000	50000	40000
	15	46000	77000				
	20	32000	56000				
	30	18000	36000				
	40	12000	25000				
	49	10000	19000				

*Max. wheel loads with boom over one wheel and all wheels supported.
No. 1—24300 lbs. with block—21300 lbs. with bucket.
No. 3—66000 lbs. with block—55000 lbs. with bucket.

CLEARANCE TABLE

With same lengths of boom as given in table on preceding page—booms at 45° angle.

	No. 1	No. 3	No. 4	No. 4	No. 6
A	19'	24'	29'	29'	31'
B	6'	7'	7'	7'	9'
C	17'	22'	27'	27'	29'
D	8'	9'	9'	9'	11'
E	14'-10"	16'	17'- 2"	17'- 2"	17'- 3"
F	8'- 8"	9'-10"	9'-10"	9'-10"	12'- 6"
G	7'- 2"	12'	26'	26'	28'
H	5'- 6"	8'	19'- 2"	19'	20'
I	7'- 7"	10'	8'- 8"	8'- 8"	10'

For bucket dimensions, see page 65

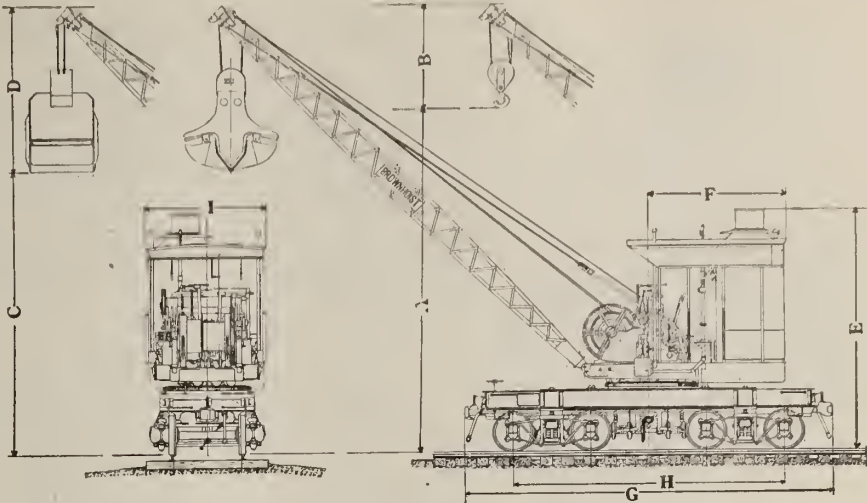
Traveling Mechanism.

The 4-wheel cranes are supplied with a traveling shaft connected to both axles. On 8-wheel cranes the traveling shaft is connected to one axle on each truck. The shaft is jointed with universal couplings which insure a good mesh of the gears when the crane is traveling on a curve.

The cranes will operate on 60° curves, and also up grades.

Boilers.

The steam cranes are supplied with vertical tube boilers having quick steaming qualities. Each boiler is made to comply with the strictest state boiler laws. The size depends upon the size of crane. Boilers are supplied for coal, coke, wood or oil firing.



CLEARANCE DIAGRAM OF NO. 4 CRANE

Operation.

All cranes are operated and fired by one man. A platform is provided for the operator where he can easily reach all levers and brakes necessary for operation. The platform is elevated so that the operator can have a full view of the work at all times.

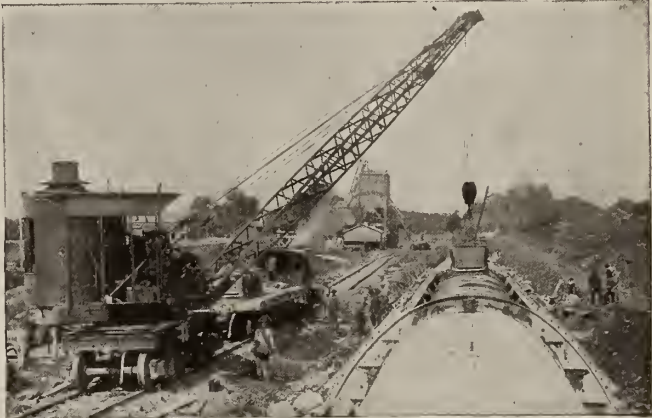
Prices.

Prices will be given on the type of crane necessary to fulfill required conditions.



NO. 1 CRANE EQUIPPED WITH BROWNHOIST (CONTRACTOR'S TYPE) BUCKET

This crane is shown here with traction wheels for working on either railroad or ground



NO. 4 CRANE WITH BOTTOM BLOCK FOR HANDLING TUBS OF CONCRETE



NO. 3 CRANE EQUIPPED WITH BROWNHOIST (CONTRACTOR'S TYPE) BUCKET



NO. 6 CRANE WITH BROWNHOIST PATENT GRAB BUCKET

THE BROWNING COMPANY

Builders of Locomotive Cranes

CLEVELAND, OHIO

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SALT LAKE CITY, UTAH

WASHINGTON, D. C.
MONTREAL, CAN.

Products.

Manufacturers of LOCOMOTIVE CRANES and their ACCESSORIES, such as BUCKETS, PILE DRIVER LEADS, and STEAM SHOVEL ATTACHMENTS.

Also, Track Pile Drivers and Wreckers.

Standardization of Equipment.

By standardization on the above types of equipment a product unsurpassed for excellence of design, material, workmanship and service has been developed.

The Browning Crane.

The Browning crane is made in various sizes, from 10 to 60 tons. It is self-propelling, carries any length of boom, and revolves in a full circle. All parts are interchangeable. May be equipped with separate rotating engine.

The latest model Browning locomotive crane is a marvel in ease and certainty of operation. All controls are placed directly in front of the operator, where they are at all times under his hand and eye. The operator is so stationed that he always has a clear view of both the bucket and the work. The separate rotating engine means a great saving in time, as it allows three distinct movements at the same time: lifting the bucket, rotating and traveling.

Another leading feature of the Browning crane is the great adaptability. It can be equipped to handle a hook block, an electric lifting magnet, an automatic bucket of any type, a drag scraper bucket, a steam shovel dipper, or a pile driver hammer and leads. All

of these are quickly interchangeable, giving the owner an all-round machine.

Some of the leading mechanical features of the Browning crane, briefly described, are as follows:

The shafting is hammered steel, ground to exact size, no turned journals being used. All bearings are bushed with phosphor bronze instead of babbitt. The track wheels have extra heavy M. C. B. webs and treads. All gears and pinions are of forged steel; those above the rotating base having machine cut teeth. The boom hoist worm wheel is bronze with cut teeth. The worm is open hearth cast steel with finished thread.

All clutches, except the boom hoist, are Browning patent all-steel type. Each working part of the clutches is hardened and ground to size, with ample provision for taking up the wear.

Every part of each Browning crane is tested before it is assembled, and when the crane is completed it is tested again, not only for its capacity, but for overload. The fact that Browning cranes have repeatedly stood up under more than 30% overload tells the story of the care used in designing, building and testing them.

The Browning crane is not limited either by design or manner of operation to any one locality. The Browning crane is in use, not only in the United States and Alaska, but also in Canada, Mexico, Cuba, the Hawaiian Islands, the Philippines, England, France, Spain, Italy, Greece, New Zealand, South America and Russia. The design is so fundamentally sound that it not only stands up under the widely different operating conditions, but is readily understood and economically handled and repaired by the varying types of operators in these countries. The major parts of each crane are interchangeable with every other crane of the same size which this company has built. This shows conclusively that the Browning crane is so designed and built that it is a truly universal crane, and that it is not necessary to build each crane to fit each particular job or country.

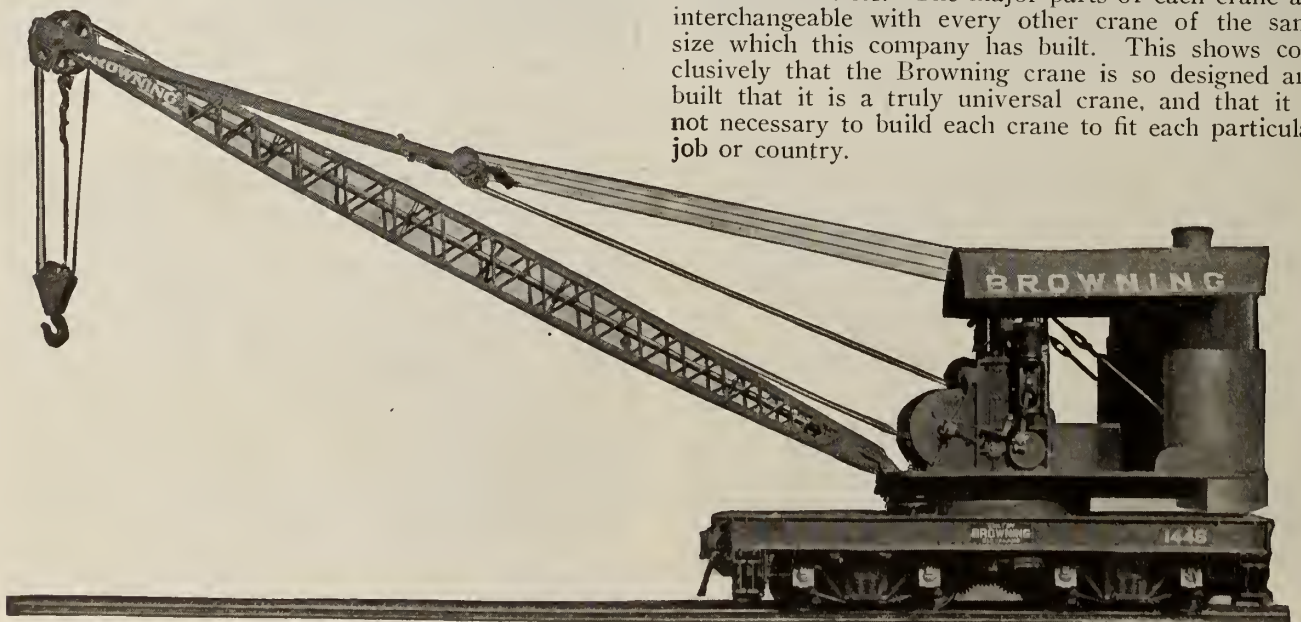


FIG. 1. BROWNING LOCOMOTIVE CRANE

THE BROWNING COMPANY is not merely interested in selling cranes, but also in seeing that every buyer gets the best possible service. With each crane is sent a comprehensive book which shows how to best operate the crane for every line of work, so that the utmost volume of work may be done economically. In addition to this the book shows how to order repair parts so that it may be known just what is wanted when the order is received. This helps to ship the part without unnecessary delay, and to give the service to which clients are entitled.

Browning Buckets.

Browning buckets are especially designed by engineers of combined crane and bucket experience for the particular line of work they are to perform, and insure satisfactory performance under the most difficult working conditions. All wearing parts are bronze bushed and carry individual grease cups.

Reeved Type Bucket.

The lightest successful bucket for hard digging. It has great closing power, right up to the point where the jaws come together. Leaves a flat track without lumps or ridges. Can be fitted with steel teeth if required. The sheaves are arranged so that the reeving is adaptable to the material handled—in "loose" digging fewer parts may be used and the speed increased; in "hard" digging the number of parts is increased and greater closing power is attained, insuring capacity loads. The bucket always hangs square (Fig. 3).

Flat Chain Clamshell Bucket.

A quick detachable bucket of splendid digging power. This bucket is similar to the reeved type bucket except in its power mechanism. Instead of securing its closing power direct from the closing cable, the power is transmitted by the large power wheel and flat chains. This design requires but three wraps of the cable around the power wheel, thus permitting the bucket to be quickly unfastened and removed when the crane or derrick is to be used for other purposes (Fig. 4).

Coke Fork.

Handling coke does not permit the use of the ordinary clamshell bucket. This type of bucket crushes the coke to such an extent that the waste prohibits

its use. The Browning coke fork is designed to overcome this condition. Identical with the clamshell bucket in operation and action, the round steel picks, which replace the solid plates, slide into and under the coke with a minimum of breakage. Picks up clean coke only, the dirt and dust falling through the tines.

Originally designed for use at coke ovens and blast furnaces, it has proved equally popular for handling straw, manure and garbage (Fig. 2).



FIG. 2. COKE FORK—OPEN

Wood Grapple.

Designed to solve the problem of handling pulp wood rapidly and economically, it gave such satisfaction that it is now in general use in handling logs, ties and similar material. Similar in principle to a clamshell bucket, the steel scoops are replaced by tough steel tines, correctly shaped to gather and hold the largest load possible. If not required by the material handled, the steel plates with which the tines are fitted (that are so designed as to hold the shorter pieces in the load from twisting and preventing full loads) may be removed (Fig. 5).

Co-operative Service.

The Department of Engineers invites questions on any type of work requiring machinery of this nature. This department will furnish, without charge, trustworthy information, accompanied by photographs when possible. This information, given free, is entirely in the interest of better methods in this field.

Catalogues.

New catalogues of the Browning locomotive cranes and Browning buckets, which graphically show their wide adaptability and economical operation, will be sent free to all who are interested.



FIG. 3. Reeved Type—Open



FIG. 4. Flat Chain Type—Closed
THREE TYPES OF BROWNING BUCKETS



FIG. 5. Wood Grapple—Open

THE JOHN F. BYERS MACHINE CO.

Manufacturers of Auto-cranes, Hoisting Machinery and Portable Derricks

270 Sycamore Street
RAVENNA, OHIO

SALES OFFICES IN PRINCIPAL CITIES

Products.

AUTO-CRANES: Steam, Gasoline, Electric, Erection, Grab Bucket, Electric Magnet.

PORTABLE DERRICKS: for special work.

EXCAVATORS: Derrick, Grab Bucket, Drainage, Trench Excavating Machinery.

BUCKETS: Clamshell, Excavating, Grab.

HOISTS: Steam, Gasoline, Electric and Belt.

Ash and Refuse Handling Machinery; Backfillers; Ditching Machines; Car and Wagon Loaders and Unloaders; Pile Drivers; Steam Shovels.

Auto-crane.

A small, compact, high powered steel derrick, or combination locomotive crane, traveling readily on ground to any place it is needed. Light, moderate in price and simple to operate.

Built for travel on road wheels, rail trucks or caterpillars.

Forward and reverse propelling mechanism through spiral steel clutches, by steel roller chain and heavy differential.

Handled by operator instantly by means of conveniently placed levers. One man operates all hoisting drum levers, boom swing and traction.

Rail truck crane built for any gage.

Choice of three kinds of power—steam, gasoline or kerosene, electricity.

Special Features.

Self-propelling; one-man control; spots cars; rehandles materials; hook, skip, magnet, clamshell or orange peel bucket; dragline bucket or steam shovel attachment.

"Tell us the work, and we'll show you an Auto-crane doing similar work."

Guarantee.

One round trip per minute of boom and bucket is guaranteed. This guarantee is conservative and can be easily bettered by a good operator. Byers Auto-crane is guaranteed for one year against defective material and workmanship.

Shipping.

The Auto-crane is shipped set up, ready to work, but with boom and trucks removed. Can be shipped from job to job by rail or travel over streets, as its size comes entirely within railroad and highway clearances.

Catalogue.

Gladly sent on request. Remember, "There's an Auto-crane for your work, too."



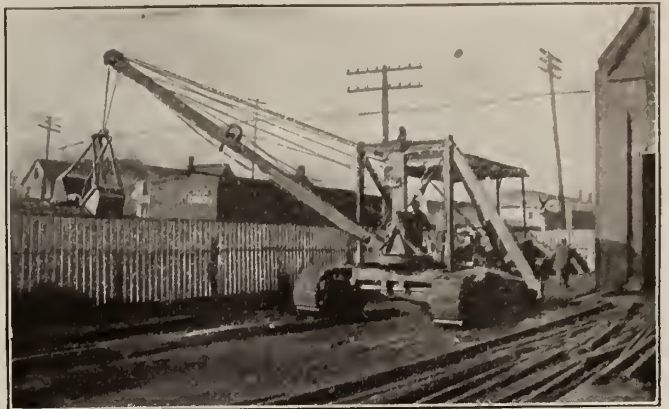
UNLOADING CARS, WESTERN PACKING & PROVISION CO., CHICAGO, ILL.



UNLOADING BARGES, FIRTH-STIRLING CO., PITTSBURGH, PA.



STEAM POWER—ROAD WHEEL AUTO-CRANE,
U. S. MARINE CORPS, QUANTICO, VA.



GASOLINE POWER—APRON TREAD AUTO-CRANE,
U. S. NAVAL AIR STATION, MIAMI, FLA.



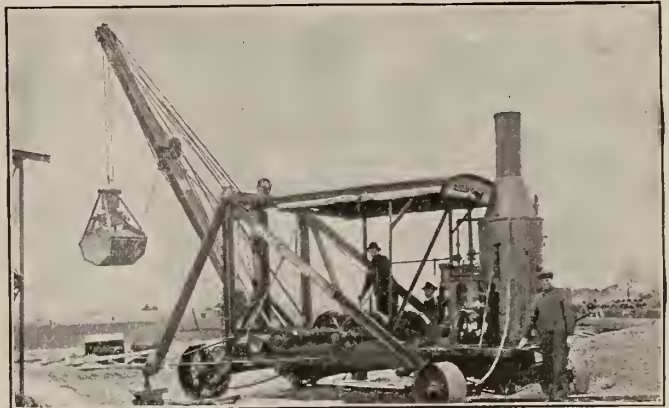
HANDLING MATERIAL—W. B. BRADY CONSTRUCTION CO.,
DETROIT, MICH.



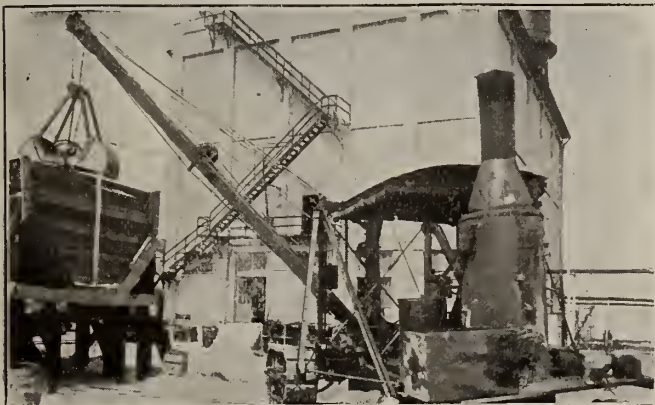
EXCAVATING—ATLANTIC BITHULITHIC CO.,
RICHMOND, VA.



MAGNET AUTO-CRANE HANDLING SCRAP



STEAM POWER—ROAD WHEEL CRANE ALL READY FOR
BUSINESS



STEAM POWER—APRON TREAD CRANE,
THE TEXAS CO., OWNERS



STEAM POWER—ROAD WHEEL CRANE CUTTING OUT
DEMURRAGE

FOUNDED 1873

INDUSTRIAL WORKS

Industrial Cranes

CABLE ADDRESS:

"INDUSWORKS, BAY CITY"

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BAY CITY, MICH.

CODE:

ABC, Third Edition

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DETROIT, MICH., Book Building

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SEATTLE, WASH., NORTHWESTERN EQUIPMENT Co.
MONTREAL, CANADA, F. H. HOPKINS & Co.

Products.

LOCOMOTIVE CRANES, WRECKING CRANES, ERECTION CRANES, GASOLINE COALING CRANES, PILLAR CRANES, TRANSFER CRANES.

Pile Drivers, Transfer Tables, Portable Rail Saws, Dragline Excavators, Steam Pile Driving Hammers, Lifting Magnets, etc.

For Grab Buckets, see pages 70-71.

Experience and Scope.

INDUSTRIAL WORKS was founded in 1873.

Being pioneer builders of locomotive and wrecking cranes, this company has acquired a fund of practical experience that could come only from having many machines in various kinds of service. "Industrial" cranes of today are the development of this varied experience. Satisfactory service has proved that they are fundamentally correct in design, sturdy in construction, and efficient in operation. In size they range from 2-ton hand operated pillar cranes to wrecking cranes of 160 tons capacity. INDUSTRIAL WORKS has had a good deal of experience building special cranes for special work where no standard machine would fit. This organization is particularly adapted to handle such work.

Locomotive Cranes.

"Industrial" locomotive cranes, steam, gasoline or electrically operated, are made in capacities of from 5 to 60 tons, and with booms from 20 to 125 ft. long. They are mounted on 4-wheel or 8-wheel cars for standard or special gage track, or on boats and gantries.

They are largely employed in railroad operations, bridge building and construction work; in loading and unloading coal, ore, sand, and other bulk material; in handling structural material, machinery and lumber. Being self-propelling, they switch several loaded cars. As used by contractors, they handle forms and concrete material, erect structures, drive piles, and do excavating generally.

These cranes may be used with grab buckets and lifting magnets, or arranged for operating with a dragline bucket, pile driver leads, or a steam shovel dipper arm.

Mechanically, "Industrial" cranes are not excelled. Every crane is made, assembled and tested in the company's extensive shops. All parts of the crane are accessible for easy examination, a large man being able to pass through the machinery part and car to the ground. Absolute interchangeability of parts is assured by the use of jigs and templates at every possible point in the construction. Inconvenient bearings are lubricated through oil pipes. The propelling gears on 8-wheel cars are placed in or out of mesh from the outside of the car body.

The system of clutches and independent drums makes "Industrial" cranes unexcelled for clamshell bucket work. Both drums are independent, and the auxiliary take-up drum for the holding line is entirely automatic in its action, requiring no attention from the

operator. With this drum he can raise the bucket open if desired.

DATA—In general all sizes of locomotive cranes do the same kind of work, the amounts being limited, of course, by their capacities.

The 60-ton capacity cranes are used chiefly for erection purposes; those from 20 to 60 tons for erection work or for handling large quantities of material with a bucket or magnet; cranes from 5 to 20 tons are general purpose machines, being used for all kinds of loading and placing of material.

Locomotive cranes are usually rated according to their maximum capacity at the minimum radius (about 12 ft.).

The following table gives the approximate radius in feet at which various size cranes will handle clamshell buckets full of coal and sand:

	1½-YD. BUCKET				2-YD. BUCKET		
	5-ton	12-ton	15-ton	20-ton	25-ton	30-ton	40-ton
Coal.....	20	25-37	41-46	48-52	49-52	52-54	58-61
Sand.....	18	25-33	36-41	44-48	37-41	42-46	47-51

A 1½-cu. yd. bucket holds approximately 1 ton of coal.

To unload material with a grab bucket from the far end of a modern gondola car, standing on the same track as the crane, requires a 50-ft. boom. In general, the shorter the boom, the easier and faster will be the operation of the crane.



LOCOMOTIVE CRANE AT WORK ON CONSTRUCTION OF LARGE INDUSTRIAL BUILDING

Features of "Industrial" Cranes.

(1) "Industrial" cranes are built complete in our shops.

(2) Each crane is completely assembled and given a full working test before leaving the plant.

(3) Absolute control of all materials used in the construction of product is had through our chemical and physical laboratories.

(4) Heavy duty gears and shafting are heat treated.

(5) Vanadium steel castings are used extensively.

(6) Through bolts with grip nuts, and not stud bolts, are used on all heavy duty parts. Turned bolts are used wherever there is possibility of relative motion.

(7) All gearing is of cast steel or bronze and all except slewing racks and pinions and a few slow moving gears are cut.

(8) All running bearings provided with replaceable bronze bushings. Wearing surfaces of all thrust bearings are separated by bronze washers. There is a bronze collar behind each bevel gear.

(9) Flexible arrangement of auxiliary drum on bucket cranes.

(10) Specially designed clutches, each developed particularly for the work it has to do.

(11) Rollers under the crane are adjustable for wear.

(12) Special trucks built for extra heavy crane duty.

(13) Spur gear propelling mechanism with fewest possible wearing parts.

(14) Heavy rack bolted to car body and efficient brake on rotating motion giving absolute control and obviating the danger of involuntary rotation.

Inquiries.

Inquiries for locomotive cranes should give the following information:

(1) Steam, electric or gasoline operated.

(2) Gage of track, and weight of rails used.

(3) Any unusual clearance conditions.

(4) Maximum load to be lifted.

(5) Radius at which maximum load is to be handled. (Radius is measured from center of rotation of crane to center of gravity of load.)

(6) Maximum radius crane must be capable of maximum load to be handled at that radius and height to which it must be raised.

(7) Nature of work to be done (including propelling service expected) and kind of material to be handled.

(8) Whether a grab bucket or lifting magnet is to be handled and if so, what size.

(9) If magnet is to be handled, whether generating set or plug-in system is to be used.

(10) If electrically operated, state whether current is D. C. or A. C. In either case voltage should be given and if A. C., voltage, phase and cycle.

(11) If electrically operated, whether current will be taken by trolley, plug-in or third rail.

Inquiries for wharf and shipbuilding cranes or other cranes mounted on fixed piers, traveling gantries, traveling piers of the simple raised type, or of portal or semiportal type, etc., should give the following additional information:

(12) Height of revolving crane above rails.

(13) Clearances allowable each side of supporting rails.

(14) Gage and relative levels of the supporting rails for the substructure.

(15) Any special clearances desired under substructure when of the traveling portal or semiportal pier type.

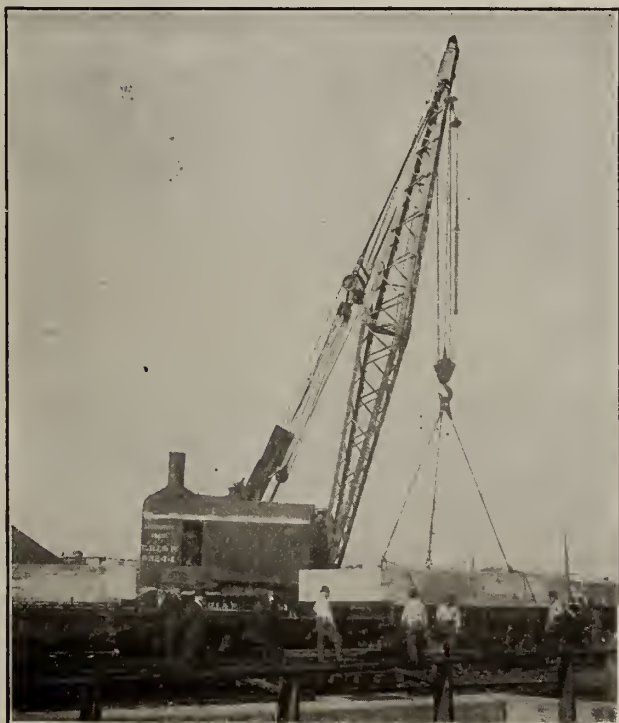
(16) Lowest and highest working positions of hook at maximum and minimum radii.

(17) Fixed or variable radius.

(18) If traveling gantry is desired will revolving crane be fixed upon the same or will it travel along the top?

CRANE CAPACITIES, WEIGHTS AND RADII WITH DIFFERENT LENGTH BOOMS

Type crane	Length of boom, ft.	Max. weight of crane in operating conditions, lbs.	Capacities at maximum and minimum radii without outriggers				Capacities at maximum and short radii with outriggers			
			Min. radius, ft.	Cap. at min. radius, lbs.	Max. radius, ft.	Cap. at max. radius, lbs.	Radius of max. cap., ft.	Max. cap., lbs.	Max. radius, ft.	Cap. at max. radius, lbs.
"A" (4-wheel)	25	41,300	10	10,000	25	3,000				
	25	59,200	10	10,000	25	3,000				
"C A" (8-wheel)	40	93,000	12	25,000	40	5,000				
	45	94,300	12	25,000	45	3,400				
"C B" (4-wheel)	40	84,700	12	25,000	40	5,000				
	45	86,000	12	25,000	45	3,400				
"E A" (8-wheel)	40	110,900	12	30,000	40	7,500				
	45	111,300	12	30,000	45	6,100				
	50	111,700	15	24,500	50	4,950				
"E B" (4-wheel)	40	99,000	12	30,000	40	6,100				
	45	99,400	12	30,000	45	4,850				
"G" (8-wheel)	40	128,850	12	40,000	40	9,000	13	40,000	40	10,200
	45	129,300	12	40,000	45	7,200	13	40,000	45	8,600
	50	129,500	15	31,000	50	6,100	15	31,000	50	7,000
	60	130,050	20	22,000	60	4,200	20	23,500	60	5,500
"H" (8-wheel)	40	145,350	12	50,000	40	10,200	14	50,000	40	14,000
	45	145,850	12	50,000	45	8,800	14	50,000	45	11,500
	50	146,350	15	37,000	50	7,500	15	47,000	50	10,000
	60	147,300	20	25,000	55	5,100	20	35,000	60	7,000
"K A" (8-wheel)	70	148,300	25	18,000	60	3,200	25	27,000	70	5,000
	40	173,500	12	60,000	40	12,400	15	60,000	40	20,500
	45	174,050	12	60,000	45	9,900	15	60,000	45	17,000
	50	174,400	15	44,000	50	8,400	15	60,000	50	14,500
"L" (8-wheel)	60	175,100	20	30,000	60	5,800	20	45,000	60	11,000
	70	175,800	25	21,500	70	3,800	25	35,000	70	8,000
	80	176,500	30	16,500	80	2,400	30	28,500	80	6,000
	90	177,200	35	12,500	90	900	35	23,500	90	4,000
"M" (8-wheel)	40	189,250	12	70,000	40	15,000	16½	80,000	40	25,300
	45	189,950	12	70,000	45	12,000	16½	80,000	45	21,500
	50	190,450	15	51,000	50	10,000	16½	80,000	50	18,500
	60	191,500	20	35,000	60	6,900	20	63,000	60	14,600
	70	192,550	25	25,500	70	4,700	25	48,000	70	11,000
	80	193,350	30	19,500	80	3,000	30	37,200	80	8,200
	90	194,250	35	15,000	90	1,500	35	29,900	90	6,000
"N" (8-wheel)	100	195,000	40	12,000	100	0	40	24,400	100	4,500
	40	177,450	16	39,200	40	10,700	16	120,000	40	37,000
	50	178,300	20	28,200	50	6,300	20	98,000	50	26,400
	60	179,400	25	19,760	60	3,360	25	74,000	60	19,300
	70	180,500	25	18,400	70	1,000	25	73,200	70	13,800
	80	182,700	25	15,500	50	2,000	25	70,000	80	9,200
	90	184,300	30	9,700	50	900	30	53,000	90	5,800
	100	185,500	35	5,500	45	1,400	35	40,000	100	3,000



LOCOMOTIVE CRANE LOADING RAILROAD CARS



LOCOMOTIVE CRANE AT WORK IN SHIPYARD

LINK-BELT COMPANY

Manufacturers of Elevating, Conveying and Power Transmission Machinery

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CHICAGO

INDIANAPOLIS

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ST. LOUIS, MO., Central National Bank Building

NEW ORLEANS, LA., C. O. Hinz, Hibernia Bank Building

SEATTLE, WASH., 576 First Avenue, South
LOS ANGELES, CAL., 161 North Los Angeles Street
DENVER, COLO., LINDROOTH, SHUBART & Co., Boston Building
SAN FRANCISCO, CAL., 582 Market Street

Products.

ELEVATING and CONVEYING MACHINERY for handling all kinds of materials: Locomotive Cranes; Coal and Ashes Handling Conveyors; Portable Loaders; Belt Conveyors; Slat Conveyors; Link-Belt Roller Chain; Silent Chain Drives; Grab Buckets; Elevator Buckets; Screens; Friction Clutches; Chains and Sprockets; Bucket Carriers; Coal Crushers; Electric Hoists.

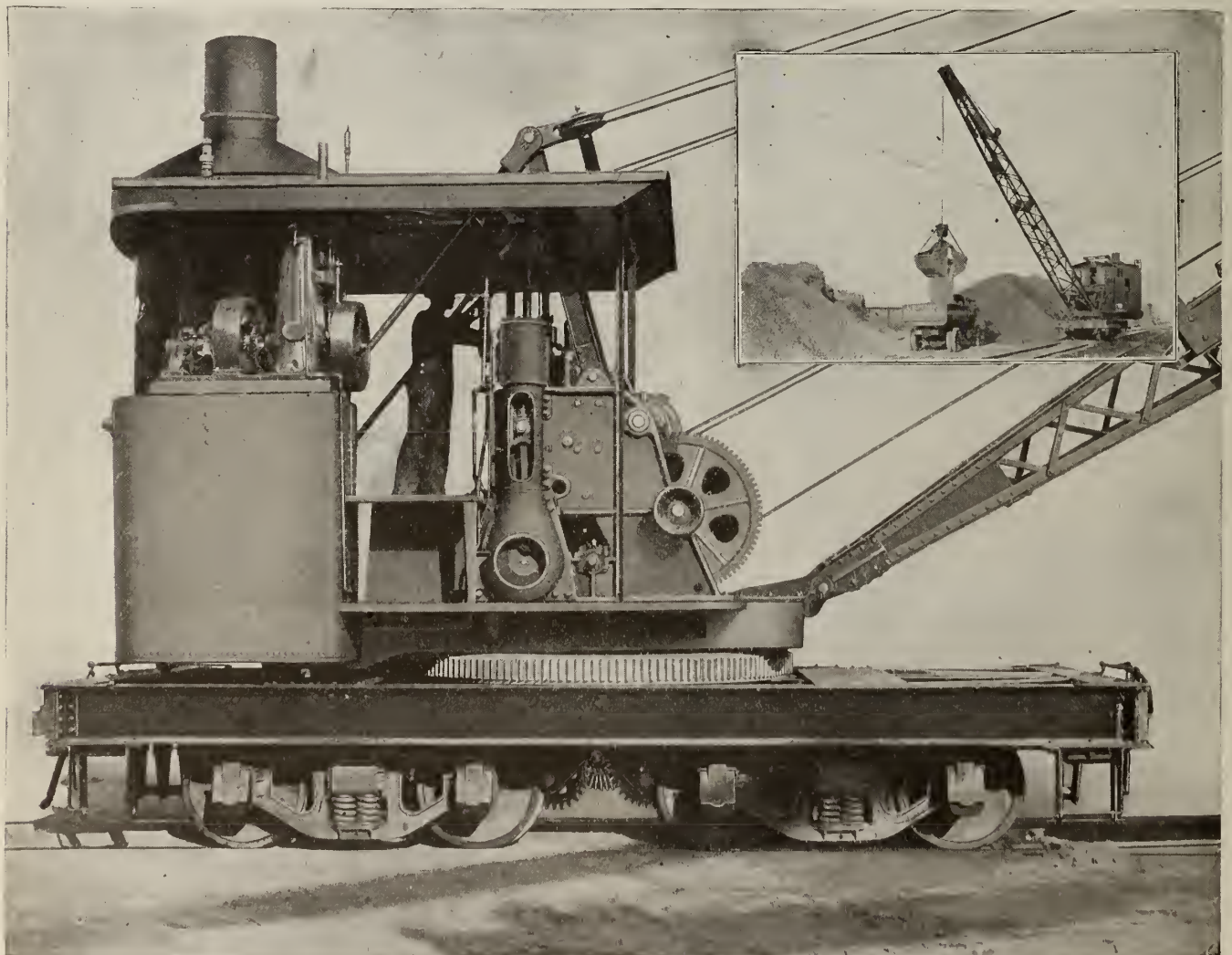
Also, Excavating Machinery; Dragline Excavators; Coal Storage Systems for powerhouses, etc.; Coal Tipples, and Coal Washeries; Freight and Package Carriers; Screw Conveyors; Gondola Car Unloaders; Power Transmission Machinery.

Link-Belt Locomotive Crane.

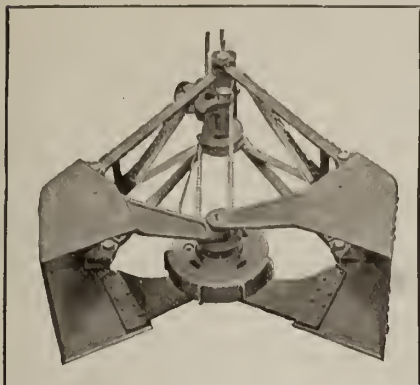
Handles anything: coal, stone, logs, pig iron and structural steel, packages, boxes, etc., weighing from 1 to 25 tons. Can be used as a switch engine capable of pulling 8 standard gondola cars on a straight track. Does the work of from 20 to 40 laborers.

DISTINCTIVE FEATURES—Steel gears and bronze bushings throughout; one-point adjustment on clutches; few parts, every one accessible; large roomy platform for operator, everything handy; exceptionally large factor of safety used; the only crane with foolproof safety device on swinging mechanism.

Reliability, the most desired quality in any locomotive crane, will be found in Link-Belt cranes, coupled with speed and ease of operation.



LINK-BELT LOCOMOTIVE CRANE
Note simplicity and compactness



LINK-BELT TYPE "AE" GRAB BUCKET
For handling abrasive materials such as gravel and sand



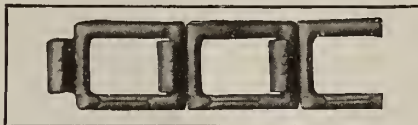
LINK-BELT LABOR-SAVING ELEVATORS AND CONVEYORS
Increase production, save labor and promote general efficiency



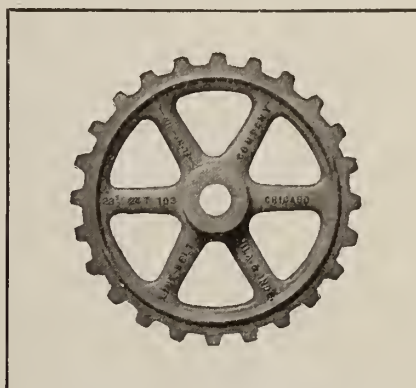
LINK-BELT WATER INTAKE SCREENS



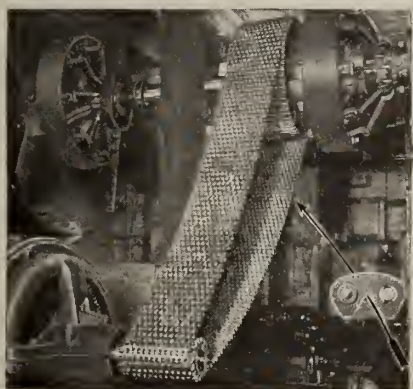
MALLEABLE IRON ELEVATOR BUCKET



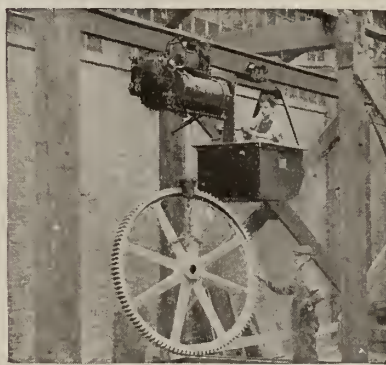
EWART DETACHABLE LINK-BELT



FLINT-RIM SPROCKET WHEEL
For durability



LINK-BELT SILENT CHAIN
For high speed power transmission



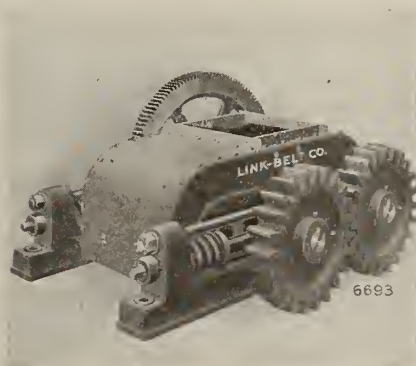
ELECTRIC HOIST WITH OPEN TRAILING OPERATOR'S CAGE



LINK-BELT BELT CONVEYOR
For handling all kinds of material



LINK-BELT PORTABLE LOADER
Loads a ton of any loose material a minute



LINK-BELT COAL CRUSHER
For reducing coal to size required for stokers. Made in many types and sizes to meet all requirements.



PECK OVERLAPPING PIVOTED BUCKET CARRIER
For handling coal and ashes, stone, gravel, etc.

OHIO LOCOMOTIVE CRANE CO.

Iron Street
BUCYRUS, OHIO

Products.

LOCOMOTIVE CRANES.

Facilities.

OHIO LOCOMOTIVE CRANE Co. is the only concern in the country today devoting its time and attention exclusively to the manufacture of locomotive cranes.

The company's factory buildings and equipment are modern and its facilities for turning out locomotive cranes are unsurpassed. These cranes are completely built in the company's shops which include grey iron, steel and brass foundries and a large well equipped machineshop.

Adaptability.

Ohio locomotive cranes are constructed in such a manner that possibilities of application to various classes of work are unlimited. Cranes are made in a wide variety of types, and can be operated by steam, electricity, compressed air, oil or gasoline engines, and can be furnished in capacities ranging from 5 to 50 tons.

Ohio cranes are largely employed in industrial plants, railroad operations and construction work.

They can be equipped with a bucket for handling sand, gravel, crushed stone, slag, coal, sugar beets, ore, dirt, etc.; with a generating set and lifting magnet for handling scrap iron, castings, bars, etc.; with a dragline

Shafts are made of forged steel turned to proper size. The boom, sluing and hoisting clutches used are of the cone friction type. The traveling clutch is of the multiple disc friction type, requiring adjustments at very wide intervals and being a very powerful and simple design.

All gears are made of steel, excepting the worm gear on the hoist boom which is made of bronze. All gears have teeth cut from the solid with the exception of the rotating rack and the slow motion propelling gears, and all have machine cut teeth.

Of the castings employed, 90% are open hearth steel, 7% are iron and 3% are bronze.



25-TON CAPACITY, 8-WHEEL CRANE, PENNSYLVANIA STEEL CO., STEELTON, PA.
Equipped with orange peel bucket

bucket for rapid excavation; with a fall block and hook for all general hoisting purposes; with pile driving attachments for driving pile, and can be used as a switching engine.

Construction.

The main base supporting most of the mechanism is one large steel casting, to the sides and rear of which are securely fastened by rivets a structural steel frame supporting the boiler, forming a rigid construction which insures against breakage.

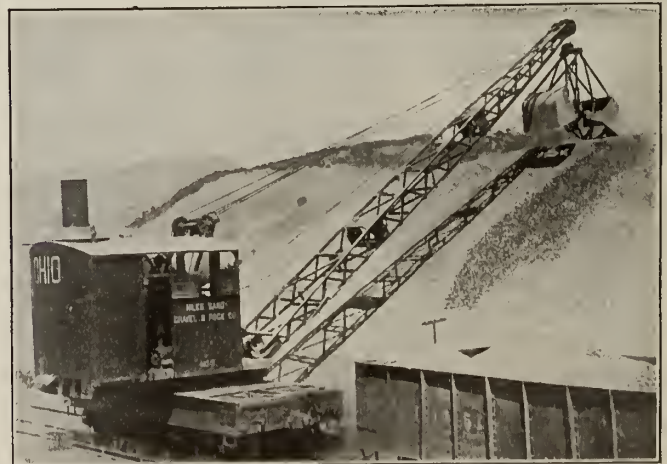
All the bearings used are of the very best quality of bronze. The shaft-shell bearings are of the same size and therefore interchangeable. A feature incorporated in no other make of crane.



20-TON CAPACITY, 8-WHEEL CRANE, WILKOFF IRON & STEEL CO., YOUNGSTOWN, OHIO
Used for handling heavy material about their scrap yards. Equipped with magnet and generator

Catalogues.

It is impossible to give an adequate description of the construction and the scope of utility of the Ohio locomotive crane on this page. The company's own catalogues, giving full particulars, will be gladly furnished on request.



20-TON CAPACITY, 8-WHEEL CRANE, NILES SAND, GRAVEL & ROCK CO., NILES, CAL.
Equipped with oil burner and Hayward bucket for storing and loading crushed rock

LIDGERWOOD MANUFACTURING CO.

Hoisting and Hauling Machinery

MAIN OFFICES

Liberty and Church Streets

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BRANCH OFFICES

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PITTSBURGH, PA.

PHILADELPHIA, PA.

SEATTLE, WASH.

LONDON, ENGLAND

Products.

STEAM, ELECTRIC and GASOLINE HOISTS for contractor's work, derrick work, grab bucket work, shafts, coal and freight handling, mines, quarries, dredges and excavators; CABLEWAYS and CABLEWAY EXCAVATORS.

Steel and Wood Derricks and Derrick Fittings, Ballast Unloaders, Ship and Dock Winches, Steering Engines, Towing Engines, Logging Machinery.

Experience.

Since 1873 this company has devoted itself exclusively to the manufacture of hoisting and hauling machinery, and the Lidgerwood machinery of today embodies every improvement in design and construction suggested by this long experience.

This company equips its electric hoists with the types of motor best adapted for the work to be done by the hoist, and is prepared to equip both electric and steam hoists with the latest type of automatic control and safety devices.

Lidgerwood Hoists.

It is the practice of the LIDGERWOOD MANUFACTURING Co. to design the complete machine to operate under the maximum service it is built to perform, and to build every part of the machine to meet the strain of working at its full capacity.

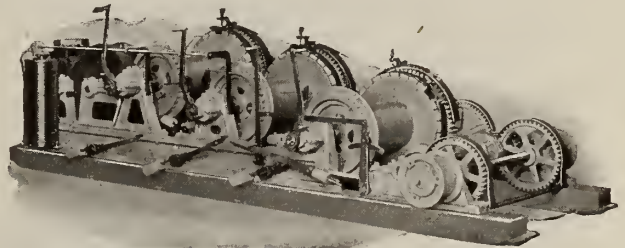
Drums are built of the friction, clutch and fixed types. The friction drums, both cone and band type, have the patented cork inserted friction woods, which greatly increase their holding capacity.

Two types of contractors' hoists are shown: a double drum steam hoist, without boiler for derrick work, and an electric hoist for 3-line derrick operating

ing a grab bucket, the hoist having 3 drums and the Lidgerwood patented swinging gear for operating the bull wheel that swings the derrick.

The steam, electric and gasoline hoists are built in single, double, and triple drum types—the double and triple drum hoists can be fitted with the boom swinging gear. Steam hoists are built in all styles both with and without boilers. Electric hoists are fitted with either direct or alternating current motors. The company has standard hoists built for every ordinary hoisting service required in contracting, building, industrial plants, mast and gaff rigs, warehouse and dock work, pile driving, derrick work, operating grab buckets, excavating and dredging, mining and quarrying.

In addition to the standard sizes and styles, the LIDGERWOOD MANUFACTURING Co. is equipped to build steam hoists of special types up to 1000 h.p. and electric hoists in any size for all hoisting work.



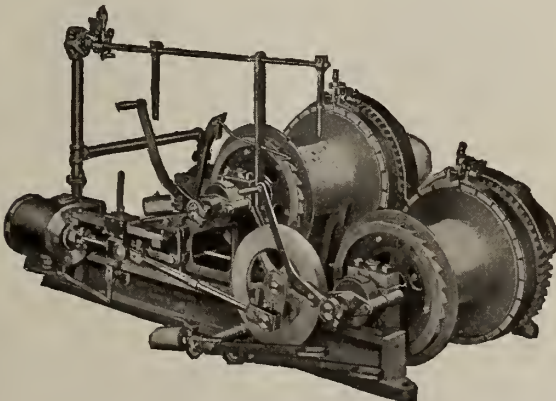
THREE-FRICTION DRUM ELECTRIC HOIST WITH BOOM SWINGING GEAR

In requesting estimate, state what power is to be used—if steam, whether boiler is to be supplied with the hoist, if not, what steam pressure is available at throttle; if electric, give voltage if direct current, and voltage, cycle and phase if alternating. State either the maximum rope pull on single line, or, if block and tackle be used, give maximum load and number of parts of rope to be used, giving a general description of the work to be done.

Lidgerwood Cableways.

Lidgerwood cableway is a hoisting and conveying machine, capable of carrying single loads up to 30 tons over spans of 2000 ft. without intervening supports. They have stationary or traveling towers. They handle loads in slings, plain or automatic dumping skips, and operate clam, orange peel, or scraper buckets for excavating.

Cableways are valuable in constructing dams, bridges, filtration beds, and for open pit mining, quarrying, and excavating over wide areas.



DOUBLE FRICTION DRUM, DOUBLE CYLINDER STEAM HOIST WITHOUT BOILER

NOVO ENGINE COMPANY

C. E. BEMENT, VICE-PRESIDENT AND GENERAL MANAGER

Hoisting Machinery

10 Porter Street
LANSING, MICH.

CHICAGO OFFICE
800 Old Colony Building

Products.

NOVO HOISTING OUTFITS: Reversible or Non-reversible, Single or Double Drum, One or Two Speeds.

Novo Double Platform Elevators.

For Novo Gasoline Engines and Pumping Outfits, see pages 764-65; for Novo Air Compressor Outfits and Saw Rigs, see page 786.

Type DH Hoisting Outfits.

High grade single or double drum hoists can be furnished in practically any combination, reversible or non-reversible, single speed or double speed. Cast iron frame in sections, with heavy I-beam base. All cut gears with wide face and large teeth. Bearings on gear drums and sheaves bronze-bushed. Double cone or V-type wood friction to give greatest possible friction surface; wide brake bands having maximum angle of contact. Equipped with either niggerheads or sheaves, or one of each. Gear guards throughout. Furnished with 8, 10, 12, or 15 h. p. Novo engines of 1200-lb. to 4300-lb. capacities. This DH type

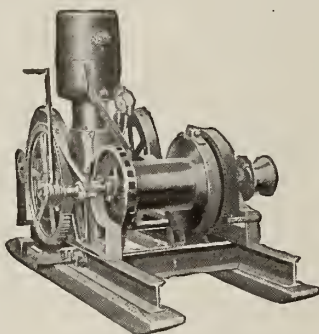


FIG. 193. NOVO TYPE DH SINGLE DRUM HOIST

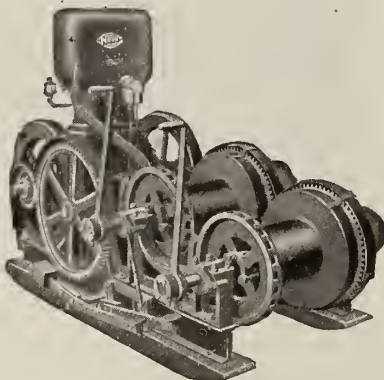


FIG. 172. NOVO TYPE DH DOUBLE DRUM HOIST

DATA, ALL SIZES DH TYPE HOISTING OUTFITS

Maximum width.....	59	in.
Diameter of drum.....	12	in.
Length of drum between flanges.....	16	in.
Diameter of drum flanges.....	20	in.
Drum holds, of 1/2-in. cable.....	1050	ft.
Diameter drum shaft.....	2 3/4	in.
Gear face.....	3	in.
Gear pitch.....	3	in.
Brake diameter.....	22	in.
Brake width.....	3	in.



TRADE-MARK

series of hoists in its various combinations is suitable for any hoisting work up to 15 or 20 h.p.

Single Drum Non-reversible Type OH Hoist.

This outfit is suitable for light pile driving and ordinary contractors' hoisting with gravity drop. The cable drum is loose on shaft and is engaged by strong friction clutch for hoisting and by a brake band operated by a foot lever for holding and lowering the load.

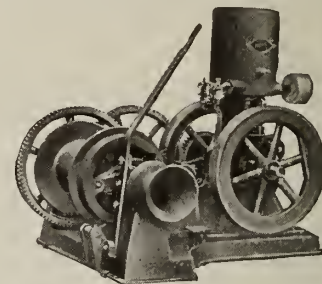


FIG. 1465. NOVO TYPE OH SINGLE DRUM NON-REVERSIBLE HOIST

Single Drum Reversible Type T Hoists.

These outfits are suitable for double platform material elevator work and all around general hoisting. They are equipped with friction clutch and large brake controlled by foot lever to hold load when clutch is disengaged.

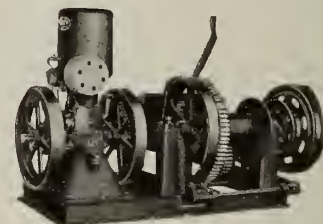


FIG. 1447. NOVO TYPE T SINGLE DRUM REVERSIBLE HOIST

DATA, SINGLE DRUM HOISTS

Outfit No.	Engine h.p.	Weight, lbs.	Drum holds 1/2-in. cable	Will lift		Code word
				Lbs.	Feet per minute	

NOVO TYPE OH SINGLE DRUM NON-REVERSIBLE HOISTS, FIG. 1465

000	3	1175	900 ft.	750	100	Nod
0	4	1300	900 ft.	750	150	Noun
00	6	1500	900 ft.	1000	150	November

NOVO TYPE T SINGLE DRUM REVERSIBLE HOISTS, FIG. 1447

1	6	2200	700 ft.	1000 to 1500	150 to 100	Noise
5	8	2650	700 ft.	1500 to 2100	140 to 100	Nephew
4	10	3050	700 ft.	2000 to 2800	130 to 100	Noiseless

HOISTING CAPACITY AND SPEED TYPE DH HOISTING OUTFITS, FIGS. 193 AND 172

	SINGLE DRUM								DOUBLE DRUM					
	Single Speed Reversible hoist No. 23 Non-revers. hoist No. 21				Two Speed Reversible hoist No. 24 Non-revers. hoist No. 22				Single Speed Reversible hoist No. 27 Non-revers. hoist No. 25			Two Speed Reversible hoist No. 28 Non-revers. hoist No. 26		
	8 h.p.	10 h.p.	12 h.p.	15 h.p.	8 h.p.	10 h.p.	12 h.p.	15 h.p.	10 h.p.	12 h.p.	15 h.p.	10 h.p.	12 h.p.	15 h.p.
Engine size.....	37x77	37x77	37x77	37x77	40x77	40x77	40x77	40x77	37x77	37x77	37x77	40x77	40x77	40x77
Size of bed, in.....	37x77	37x77	37x77	37x77	40x77	40x77	40x77	40x77	37x77	37x77	37x77	40x77	40x77	40x77
*Hoisting capacity														
Rear drum { high speed, lbs.....	1300	1750	1800	2400	1000	1400	1200	1600	1750	1800	2400	1400	1200	1600
low speed, lbs.....					1600	2100	3000	4000				2100	3000	4000
Forw'd drum { high speed, lbs.....									1750	1800	2400	1200	1500	2000
low speed, lbs.....												1600	2400	3200
*Hoisting speed, ft. per min.														
Rear drum { high speed.....	170	160	185	185	225	200	280	280	160	185	185	200	280	280
low speed.....					140	130	112	112				130	112	112
Forw'd drum { high speed.....									160	185	185	225	220	220
low speed.....												175	140	140
Weight with engine														
Reversible, lbs.....	3050	3450	3850	3950	3200	3600	4000	4100	4400	4800	4900	4700	5100	5200
Non-reversible, lbs.....	2815	3215	3615	3715	2970	3370	3770	3870	4165	4565	4665	4465	4865	4965
Code word, reversible.....	Hexe	Hexi	Hexo	Hexu	Hoda	Hodi	Hodi	Hodo	Hyla	Hyla	Hyla	Hyri	Hyro	Hyru
Code word, non-reversible.....	Haba	Haba	Habi	Habo	Heri	Hern	Hero	Humo	Humi	Humi	Humo	Humbe	Humbi	Humbo

*On special order, the gearing on Novo hoists can be changed to give a higher speed at less capacity or a lower speed at greater capacity. Niggerhead keyed to drum shaft can be furnished in place of sheave, without extra cost.

ESTABLISHED 1892

THE GEORGE HAISS MFG. CO., INC.

Contractors' and Coal Dealers' Excavating and Rehandling Machinery

Canal Place and East 141st Street

NEW YORK, N. Y.

TELEPHONE:
MELROSE 241

CABLE ADDRESS:
COAL-HOIST, NEW YORK

Products.

GRAB BUCKETS and COUNTERWEIGHT HOLDING DRUMS.

A line of Contractors' and Coal Dealers' Machinery including Floating, Portable and Tower Cranes; Steam and Electric Hoists; Mast and Gaff Hoist Fittings and Sheaves; Coal and Ore Hoisting Engines; Coal Car Cable Hauling Engines; Automatic Dumping Coal Cars; Coal and Ash Bins; Coal and Sand Cut-off Valves; Coal and Ash Gates and Chutes; Revolving and Shaker Screens; Tiering Machines; Unloading Towers; Industrial Railways.

For Loaders and Unloaders, see page 901.



TRADE-MARK

most hoisting engines are capable of making two trips per minute; and since these buckets are built in capacities from $\frac{1}{4}$ cu. yd. to 3 cu. yds., it is easily calculable what amount of material per day the Haiss "Contractor" grab bucket can handle. Two hoisting cables control the bucket operations.

DESCRIPTION—All Haiss grab buckets are constructed of heavy plate steel and steel castings. In the "Contractor" bucket, shown here, steel flat-link side chains are used. By rolling up on the hubs of the large closing wheel, these chains provide a 1:4 closing power ratio. The "High-Power" grab bucket, also shown, however, depends on the "block and fall" principle of cable reeving for drawing the two halves of the bowl together. A 1:7 closing power is thus obtained, and gives this particular bucket a powerful penetrating effect. Teeth can be bolted onto the jaws of all Haiss buckets.

The Haiss "High-Power" grab bucket should be used for hard digging, such as clay, ore, and heavy earth excavation when made either above or under water.

Haiss Type "Contractor" Grab Buckets.

USES—Haiss type "Contractor" grab buckets are used for automatic digging from sand and gravel banks, crushed stone piles, and for unloading hard and soft coal, coke, sand, stone, ore, chemicals, etc., from boats and railroad cars. They are also employed for excavating and dredging canals, making railroad embankments and dams, and for other purposes when labor and time can be reduced in construction work.

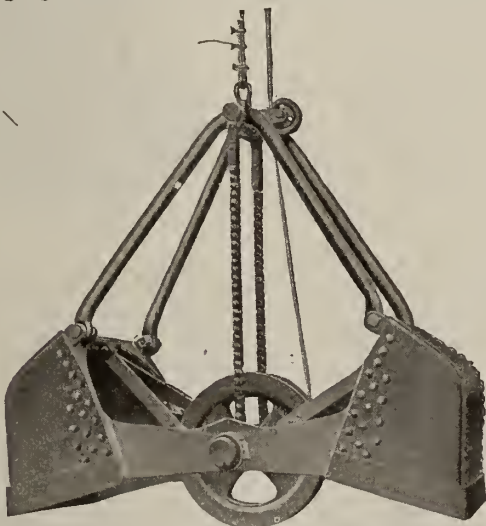
ADVANTAGES—In the first place, a Haiss "Contractor" grab bucket digs, loads and discharges mechanically; and in the second place, being attached to any type of derrick or crane, the load of material which it has dug may be raised from almost any depth to any reasonable height, and swung or carried to a near or distant point before discharging its load. Under usual working conditions



HAISS "CONTRACTOR" BUCKET DIGGING IN A SAND PIT



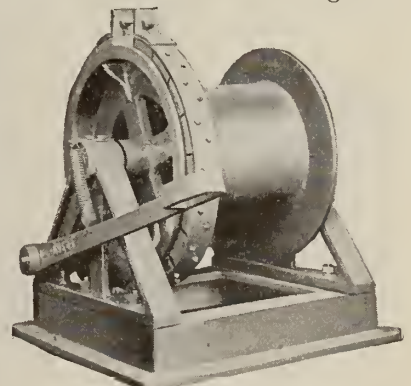
HAISS "HIGH-POWER" BUCKET FOR HARD DIGGING



HAISS TYPE "CONTRACTOR" GRAB BUCKET
OVER ALL DIMENSIONS AND WEIGHTS

Capacity, yds.	Weight, lbs.	Closed		Width, ft.	Length, ft.	Open	
		Height, ft.	Length, in.			Height, ft.	Length, in.
$\frac{1}{4}$	1200	4	5	3	8	5	1
$\frac{1}{2}$	2100	5	2	4	3	5	11
$\frac{3}{4}$	2400	5	4	4	9	5	4
1	2800	5	11	5	1	6	10
$1\frac{1}{4}$	3300	6	3	5	6	7	4
$1\frac{1}{2}$	4000	7	2	6	5	8	4
$1\frac{3}{4}$	4250	7	2	6	5	8	5
2	5000	7	2	6	5	8	5

Holding Drum—This drum controls the holding cable fastened to the top of the grab bucket. It takes the place of an extra drum on a hoisting engine and takes up automatically by means of a counterweight the slack in the holding cable when the closing cable is hoisting the loaded bucket. Full explanation for rigging this drum free on application.



COUNTERWEIGHT HOLDING DRUM

BLAW-KNOX COMPANY

Manufacturers of Steel Products

GENERAL SALES OFFICES
PITTSBURGH, PA.

EXECUTIVE OFFICES
HOBOKEN, PA.

NEW YORK, N. Y., 165 Broadway
BOSTON, MASS., Little Building
CHICAGO, ILL., People's Gas Building

DISTRICT SALES OFFICES

SAN FRANCISCO, CAL., Monadnock Building
DETROIT, MICH., Lincoln Building
SHEFFIELD, ENGLAND

WORKS: HOBOKEN, PA.

Products.

BLAW BUCKETS for every kind of service in which clamshells can be used with economy; BLAW AUTOMATIC SINGLE ROPE CABLEWAY APPARATUS.

For Blaw Steel Forms, Structural Steel, Plate Work, Knox Water Cooled Appliances, etc., see pages 102-103.

Blaw Single Line Buckets.

A Blaw Single Line bucket, operated with a single hoisting drum, can be hooked on the block of any crane, derrick or other hoist as easily as a sling, requiring no change whatever in the lines or machinery, to make the rig ready for clamshell work. When the bucket work is completed, slip off the closing line yoke and the crane is left free for other service.

The bucket can be reeved direct to operating drum for continuous service either for direct hoist or for operation in the "bight of line."

Blaw Single Line buckets give great closing power, not only economically handling coal, sand and other loose bulk materials, but also are in successful use excavating, cleaning out "skull cracker" pits and handling materials requiring heaviest bucket equipment.

No locks, catches, or other sliding parts to wear and give trouble. A powerful, effective tool built for hard work in use throughout the country in railroad yards, power plants, steel mills, foundries, sand pits, industrial plants, on construction work, etc.

Carried in stock in a great variety of sizes and



TRADE-MARK

weights from $\frac{1}{2}$ yd. (weighing 2000 lbs.) up to high power buckets weighing 11,000 lbs.

Blaw Speedster Buckets.

Designed for rehandling at high speed and with greatest economy, all classes of loose bulk materials such as sand, gravel, cinders, granulated slag, coal, etc. Require one closing line and arranged for either one or two holding lines.

A highly developed lever-arm type clamshell, reeved (internally) with 3-part closing line and automatic bell crank. Lines run absolutely straight from sheave to sheave; are entirely free from "S" bends and effectively guarded from the material in which the bucket is working. These features, together with an improved arrangement for leading rope into head of bucket, accomplish a great saving in wire rope wear.

The Speedster is built of sturdy, substantial, annealed open hearth steel castings and well designed steel forgings. The design accomplishes rigidity at head and scoop-hinge centers by reducing wear of parts to a minimum.

The automatic bell crank accomplishes two things; gives extra power at the beginning of the closing stroke and acts as a shock absorber when bucket is dumping.

Lubrication is provided for at points of motion by means of submerged screw plugs forcing in heavy grease. This is standard practice on all Blaw buckets.



BLAW SPEEDSTER BUCKET



BLAW SINGLE LINE BUCKET,
HOOK-ON TYPE



BLAW SINGLE LINE BUCKET
ON SKULL CRACKER PIT
WORK



BLAW SINGLE LINE BUCKET
HANDLING COAL FROM
PILE TO STOKER HOPPERS

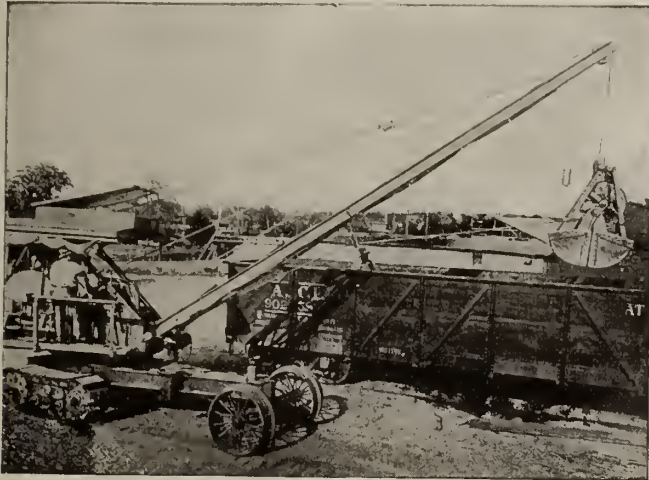


BLAW SPEEDSTER BUCKET REHANDLING SAND AND GRAVEL
FROM BARGE

Blaw Power-wheel Buckets.

By an ingenious mounting of the "bull-wheel" above the axis of the main hinge, this company has produced in the Blaw Power-wheel, a light but powerful clamshell bucket especially desirable on light portable derricks, cranes and excavators.

The bucket opens away out, yet the power wheel is well out of the material being handled. An unusually large power wheel is used, giving great closing power to the scoops with consequent enhanced pick-up ability. Equipped with teeth, these buckets are aggressive dig-



BLAW POWER-WHEEL BUCKET UNLOADING ROAD BUILDING MATERIALS FROM CARS

gers. As the bucket closes, the wheel tucks over to one side under the head, thus lowering the headroom clearance. This is an important gain on short boom machines.

For general rehandling of concrete aggregates, coal and other bulk materials, as well as on sewer and trench excavating, the power wheel has exceptional pickup capacity. The most powerful and effective bucket of its weight yet offered to the construction man.

Carried in stock in $\frac{1}{2}$ -, $\frac{3}{4}$ - and 1-yd. sizes for single or 2-part holding-line operation.

Blaw Automatic Single Rope Cableway Carriage.

Either standard carriage type of Blaw automatic single rope type cableways can be readily equipped for clamshell bucket operation by replacing the fall block with a Blaw Single Line bucket with tail sheave. No additional lines or changes in the hoist are needed. The low cost, ease of operation, and wide range of adaptability of this class of apparatus, equipped with an automatic digging and dumping bucket, make it extremely attractive for many types of construction work and

especially for rehandling materials over spans of 100 ft. or more.

The Blaw automatic single rope cableway, operated with a standard single drum non-reversible hoist, handles a Blaw Single Line bucket and forms ideal equipment for digging and transporting materials over long distances and serving storage piles covering large areas.

This company is prepared to equip existing cableways using tubs, skips or dragline buckets with every thing needed for clamshell bucket work.

Blaw Bulldog Buckets.

A powerful lever arm bucket built to handle broken rock, heavy ores, broken slag and similar refractory materials. Reeved internally with a 5-part closing line acting on end of lever arm, giving an extremely powerful closing stroke.

Carried in stock in sizes from $\frac{3}{4}$ to 3 cu. yds. Larger sizes on short notice.



BLAW BULLDOG BUCKET REHANDLING BLAST FURNACE SLAG

Blaw Four-line Buckets.

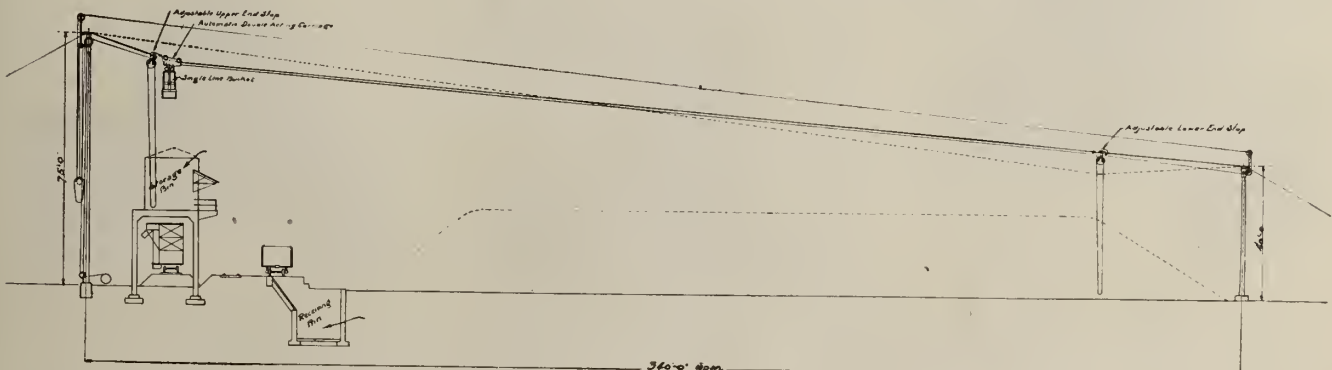
Built in sizes from 1 to 8 cu. yds. for coal and ore bridges, cranes and other rigs requiring either or both holding and closing line to "fleet through" the bucket. Very low headroom, light in weight, and of the power wheel type. Built in a variety of sizes from 1 cu. yd. up.

Blaw Dredger.

Like the Bulldog, a lever-arm bucket reeved for an extremely powerful closing stroke. Scoop and hinge arrangement designed with especial reference to quick dumping, making bucket more suitable than the Bulldog for handling sticky clay. The scoops have high "water level" capacity and are shaped to dig easily and rapidly. These buckets are used also for handling broken rock, ores, etc.; special attention has been given in the design to protect operating cables from wear and abrasion against materials bucket is handling.

The Blaw Dredger is built throughout in the heaviest and most substantial manner; all castings are open hearth annealed steel designed with special reference to securing rigidity at head hinge and scoop hinge centers. Corner bars are solid forged from soft steel ingots. There are few moving parts in bucket as in all other Blaw buckets; renewable bushings are provided wherever motion occurs.

Stock sizes run from $\frac{3}{4}$ yd. up. Complete specifications on request.



TYPICAL ARRANGEMENT OF BLAW AUTOMATIC SINGLE ROPE CABLEWAY INSTALLATION

THE BROWN HOISTING MACHINERY CO.

Manufacturers of Grab Buckets

MAIN OFFICE AND WORKS

CLEVELAND, OHIO

BRANCH OFFICES

NEW YORK, N. Y., 50 Church Street

CHICAGO, ILL., 208 South La Salle Street

PITTSBURGH, PA., Oliver Building

SAN FRANCISCO, CAL., Monadnock Building

EUROPEAN REPRESENTATIVE, H. E. HAYES, 12 Rue de Phalsbourg, PARIS, FRANCE

Products.

BROWNHOIST GRAB BUCKETS.

Storage Bins; Transfer Tables; Water Closet Shields; Ferroinclave, a combined Reinforcement and Centering for concrete roofs, sides, stairs, bins, floors, etc.

For Locomotive Cranes, Traveling Cranes, Hoists, Bridge Tramways and Trolleys, see pages 48-49; for Suspended Bins, Coal and Ash Handling Machinery, see page 891.

Brownhoist Grab Buckets.

These buckets are made to dig in coal, gravel, sand, crushed stone, cinders, ore, etc., and will excavate in ordinary soil. The excavating bucket is for excavating in stiff materials.

A grab bucket is usually subjected to extremely hard usage on account of the high rate of speed at which it is handled, and therefore the Brownhoist grab bucket has been made very strong in all parts, as will be seen in the illustrations. The bucket is so designed that it does not have to be dropped onto the material with pile hammer force to insure its filling. This results in the least damage to cars, boats, trucks, etc., and also saves wear on the bucket. Another important feature of this bucket is the wide spread of the spades when open, which gives a greater digging power than a bucket of same capacity but with a shorter spread of the spades. The ropes and sheaves are fully protected from the material being handled. The spades can be removed when worn and new ones applied.



FIG. 2. BROWNHOIST SINGLE-ROPE BUCKET

Equipped with trip lever operated by rope leading to ground or crane cab. When lever is tripped, bucket spades open and load is dumped.

BROWNHOIST

TRADE-MARK

Types.

There are the several types of Brownhoist patent grab buckets as shown, and the Contractor's type bucket and the Dragline bucket. There are two types of grab bucket: the two-rope, Fig. 1, and the single-rope, Fig. 2. The single-rope bucket is of similar design and construction to the two-rope, the only difference being in the operating mechanism.

Operation.

The two-rope bucket can be operated on any two-drum machine. The two ropes, the closing and the holding ropes, are so spaced that there is little tendency for the bucket to twist while being hoisted and lowered.

The bucket spade arms are attached to a crosshead which is operated up and down on the inside of the bucket by the closing rope. This opens and closes the spades. To dump the bucket, the holding rope is held fast and the closing rope payed out which permits the spades to open.

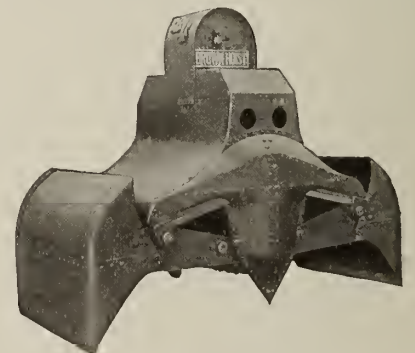


FIG. 1. BROWNHOIST STANDARD TWO-ROPE GRAB BUCKET FOR HANDLING COAL, COKE, CRUSHED STONE, CINDERS, ETC.

Bucket made a little heavier for working in ore, limestone and other heavy materials



FIG. 3. BROWNHOIST EXCAVATING BUCKET OF HEAVY CONSTRUCTION

Has greater digging power by reason of being somewhat narrower and having wider spread

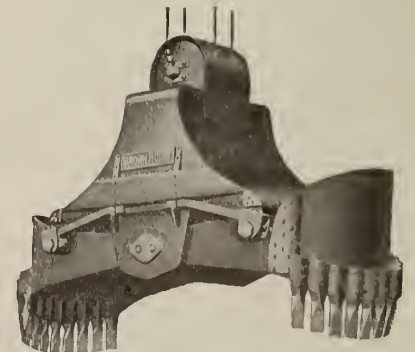


FIG. 4. BROWNHOIST SPECIAL GRAB BUCKET FOR DIGGING IN VERY HARD AND LARGE LUMP MATERIALS

Made with round cast steel spades with manganese steel teeth

Dimensions, with Diagram.

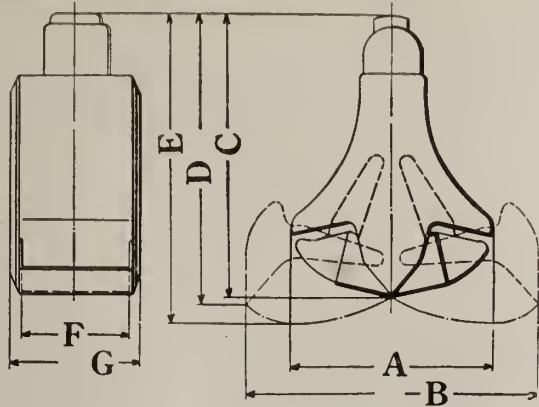


FIG. 5. DIAGRAM OF BROWNHOIST PATENTED BUCKET
Showing dimensions. See tables

TWO-ROPE BUCKETS, FIGS. 1 AND 3

Type	Code word	Capacity, cu. ft.	A	B	C	D	E	F	G	Net weight of bucket in lbs.	Measurement, cu. ft.
CG1	Rebac	27	5 6	7 9	6 6	6 8	7 2	3 2	3 8	2900	134
CG2	Rebed	40	6 9	9 7	7 4	7 7	8 3	2 10	3 6	3830	177
CG3	Rebif	54	6 9	9 7	7 4	7 7	8 3	4 5	5 1	4350	254
CG5	Rebuh	70	7 6	10 5	7 9	8 4	8 9	4 5	5 1	5200	290
CG6	Rebyk	84	8 6	11 10	8 6	8 11	9 7	4 5	5 1	7000	362
CG7	Rebwa	100	8 6	11 10	8 6	8 10	9 6	5 5	6 1	7500	435
CG12	Rebbi	110	8 6	12 9	8 3	8 4	9 3	5 5	6 1	7800	400
CG13	Rebco	180	9 7	14 5	11 5	11 7	12 6	6 0	7 0	10000	765
CG14	Rebka	230	11 11	17 8	12 10	13 2	14 5	5 6	6 6	13625	990
CG15	Rebno	260	11 10	17 7	13 4	13 9	14 11	7 8	8 8	15800	1360
CG16	Rebsi	360	11 10	17 7	13 4	13 9	14 11	9 0	10 0	17980	1580

SINGLE-ROPE BUCKETS, FIGS. 2 AND 3

Type	Code word	Material handled	Capacity, cu. ft.	A	B	C	D	E	F	G	Net weight of bucket in lbs.	Measurement, cu. ft.
OG8	Robaf	Ore	17	5 6	7 11	7 1	7 2	7 9	3 2	3 9	3300	173
OG9	Robeg	Ore	27	6 5	8 10	7 9	7 11	8 6	4 0	4 7	4410	240
CG9	Robih	Coal	27	5 6	7 11	7 1	7 2	7 9	3 2	3 10	3300	173
CG10	Robok	Coal	45	6 4	8 10	7 9	7 11	8 6	4 0	4 7	4580	257
CG11	Robul	Coal	54	6 10	9 4	8 0	8 5	8 11	4 5	5 0	5425	270
SG1	Robym	Sand	54	5 6	7 9	7 6	7 7	8 2	6 0	6 7	5000	280

EXCAVATING BUCKETS, FIGS. 3 AND 5

Type	Code word	Capacity, cu. ft.	A	B	C	D	E	F	G	Net weight of bucket in lbs.	Measurement, cu. ft.
EG1	Ribad	40	6 9	9 7	7 4	7 7	8 3	4 5	5 1	4400	242
EG2	Ribef	54	7 6	10 10	7 9	8 1	8 9	3 10	4 6	5300	263
EG3	Ribig	66	9 8	13 10	9 9	10 0	11 0	3 3	11	5550	390
EG4	Riboh	80	9 8	13 10	10 11	11 3	12 2	3 10	4 10	8700	510
EG5	Ribuk	115	11 10	17 6	13 1	13 5	14 8	5 0	6 0	12800	1412

SPECIAL GRAB BUCKETS, FIGS. 4 AND 5

Type	Code word	Capacity, cu. ft.	A	B	C	D	E	F	G	Net weight of bucket in lbs.	Measurement, cu. ft.
B1	Ritab	27	6 10	10 8	7 10	7 9	8 7	2 11	3 7	5800	190
B2	Ritak	40	7 11	11 9	8 1	8 3	9 0	4 2	4 11	7780	330

CONTRACTOR'S TYPE BUCKETS, FIGS. 6 AND 7

Type	Code word	Capacity, cu. yds.	A	B	C	D	E	F	G	H	Net weight of bucket in lbs.
Con. N1	Rutam	1/2	4 9	5 8	4 6	5 1	2 11	3 0	3 3	2 11	1600
Slag L1	Rusam										
Con. N2	Rutil	1	6 0	7 1	5 8	6 6	2 11	3 0	3 3	3 3	2500
Slag L2	Rusit										
Con. N3	Rutof	1 1/2	6 7	7 10	6 3	7 3	3 3	3 3	4 3	8 3	3500
Slag L3	Rusog										
Con. N4	Ruted										
Slag L4	Ruseb	2	7 1	8 6	6 8	7 7	3 6	3 8	3 10	3 7	4500

Prices furnished on application.

Brownhoist Contractor's Type Bucket.

Designed especially for working in sand, gravel, ashes, slag, etc. All bearings fitted with keyed bushings of manganese steel, which withstand the cutting tendency of fine particles of sand, etc. Digging edges are of manganese steel and can be easily removed when worn.

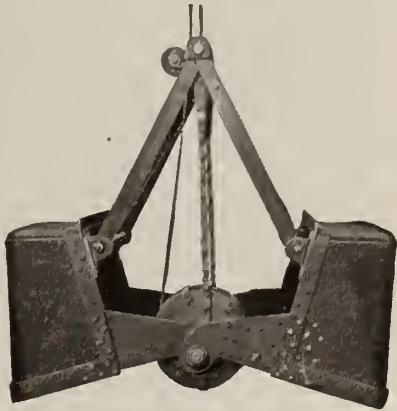


FIG. 6. BROWNHOIST CONTRACTOR'S TYPE BUCKET

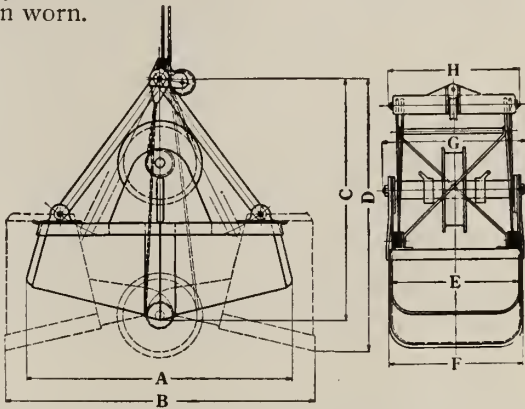


FIG. 7. DIAGRAM OF CONTRACTOR'S TYPE BUCKET
Showing dimensions. See table

Brownhoist Dragline Bucket.

A back-dumping bucket. It is operated by two lines, dragline and hoistline.

All standard buckets are equipped with steel cutting edge and two-part teeth. Each tooth is tipped with a manganese steel point. There are three types of points—which one to use depends upon whether the bucket is to work in loose digging, hardpan, or rock. Inquiries must state the class of work.



FIG. 8. BROWNHOIST SHNABLE PATENT DRAGLINE BUCKET

DRAGLINE BUCKETS, FIG. 8

Type	Code word	Capacity in cu. yds.	Width of cutting edge ft. in.	Net weight in lbs.
A-1	Ramab	1	3 0	2850
A-2	Ramac	1 1/2	3 6	4550
A-3	Ramad	2	4 2	5650
A-4	Ramaf	2 1/2	4 10	6850
A-5	Ramal	3	5 4	8200
A-6	Ramak	3 1/2	5 10	9600

THE HAYWARD COMPANY

Manufacturers of Orange Peel and Clam Shell Automatic Buckets, Drag Scraper and Electric Motor Buckets

Hudson Terminal Building
NEW YORK, N. Y.

Products.

ORANGE PEEL BUCKETS, CLAM SHELL BUCKETS, DRAG SCRAPER BUCKETS, ELECTRIC MOTOR BUCKETS, HAYWARD COUNTERWEIGHT DRUMS, GRAPPLES.

Skid Excavators, Coal Handling and Dredging Machinery.



Service.

The automatic bucket—originally considered a digging or loading machine—has developed a much wider field and today is also part of the conveying and rehandling systems of foundries, steel mills and power plants.

No single machine has been more generally adopted in the universal effort to handle bulk material more economically by mechanical means.

The succeeding pages merely suggest a few of the many applications of Hayward buckets to construction and industrial problems.

These typical examples may in some instances parallel conditions existing in your plant and hence demonstrate sufficiently the adaptability of Hayward buckets. If not, the Hayward engineers will be glad to co-operate in solving material handling problems most efficiently and economically.

Bulletins on particular classes of work, and recommendations on individual problem will gladly be sent without the request incurring the slightest obligation. Forty years of bucket building experience and ample manufacturing facilities are at your disposal.



No. A-2456. HAYWARD ELECTRIC MOTOR BUCKET
Rehandling fuel in a boiler room from car to bunkers



No. A-904. HAYWARD CLASS "E" CLAM SHELL BUCKET
On a mast and gaff rig, unloading coal from barge and dumping into hopper



HAYWARD ELECTRIC MOTOR BUCKET
In railroad ash pit service



No. A-2648. HAYWARD ORANGE PEEL BUCKET
Excavating material from within a caisson as it is being sunk



No. A-2358. HAYWARD 3-SIDED ORANGE PEEL BUCKET WITH CUT-OFF BLADES
Handling a boulder larger than itself



No. A-1645. HAYWARD CLASS "H" MULTI-POWER CLAM SHELL BUCKET (1½ CU. YDS.)
Working between sheeting 10 ft. apart and digging in sand, loam and gravel



No. C-495. HAYWARD ELECTRIC MOTOR BUCKET (3 CU. YDS.)
Loading broken open hearth slag into cars



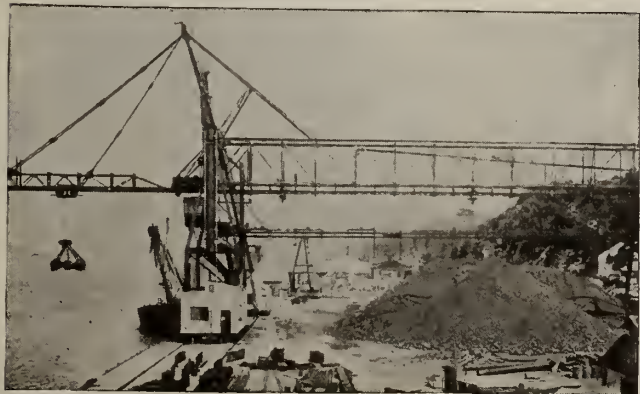
No. A-1675. HAYWARD CLAM SHELL BUCKET WITH ORE BOWL
Rehandling contractor's materials. Note the clean, accurate dump



No. C-355. HAYWARD CLAM SHELL BUCKET
Unloading crushed stone from barges



No. A-1927. HAYWARD CLAM SHELL BUCKET WITH ORE BOWL
Fitted with teeth for digging in hard packed sand or other compact materials



No. A-1584. HAYWARD SPECIAL CLAM SHELL BUCKET (2-TON CAPACITY)
Operating on bridge with 180-ft. span, unloading coal



No. A-1839. HAYWARD DRAG SCRAPER BUCKET
Digging in hard-pan. Note the full load cleanly carried



No. A-794. HAYWARD STANDARD ORANGE PEEL BUCKET

A 2-line bucket for general contractors' use. Recommended for dredging, excavating and rehandling bulk materials. Sizes from 2 cu. ft. up



No. A-798. HAYWARD MULTI-POWER ORANGE PEEL BUCKET

An extra heavy digging bucket with a 2-part side chain which gives nearly 60% more penetrating power. Sizes from 2 cu. ft. up



No. A-2595. HAYWARD 3-SIDED ORANGE PEEL BUCKET

Designed primarily to handle blasted rock and other hard and odd-shaped material, but is also an all around digging bucket. Sizes from 21 cu. ft. up



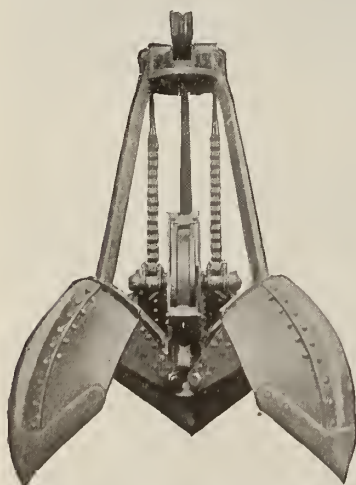
No. A-2503. HAYWARD ROPE REEVED ORANGE PEEL BUCKET

The latest model of the original Hayward bucket. Closing power is varied to suit conditions. Arranged to close by 3, 4, 5, 6 or 7 parts of line and to be operated in the bight of the line or direct. Sizes from 21 cu. ft. up



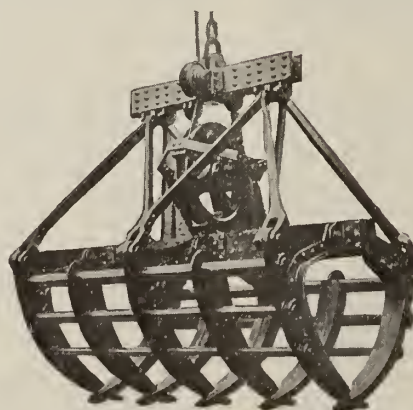
No. D-939. HAYWARD DWARF ORANGE PEEL BUCKET

A hand-operated miniature of the large orange peel buckets. Will dig inside a 12-in. pipe—the depth only limited by the length of the operating lines. Sizes from 100 cu. in. to 1 cu. ft.



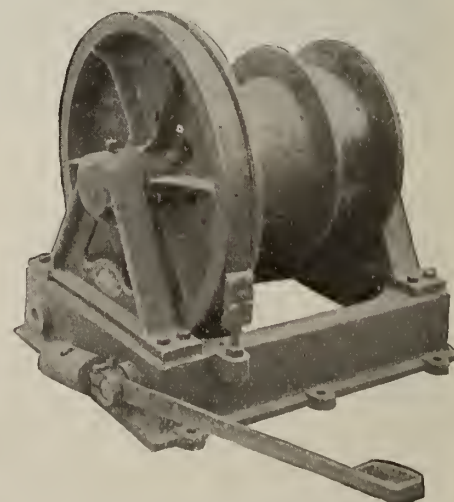
No. A-1943. HAYWARD EXTRA HEAVY 3-SIDED ORANGE PEEL BUCKET WITH CUT-OFF BLADES

The heaviest type (outside of special buckets) of orange peel, made for handling rock and specially reinforced for severe usage



No. A-159-a. HAYWARD GRAPPLES

Made in various styles for handling irregular-shaped bulk material such as logs, stumps, sugar cane, tin scrap, cord wood and similar uneven material



No. A-947. HAYWARD COUNTERWEIGHT DRUM

Takes the place of an additional drum on the engine. Is not connected to hoisting engine so may be placed in any convenient location for leading the holding line to the bucket and the counterweight line to the counterweight. Band brake operated by foot or hand lever



No. A-2565. HAYWARD CLASS "E" CLAM SHELL BUCKET WITH REGULAR BOWL

The light "E" bucket is recommended for handling coal and other light, loose materials; the heavy "E" for dredging. The shape of the bowls allows a gradual yet rapid discharge. Sizes from $\frac{1}{2}$ cu. yd. up.



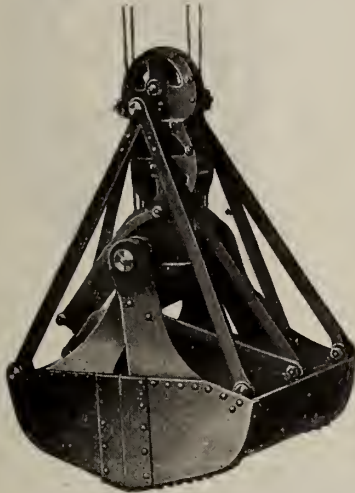
No. A-719. HAYWARD CLASS "E" CLAM SHELL BUCKET WITH ORE BOWL

In proportion to size, ore bowl buckets carry larger loads and will dig harder materials than regular bowls, owing to their shovellike shape. Sizes from $\frac{1}{2}$ cu. yd. up



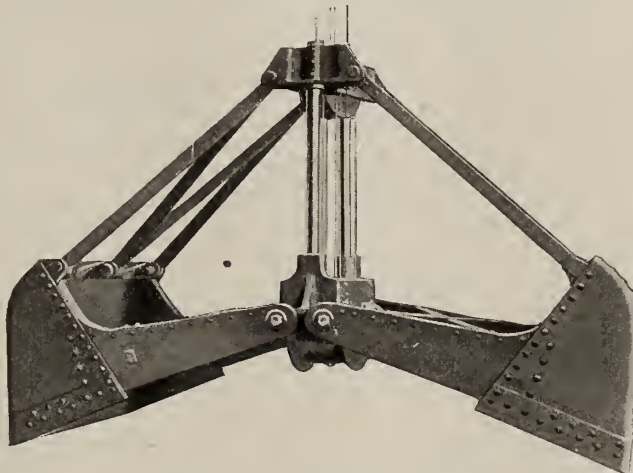
No. A-1037. HAYWARD CLASS "H" CLAM SHELL BUCKET

Has 60% more closing power than a Class "E" bucket and thus is slower, but the penetration is much greater and there is less tendency to lift while closing. Sizes from $1\frac{1}{2}$ cu. yds. up



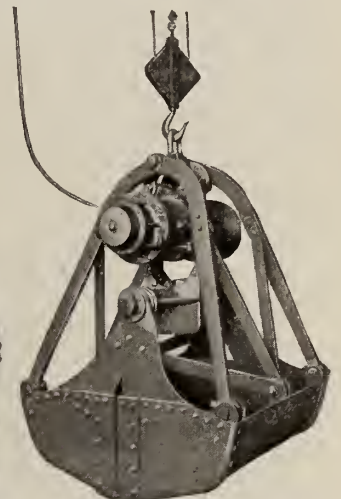
No. A-1323. HAYWARD CLASS "G" CLAM SHELL BUCKET WITH ORE BOWL

A rope reeved bucket. May be operated in bight of the line and practically twice the load handled without increasing size of hoisting engine. Advantageous on cableways, as no headroom is lost. Sizes from $\frac{1}{2}$ cu. yd. up



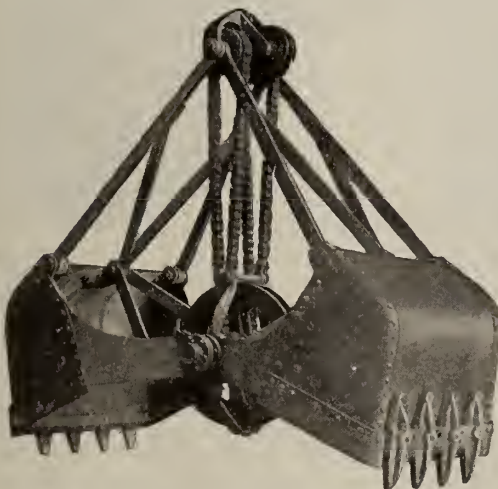
No. A-1599. HAYWARD SCRAPER CLAM SHELL BUCKET

Recommended for handling iron ore, pumped sand and other densely packed and heavy materials. Fills with but little material under the bucket, gathering its load by a combined digging and scraping movement. Sizes from $2\frac{1}{2}$ cu. yds. up



No. A-2377. HAYWARD ELECTRIC MOTOR CLAM SHELL BUCKET WITH ORE BOWL

Can be hung on a crane or any hoisting apparatus. Bowls are electrically operated with self-contained mechanism. Works within its own height. Digging and discharge under control at every stage. Sizes from $\frac{3}{4}$ cu. yd. up, with A.C. or D.C. motors



No. A-1340. TEETH FOR HAYWARD CLAM SHELL BUCKETS

Made of steel. Recommended for handling some materials in their natural state. Can be attached to all styles and sizes of Hayward clam shell buckets with ore bowls



No. A-1232. HAYWARD DRAG SCRAPER BUCKET

May be operated on almost every type of machine with double drum engine. Can be adjusted to enter material at any angle—and has no rigid bale or bridle in the bucket, hence nothing to break if it lands on side or top. Sizes from $\frac{3}{4}$ cu. yd. up

FOUNDED 1873

INDUSTRIAL WORKS

Manufacturers of Clamshell Buckets

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"INDUSWORKS, BAY CITY"

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Products.

POWER WHEEL, HIGH POWER and MULTIPOWER
CLAMSHELL BUCKETS.

For Locomotive Cranes, see pages 54-55.

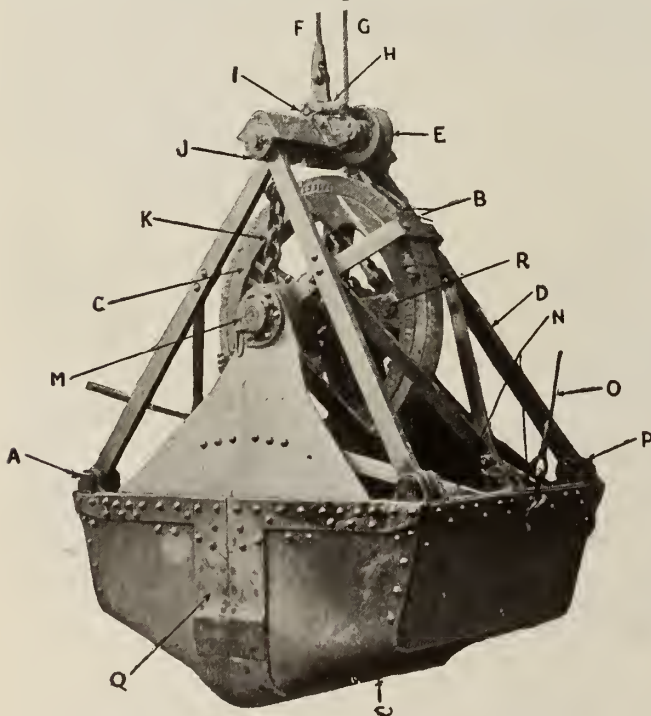
"Industrial" Power Wheel Bucket.

Owing to the simple and direct application of the opening and closing forces, this bucket is, without exception, the fastest operating bucket on the market today. It is extremely simple in design, which allows great strength, durability and rigidity with a moderate weight. At the same time no other bucket of the power wheel type has greater digging power.

This bucket is recommended for rehandling coal, gravel, sand, sugar beets, etc.

The power wheel type has many inherent advantages over other types of buckets. It may be rapidly attached or detached from the crane operating it. It is remarkably economical of hoisting rope, as one crane hoisting rope is fastened externally to the bucket head and the other hoisting rope winds about the large diameter power wheel and is guarded with roller guards against any possible chafing. The closing chains are round iron close link chains that can be repaired or renewed by any blacksmith.

This bucket is recommended as simple, safe and economical in operation. It will give a maximum of results with a minimum of repairs.



KEYED ILLUSTRATION OF POWER WHEEL BUCKET

SPECIFICATIONS—A—Hardened steel bushings in lower ends of connecting rods. (All wear is concentrated upon easily removable bushings.)

B—Patented steel rope guard extending completely around power wheel to prevent any possible fouling of closing line with consequent loss of time. Guard is made in halves and is large enough to allow spliced thimbles or open socket to pass through it.

C—Large heavy power wheel, bushed.

D—Heavy steel connecting rods, thoroughly braced to maintain proper alignment of bucket parts.

E—Hard alloy steel idler sheave, bushed.

F—Closing line, guarded at every point against chafing.

G—Opening line does not enter bucket.

H—Three roller rope guards about idler sheave.

I—Anchor pin for opening line, may be used with opening cable equipped either with thimble spliced in end or with open socket.

J—Hardened steel bushings in upper ends of connecting rods.

K—Best quality round iron chain, close link "dredge" type.

L—Patented crescent shaped equalizer distributes closing force between the two sides of chain and leads chain into grooves in power wheel hub. These grooves are arranged so chain leads into them with no unnecessary friction and greatly lengthens the service life of chains.

M—Steel shaft bearings. Note shaft is pinned to outside bearings to concentrate all wear on bushings in inner bearings.

N—Rigid braces to hold connecting rods in alignment.

O—Tagline connection that can be shifted to hold bucket at different angles.

P—Heavy cast steel corner brackets.

Q—Plate reinforcements scientifically located.

R—Simple way of fastening rope. Either spliced thimble or babbitted open socket may be used on closing line and either will pass all rope guards except at idler sheave. Rope clamps, not necessary but may be used. Bucket can be attached to or removed from crane ropes in 3 minutes. Only 3 pins need be removed (R, I, and pin in idler sheave E) and ropes are entirely free from bucket.

S—Replaceable hard alloy cast steel cutting edges.



PATENTED "ALL AROUND" ROPE GUARD



PATENTED ARRANGEMENT OF EQUALIZER AND GROOVES FOR THE CHAIN

DATA, POWER WHEEL BUCKETS

Capacity	Closed		Width	Open		Approximate weight
	Height	Length		Height	Length	
¾ cu. yd.	6'-0"	5'-4"	3'-5"	6'-11"	7'-2"	2600 lbs.
1 cu. yd.	6'-5"	5'-4"	3'-5"	7'-2"	7'-9"	3000 lbs.
1½ cu. yd.	7'-8"	6'-1"	3'-10"	8'-4"	9'-1"	3900 lbs.
2 cu. yd.	7'-11"	6'-2"	4'-8"	8'-6"	9'-8"	4800 lbs.

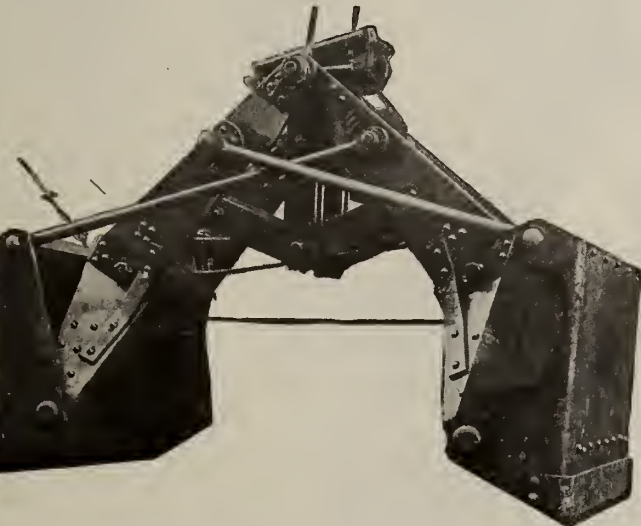
“Industrial” High Power Scraper Bucket.

This powerful bucket is of the scraper type and gathers its load by a combined digging and scraping action.

It is especially efficient in heavy ore, crushed stone, large lump coal, large producer coke, and water packed material, as it is one of the most powerful buckets in use, and shows no tendency to lift while closing. With the addition of hard alloy steel teeth it is available for severe excavating duty and will then operate in heavy clay, hardpan and other difficult materials.

ADVANTAGES—There are many advantages over buckets of the scraper type: (1) In the position of operating ropes and sheaves, as they are kept very high and out of the way of the material. (2) In the great power transmitted to edge of the blades, which increases as bucket is being closed; this brings the greatest crushing strength at the instant of closing and enables it to handle successfully materials impossible for ordinary buckets. (3) In the simple opening and closing mechanism that avoids the usual complicated link work. (4) In the increased speed of operation due to efficient arrangement of the cast steel connecting rods, which in closing force blades together rapidly and in opening pull them quickly to a dumping angle.

Trays are of flange steel with replaceable hard alloy steel shoes for cutting edges. Buckets are designed to concentrate all wear on the replaceable bushings, making renewals an easy and inexpensive matter. Rope sheaves are of hard alloy steel with finished treads and faces and are bronze bushed. A valuable feature is the complete system of rope guards to keep the rope in place and to reduce wear on it to a minimum. At the top of the bucket where the closing line enters, there are roller guards, so that from whatever direction the rope is pulled it can not rub. Special arrangements of holding lines may be provided for use on ore and coal bridges, traveling cranes, etc.



“INDUSTRIAL” HIGH POWER SCRAPER BUCKET						
Capacity	Closed		Width	Open		Approximate weight
	Height	Length		Height	Length	
¾ cu. yd.	7'-0"	6'-0"	3'-3¼"	6'-6"	8'-2¼"	3500 lbs.
1 cu. yd.	7'-10"	6'-0"	4'-2¼"	6'-6"	8'-2¼"	3800 lbs.
1½ cu. yd.	8'-0¾"	6'-0½"	4'-3"	6'-7¼"	8'-7½"	4300 lbs.
2 cu. yd.	8'-6½"	6'-8"	4'-3"	6'-10⅞"	9'-5½"	4700 lbs.

“Industrial” Multi-power Bucket.

This multi-power bucket has been developed from the power wheel type of which the most important advantages have been retained and about one-third greater digging power added.

It is recommended for general service in run-of-mine and lump coal, packed sand and gravel, crushed stone and for emergency light excavating duty. It ranks midway between the other two types in digging power.

The “M-P” bucket is of the rope reeved type, but the hoisting ropes from the crane are not reeved back and forth inside the bucket mechanism. A short piece of rope entirely separate from the crane ropes is used. The bucket can be attached to or detached from the crane in 3 minutes.

Practical men will be attracted by the fact that this bucket operates entirely with wire rope, requiring inside the bucket a short piece which can be readily replaced when necessary.

Other attractions are the large diameter sheaves used, the small compact operating mechanism, the substantial appearance and the great closing power.

All “Industrial” features are maintained as to material, rigid bracing, concentration of wear upon renewable bushings and hard alloy steel renewable cutting edges.

The all around rope guard for the crane rope on the power wheel is a feature of this bucket, although removed to show the operating ropes in illustration below.



“INDUSTRIAL” MULTI-POWER BUCKET						
Capacity	Closed		Width	Open		Approximate weight
	Height	Length		Height	Length	
1½ cu. yd.	7'-2"	6'-1"	3'-10"	8'-0"	9'-1"	4500 lbs.
2 cu. yd.	7'-4"	6'-1"	4'-9"	8'-2"	9'-1"	5400 lbs.
2½ cu. yd.	7'-4"	6'-1"	5'-8"	8'-2"	9'-1"	5800 lbs.
3 cu. yd.	8'-4"	7'-0"	6'-4"	9'-5"	10'-6"	6500 lbs.

BUFFALO HOIST & DERRICK CO.

Manufacturers of Clamshell Buckets

129 Erie Street
BUFFALO, N. Y.

NEW YORK OFFICE, 30 Church Street

Products.

CLAMSHELL BUCKETS.

For Locomotive Cranes and Hoists, see page 47.

Service.

The Engineering Department of this company will co-operate and place at the client's disposal its experience and service where problems involving a special type of bucket may arise.

Buffalo Buckets.

The Buffalo clamshell bucket is the result of a thorough scientific study by a corps of engineers building buckets for the past 20 years, and its remarkable efficiency is obtained conjointly with this fact and the embodiment of practical contractors' ideas.

These buckets are manufactured in two main types that cover the general needs of the contractor. Other types are also manufactured for special uses.

The Buffalo equalizing arm is the predominating feature in all types of Buffalo buckets. It causes the scoops to travel with uniform speed, thereby increasing

the efficiency of the bucket and insuring a maximum capacity.

STANDARD TYPE—This type bucket is suitable for handling coal, sand, gravel and similar material.

Made in capacities from $\frac{1}{2}$ to 3 cu. yds.

MONARCH TYPE—This type bucket is suitable for handling and digging hard clay, slag, frozen limestone and for all other purposes requiring a powerful heavy digging bucket.

The teeth on this bucket are forged steel and are bolted in place, so that they can be easily removed when not needed.

Made in capacities from $\frac{1}{2}$ to 3 cu. yds.

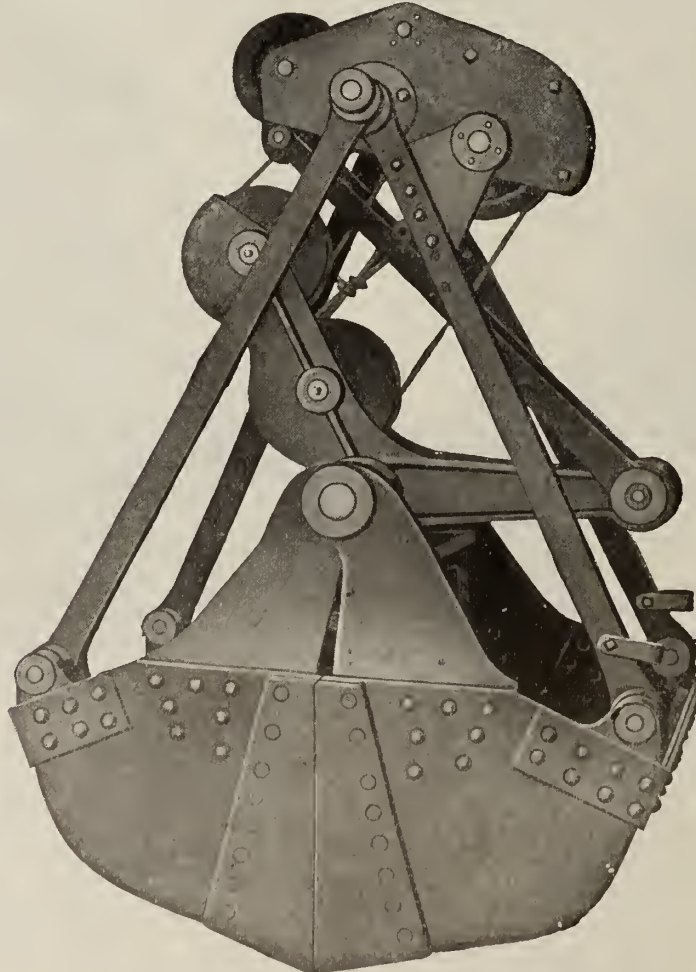
OTHER TYPES—Buffalo buckets are also made in 4 other types:

Clean-up Type—For use in cars, boats, etc.

Three-line Type—Designed for use on overhead or monorail cranes, where it is not practicable to maintain alignment of bucket by means of a steady carriage.

Four-line Type—Designed to operate on cable or man trolley bridges.

Slag Type—For handling granulated slag.



STANDARD TYPE BUFFALO CLAMSHELL BUCKET
Suitable for handling coal, sand, gravel and similar material

G. L. STUEBNER

Manufacturer of Hoisting Buckets, Dump Cars and Melting Furnaces for
Contractors' Service

TELEPHONE:
HUNTER'S POINT 59

201-221 Vernon Avenue
LONG ISLAND CITY, N. Y.

Products.

TURNOVER and BOTTOM DISCHARGE BUCKETS;
STEEL SKIPS; SMALL PLATFORM, END, SIDE and BOT-
TOM DUMP CARS.

PUSH CARTS, ASPHALT MELTERS, PIPE LINE LEAD
MELTING FURNACES, etc.

Standard Self-dumping and Self-righting Contractors' Buckets.

Made in classes "A" and "B." Designed for use
with stone, sand, clay, concrete, etc.

CLASS "A" — Top of
bucket is from 8 to 10 ins.
wider than the bottom, permit-
ting the bucket to be quickly
filled and rapidly dumped in a
clean manner. Easily handled
and well adapted for sinking
shafts, sewer work and similar
operations.



STEEL SKIP



"Invincible"
Bottom Dump
(Patented)



Self-dumping
and Self-righting
Turnover Type



"Excelsior" Bottom
Dump
(Patented)



"Pin-controllable"
Central Discharge
Pier Bucket
(Patented)



"Controllable"
Central Discharge
(Patented)



Two-line Bottom
Dump
(Patented)



Round Type



Side- and Back-lever Catch for Coal Hoisting



STUEBNER HOISTING BUCKETS

CLASS "B"—Similar to class "A," except that the
sides are straight, of equal width top and bottom.
This bucket is nicely balanced, has double bottom,
strong bail, trunnions, reliable latch; also, weighs and
costs less than class "A." See illustrations of various
types of buckets made by G. L. STUEBNER.

"CONTROLLABLE" CENTRAL DISCHARGE BUCKET—
Used for depositing concrete into smallest as well as
largest forms. Provided with patent pin-controlling
device, to regulate width of discharge opening; and with
powerful levers for controlling quantity of concrete
running out.

"EXCELSIOR" AND "INVINCIBLE" BOTTOM DUMP
BUCKETS—Particularly adapted to handle concrete, mud,
clay, sand, rock, etc. Quick acting, clean, dumping and
labor saving buckets.

Dump Cars, Push Carts and Melting Furnaces.

Strongly
built of best
materials, in
various types
and sizes, for
severe service.
See illustra-
tions.



End Dump



Side Dump

DUMP CARS



PUSH CARTS



BOILER ROOM
CHARGING
WAGON



STATIONARY
LEAD MELTING
FURNACE



PORTABLE TAR MELTING BOILERS



STATIONARY
TAR MELTING
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Capacities, Dimensions and Prices.

Quoted on application.

Catalogue.

Write for catalogue and further information.

THE G. H. WILLIAMS CO.

Manufacturers of Clamshell Buckets and Material Handling Machinery
ERIE, PA.

Products.

WILLIAMS CLAMSHELL BUCKETS, for digging and rehandling purposes.

Description.

The Williams buckets are the result of years of experience and will stand up under the most severe duty. Many different types and improvements are embodied in the present line.

A bucket for every purpose and operated on any type of machine.

Buckets for special purposes built on short notice.

Built entirely of steel and in sizes ranging from $\frac{1}{4}$ to 10 cu. yds. capacity.

Castings are best grade of open hearth steel, properly annealed; corner bars, forged steel; teeth 40 to 50 point carbon steel forgings; lips 40 to 50 point carbon steel except where manganese is used; scoops and plates open hearth steel; bushings phosphor bronze.

No cast iron is used.

Special Features.

The special features of Williams buckets are:

DIGGING ABILITY—The combination of lever (or power arm) and block and tackle principle exert great digging force to the cutting edge of the scoops and insure a full load. *Built to dig, and last while digging.*

LONG LIFE—The triangular construction, the large bearings and massive construction throughout insure long life.

LOW COST OF UPKEEP—Strength of materials employed, the perfect alignment and rigidity and the proper proportioning of its few number of parts.

ECONOMY OF OPERATION—Perfect lubrication, small

number of working parts, and straight leads over large sheaves insure long cable life and speed.

WORKMANSHIP—Is of the best and performed by high grade mechanics. Accurate replacements are insured by the use of the duplicate part system.

ROPE REEVING—A modification of the block and tackle principle which provides straight leads in perfect alignment.

LUBRICATION—All running parts lubricated from center which forces dirt out of bearings at each application.

GUARANTEE—Any parts proving defective will be replaced without charge, f. o. b. factory, on receipt of defective part, prepaid.

Favorite Bucket.

Designed especially for the economical handling of sand, gravel, crushed stone, ore, coal and like bulk material and is the proper weight for effective operation, making it particularly adaptable for use on locomotive cranes, derricks, monorail trolley and like installations.

The reinforced cutting lips are of manganese or high carbon steel plate, and designed to cover the bottom of scoops and to come up past the wearing point on the sides. They are designed to be easily removed in case of excessive wear.

Hercules Bucket.

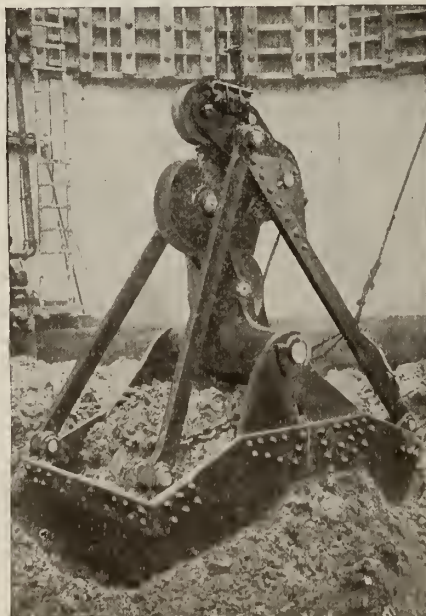
The most rugged and powerful bucket built, and is replacing orange peel buckets in the handling of the most difficult excavating and dredging work.

Hercules bucket handles hardpan, cemented gravel, clay, boulders, rock and iron ore.

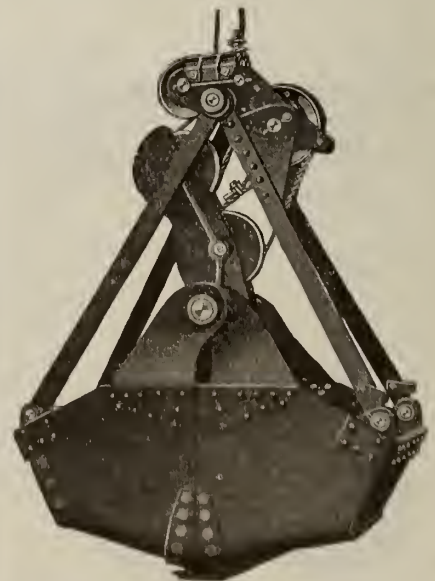
The scoops are formed of one continuous extra heavy plate, bent to shape, and fitted with high carbou



"FAVORITE" REHANDLING BUCKET



CLAMSHELL BUCKET IN OPERATION



HERCULES EXCAVATING BUCKET

steel cutting lips with chamfered cutting edge. Bucket is furnished with steel forged digging teeth.

No. 2 Single Rope Bucket.

Designed especially to operate in connection with hoisting machinery having only one drum available for bucket operation. It can be applied to any type of crane or derrick without added equipment. Practice has proved it to be of great help to general contractors, as it will handle all classes of work and material, and no special skilled or high priced labor is required for its operation.

Standard buckets are designed for handling coal, sand, gravel, etc.; and buckets of special weight for handling iron ore, furnace cinders, crushed stone, and for excavating.



No. 2. SINGLE ROPE BUCKET

No. 3 Single Rope Foundry Buckets.

Built to meet the need of some means of handling sand, coal, etc., in large foundries and plants, and to be operated by crane of ordinary type without special hoisting apparatus, which will leave the crane free for other service when bucket is not in use. This



No. 3. SINGLE ROPE FOUNDRY BUCKET

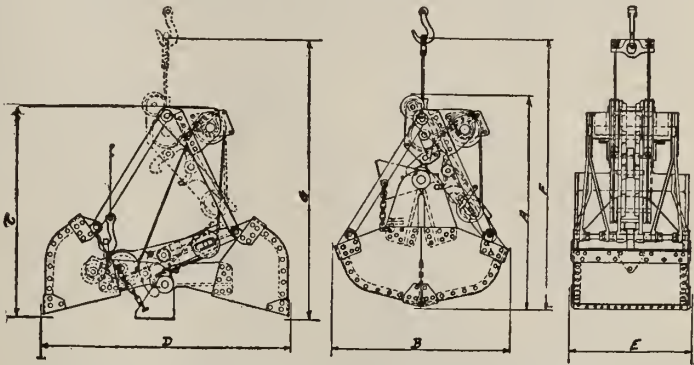
bucket can be attached or detached from crane hook in a few minutes and is designed for use where distance between crane hook and ground is limited.

A Bucket for Every Purpose and Installation.

For coal, sand, gravel and loose bulk material: Standard, Favorite, Scraper Type and No. 2 Single Rope buckets. For railroad, dredging and bridge contractor or general material handler: Standard X, Hercules and Special Dredging, Deep Water Dredging and No. 2 Single Rope buckets.

For manufacturers and users of overhead cranes, fast plants, monorail cranes and coal and ore bridges: No. 1 Single Rope and the Three and Four Rope buckets. For foundry service: No. 3 Single Rope bucket. For other types of buckets refer to the general catalogue issued by this company.

Standard buckets kept in stock for prompt shipment. Buckets for special purposes built on short notice. Put your bucket problems up to us for solution.



DIAGRAMS AND DIMENSIONS, WILLIAMS CLAMSHELL BUCKETS

Ca- pacity, cu. yds.	Approx. weight, lbs.	Over all dimensions					Code words
		A	B	C	D	E	
FAVORITE BUCKET							
1/2	2200	6'-10"	4'-10"	8'-0"	6'-0"	2'-10"	Factor
3/4	2500	7'-2"	5'-3 1/2"	8'-1"	6'-9"	2'-10"	Falcon
1	3100	7'-4"	5'-9"	8'-7"	6'-11"	3'-3"	Fellow
1 1/4	3400	7'-5"	6'-4"	9'-1"	7'-7"	3'-6"	Ferment
1 1/2	4500	8'-11"	6'-8 1/2"	10'-5"	8'-6 1/2"	3'-10"	Fisher
2	5000	8'-11"	6'-8 1/2"	10'-5"	8'-6 1/2"	4'-4"	Flutter
2 1/2	5700	9'-3"	7'-6"	11'-0"	9'-9"	4'-10"	Forest
3	6500	9'-3"	7'-6"	11'-0"	9'-9"	5'-4"	Founder
HERCULES BUCKET							
1/2	2600	6'-11"	4'-10"	8'-5"	6'-4"	2'-11"	Hansom
3/4	3100	7'-3"	5'-3 1/2"	8'-6"	7'-0"	2'-11"	Hardy
1	3800	7'-5"	5'-9"	9'-0"	7'-2"	3'-4"	Hermit
1 1/4	4200	7'-6"	6'-4"	9'-6 1/2"	7'-10 1/2"	3'-7"	Hindoo
1 1/2	5700	9'-0"	6'-9"	10'-10"	9'-0"	3'-11"	Hobble
2	7000	9'-0"	6'-9"	10'-10"	9'-0"	4'-5"	Homage
2 1/2	9000	9'-3"	7'-6"	11'-6"	9'-3"	4'-11"	Hornet
3	10500	9'-6"	7'-6"	11'-6"	9'-6"	5'-6"	Hurdle
No. 2 SINGLE ROPE BUCKET							
1/2	2400	6'-2"	4'-6"	6'-9 1/2"	6'-9"	2'-9"	Secretary
3/4	2650	6'-5"	5'-0"	6'-10 1/2"	7'-4"	2'-9"	Stratagem
1	3250	7'-0"	5'-6 3/4"	7'-9"	7'-9"	3'-3"	Succeed
1 1/4	3500	7'-3"	6'-0 3/4"	7'-11"	8'-4"	3'-9"	Satisfy
1 1/2	4500	9'-2 3/4"	6'-7 3/4"	9'-3 1/2"	9'-1"	3'-9"	Steno'pher
No. 3 SINGLE ROPE FOUNDRY BUCKET (SHOWN ABOVE)							
1/2	2700	5'-10"	4'-9"	6'-0"	6'-9"	3'-0"	Treasure
3/4	2900	6'-1"	5'-2"	6'-2"	7'-1"	3'-0"	Truot
1	3500	6'-1"	5'-2"	6'-2"	7'-1"	3'-6"	Trustee
1 1/4	3800	6'-3"	5'-4"	6'-4"	7'-5"	3'-9"	Treaty
1 1/2	4800	6'-5"	5'-6"	6'-6"	7'-9"	4'-0"	Truly
F G							
1/2	2700				9'-7"	9'-8"	Treasure
3/4	2900				9'-9"	9'-10"	Truot
1	3500				9'-9"	9'-10"	Trustee
1 1/4	3800				9'-11"	10'-0"	Treaty
1 1/2	4800				10'-3"	10'-6"	Truly

THE SASGEN DERRICK CO.

CANADIAN BRANCH
TORONTO, No. 1 Wabash Avenue

3101-3119 Grand Avenue
CHICAGO, ILL.

NEW YORK OFFICE
Grand Central Terminal

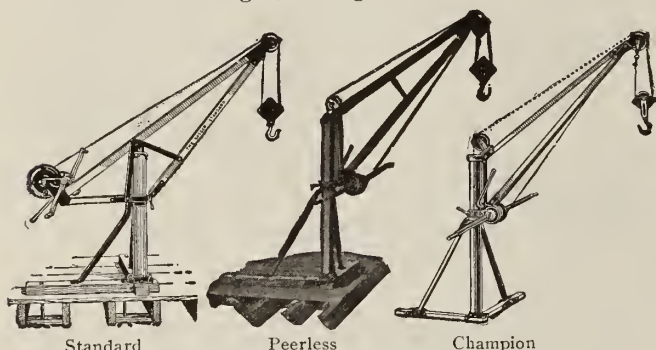
Products.

Manufacturers of PORTABLE CIRCLE SWING BUILDERS' DERRICKS for Hand, Horse or Power; CIRCLE SWING DERRICKS with DOUBLE DRUM WINCH for handling Orange Peel Buckets; STIFF LEGGED DERRICKS, 1 to 10 tons; "A" FRAME, TRIPOD, POLE, TOP POINT and REGULAR SETTER DERRICKS; HORSE and POWER MATERIAL ELEVATORS; WINCHES, CRABS, BLOCKS, and TOWER BOOMS.

Also, Stone and Timber Tongs, Stone Hooks, Lewises, Rope and Cable.

Advantages.

This company's motto is "Satisfaction or no Sale." Derricks shipped on trial to reliable contractors. These derrick are built of best malleable and steel fittings, which make them light, strong and durable.



SASGEN CIRCLE SWING DERRICKS

STANDARD—Equipped with best crucible steel and malleable fittings, including geared winch. Boom can be detached from mast. Operated by hand or power. Drum holds 275 ft. of $\frac{1}{4}$ -in. cable. Capacity 2500 lbs.; weight 350 lbs.; height 8 ft. Boom reach 5 ft. Equipped with 150 ft. steel cable and block.

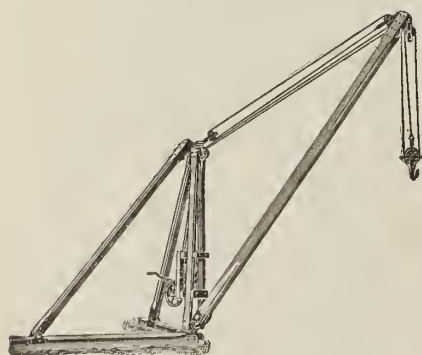
Price, hand power..... \$81.50
Price, hand and power..... 85.00
Equipped with steel boom, extra..... 4.50

PEERLESS—Self-lubricating bushings, load and boom brake; used by hand, horse or power. Boom instantly removed by loosening one nut. Weight 275 lbs.; capacity 1800 lbs.; height 8 ft. Boom reach 5 ft. Equipped with 125 ft. crucible steel cable and block.

Price, hand power..... \$68.50
Price, hand and power..... 71.50

CHAMPION—Used by hand, horse or power. Folds in two parts and can be transported in touring car. Has self-lubricating bushings, also boom and load brake. Weight 200 lbs.; capacity 1000 lbs.; height 7 ft. 6 in. Boom extends 5 ft. Equipped with 110 ft. steel cable and block.

Price, hand power..... \$54.00
Price, hand and power..... 56.00



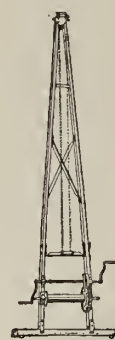
SASGEN STIFF LEGGED DERRICK



SASGEN POLE DERRICK

Equipped with winch not geared, 100-ft. cable, hoisting block. Very handy for light work

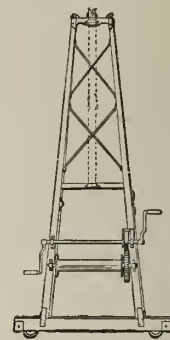
Cap., lbs.	Length, ft.	Price
1400	16	\$47.00
	18	48.00
	20	49.00



TOP POINT SETTER DERRICK

Equipped with all malleable and steel fittings, including gears. Has sheave frame at top and clamps for fastening extension pole

Cap., lbs.	Length, ft.	Price
3000	18	\$53.00
3000	20	55.00
3000	22	57.00



REGULAR SETTER DERRICK

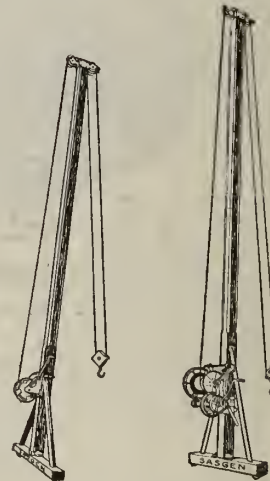
Equipped with all malleable and steel fittings, including gears. Has sheave frame at top and clamps for fastening extension pole

Cap., lbs.	Length, ft.	Price
4000	18	\$61.00
4000	20	63.00
4000	22	65.00



SASGEN "A" FRAME DERRICK

Practical for setting timbers, girders, columns, etc. Capacity 2500 lbs., with 125 ft. of cable. Price..... \$86.50
Combination pole and "A" frame, price.... 93.50



SASGEN POLE DERRICKS

Used by contractors, stone and iron setters. Equipped with crucible steel top sheave frame, lugs for guy lines, and sheave in back to bring cable to hoisting drum. Bottom sill has rollers. Equipped with 125 ft. crucible steel cable, block, complete for use

DATA ON SASGEN ONE, TWO, THREE AND FOUR-TON STIFF LEGGED DERRICKS

No.	Length boom, ft.	Price equipped for power	Price, with drum winch for hand	No.	Length boom, ft.	Price, equipped for power	Price, with drum winch for hand
ONE-TON CAPACITY				TWO-TON CAPACITY			
40	12	\$125.00	\$155.00	200	18	\$198.00	\$254.50
41	14	127.50	157.50	201	20	206.50	261.50
42	16	130.00	160.00	202	22	215.00	270.00
43	18	132.50	162.50	203	24	223.50	278.50
44	20	135.00	165.00	204	26	237.50	293.00
45	22	138.00	168.00	205	28	254.50	309.50
46	24	141.00	171.00	206	30	272.50	326.50
THREE-TON CAPACITY				FOUR-TON CAPACITY			
220	20	\$293.00	\$349.00	240	30	\$437.00	\$535.00
221	22	301.00	356.50	241	32	453.00	552.00
222	24	318.00	365.00	242	34	470.00	568.50
223	26	332.50	380.50	243	36	486.00	585.00
224	28	349.00	396.00	244	38	502.50	602.00
225	30	365.00	413.00	245	40	519.00	619.00
226	32	380.50	428.50	246	42	535.00	636.00
227	34	396.00	444.00	247	44	551.50	652.50
228	36	413.00	459.50	248	46	568.00	669.00
229	38	428.50	475.00	249	48	585.50	686.00
230	40	447.50	492.00	250	50	602.00	703.00

For stiff legged derricks from 5 to 10 tons write for prices. Give length of boom and capacity wanted.

Length, ft.	Size, in.	Capacity	Price
18	6 x 6	2,500	\$57.00
20	6 x 6	to	82.00
22	6 x 6	3,000 lbs.	59.00

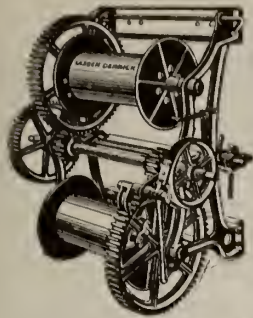
For additional lengths add \$1.00 per ft.

Length, ft.	Size, in.	Capacity	Price
18	6 x 8	4,000	\$80.00
20	6 x 8	to	82.00
22	6 x 8	5,000 lbs.	84.00

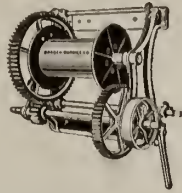
For additional lengths add \$1.50 per ft.

Length, ft.	Size, in.	Capacity	Price
18	8 x 8	8,000	\$138.00
20	8 x 8	to	140.00
22	8 x 8	10,000 lbs.	142.00

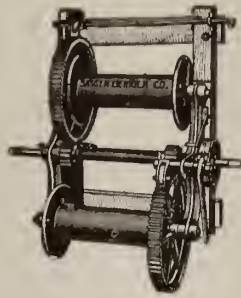
For additional lengths add \$2.00 per ft.



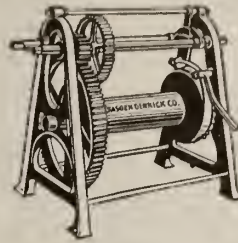
SASGEN DOUBLE DRUM
DOUBLE PURCHASE
WINCH



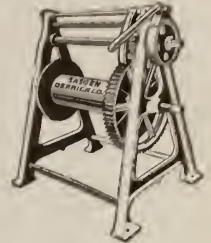
SASGEN SINGLE
DRUM DOUBLE
PURCHASE WINCH



SASGEN DOUBLE DRUM
GEARED WINCH



Double Purchase
SASGEN HOISTING
CRABS



Single Purchase
SASGEN HOISTING
CRABS

DATA, SASGEN WINCHES, GEARS AND
FRAME BEST MALLEABLE

No.	Diameter and length of drum, in.	Diameter of gear and pinion, in.	Lift 2 men 2 lines, lbs.	Lift 2 men 4 lines, lbs.	Price, each
DOUBLE DRUM DOUBLE PURCHASE WINCH					
150	9 x 14	22 x 15-4	10,000	20,000	\$125.00
151	9 x 16	" " "	"	"	128.50
152	9 x 18	" " "	"	"	132.00
153	9 x 20	" " "	"	"	135.50

SINGLE DRUM DOUBLE PURCHASE WINCH					
160	9 x 14	22 x 15-4	10,000	20,000	\$113.00
161	9 x 16	" " "	"	"	116.50
162	9 x 18	" " "	"	"	119.00
163	9 x 20	" " "	"	"	122.50

DOUBLE DRUM GEARED WINCH					
140	5 x 14	18 x 4	3,000	6,000	\$69.50
141	5 x 16	" " "	"	"	71.00
142	5 x 18	" " "	"	"	72.00
143	7 x 14	" " "	"	"	74.50
144	7 x 16	" " "	"	"	75.50
145	7 x 18	" " "	"	"	77.00

SINGLE DRUM GEARED WINCH					
130	5 x 14	18 x 4	3,000	6,000	\$36.00
131	5 x 16	" " "	"	"	37.00
132	5 x 18	" " "	"	"	38.00
133	7 x 14	" " "	"	"	39.00
134	7 x 16	" " "	"	"	40.00
135	7 x 18	" " "	"	"	42.00

JUNIOR SINGLE DRUM GEARED WINCH					
5	5 1/2 x 8	10 x 3	1,500	3,000	\$25.00
6	5 1/2 x 12	" " "	"	"	26.50

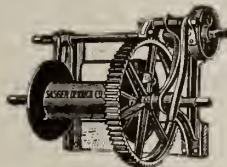
SMALL DOUBLE DRUM GEARED WINCH					
112	4 x 8	12 x 3	2,000	3,000	\$45.50

SMALL SINGLE DRUM GEARED WINCH					
110	4 x 8	12 x 3	2,000	3,000	\$18.50

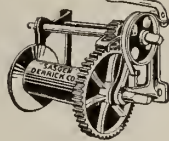
With bronze bushings, \$20.00.

DATA, SASGEN SAFETY WORM GEAR
WINCH MADE OF BEST MALLEABLE

No.	Diameter and length of drum, in.	Worm gear	Capacity 1 man 1 line, lbs.	Capacity 1 man 2 lines, lbs.	Price, each
1	5 1/2 x 6	....	750	1,500	\$16.00



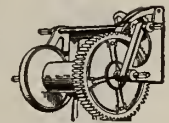
Single Drum



Junior
SINGLE DRUM
GEARED WINCHES



Double Drum



Single Drum
SASGEN SMALL
GEARED WINCHES



SASGEN SAFETY
WORM GEAR WINCH

DATA, SASGEN HOISTING CRABS AND
WINCH, GEARS AND FRAME BEST
MALLEABLE

No.	Diameter and length of drum, in.	Diameter of gear and pinion, in.	Lift 2 men 2 lines, lbs.	Lift 2 men 4 lines, lbs.	Price, each
DOUBLE PURCHASE HOISTING CRAB					
220	6 x 16	24 x 12-4 1/2	8,000	16,000	\$111.50
221	6 x 18	" " "	"	"	115.00
222	6 x 20	" " "	"	"	119.00
223	6 x 22	" " "	"	"	122.50
224	7 x 18	" " "	"	"	119.00
225	7 x 20	" " "	"	"	122.50
226	7 x 22	" " "	"	"	126.00
227	7 x 24	" " "	"	"	129.50

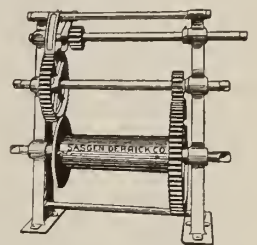
SINGLE PURCHASE HOISTING CRAB					
120	5 x 16	18 x 4	3,000	6,000	\$69.50
121	5 x 18	" " "	"	"	73.00
122	5 x 20	" " "	"	"	77.00
123	5 x 22	" " "	"	"	80.50
124	7 x 16	" " "	"	"	73.00
125	7 x 18	" " "	"	"	77.00
126	7 x 20	" " "	"	"	80.50
127	7 x 22	" " "	"	"	84.00

DOUBLE PURCHASE WAGON WINCH					
230	7 x 16	18 x 12-4 1/2	6,000	12,000	\$58.00
231	7 x 18	" " "	"	"	60.00
232	7 x 20	" " "	"	"	62.00
233	7 x 22	" " "	"	"	64.00
234	7 x 26	" " "	"	"	66.00
235	7 x 30	" " "	"	"	68.00

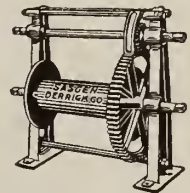
SINGLE PURCHASE WAGON WINCH					
240	6 x 14	18 x 4	3,000	6,000	\$44.00
241	6 x 16	" " "	"	"	45.00
242	6 x 18	" " "	"	"	46.00
243	6 x 20	" " "	"	"	47.00
244	6 x 22	" " "	"	"	48.00
245	6 x 24	" " "	"	"	49.00

DATA, SASGEN SINGLE SHAFT GEARED
WINCH

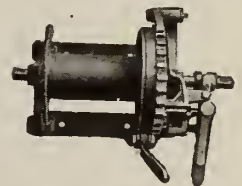
No.	Diameter and length of drum, in.	Geared	Lift 2 men 2 lines, lbs.	Lift 2 men 4 lines, lbs.	Price, each
115	4 1/2 x 5	3 to 1	1,500	3,000	\$23.00
SMALL WINCH, NOT GEARED					
3	3 1/2 x 7	.....	800	1,600	\$8.50



DOUBLE PURCHASE
WAGON WINCH



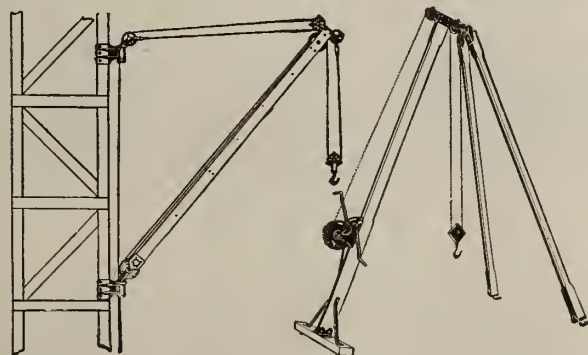
SINGLE PURCHASE
WAGON WINCH



SINGLE SHAFT
GEARED WINCH



SASGEN SMALL
WINCH, NOT GEARED



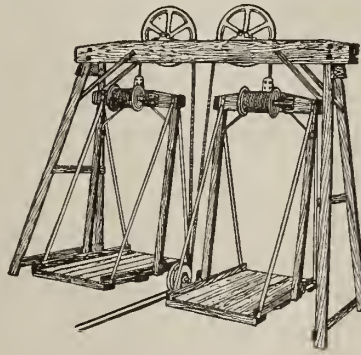
SASGEN TOWER BOOM

Has all crucible steel fittings; practical, light and strong; load and boom can be operated by power.
Price, 14-ft. boom..... \$66.00
Add \$1.00 per ft. up to 24 ft.
Price for fittings, per set. \$51.00



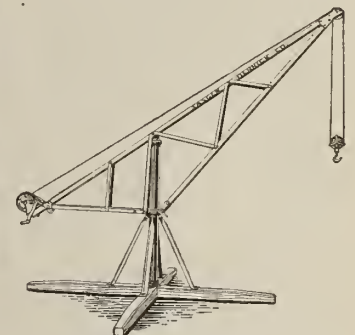
SASGEN TRIPOD

Capacity 3,000 lbs. Equipped with geared winch, 100-ft. cable. Price..... \$50.50



MATERIAL ELEVATOR

Cages 3 ft. 4 in. by 6 ft. Built of oak; well braced; fittings malleable iron except sheaves.
No. 300. Complete, without guides, \$132.00
No. 301. Brake attached for horse power..... 150.00
3/4-in. cable, 15c. per ft.; 1/2-in. cable, 16c. per ft. Guides, 25c. per ft.



SASGEN CIRCLE SWING COUNTER-
WEIGHT DERRICK

Can be used portable or stationary. Has height of 14 ft., circle swing of 18 ft. Weight 500 lbs. Capacity 1500 lbs. Equipped with cable and block. Price..... \$126.00

AMERICAN STEEL & WIRE COMPANY

Manufacturers of Wire Rope

SALES OFFICES

CHICAGO, 208 South La Salle Street
NEW YORK, 30 Church Street
WORCESTER, 94 Grove Street
BOSTON, 120 Franklin Street
PHILADELPHIA, Widener Building
PITTSBURGH, Frick Building
BUFFALO, 337 Washington Street
DETROIT, Foot of First Street
CINCINNATI, Union Trust Building

CLEVELAND, Western Reserve Building
BALTIMORE, 32 South Charles Street
WILKES-BARRE, PA., Miners Bank Building
ST. LOUIS, Third National Bank Building
ST. PAUL-MINNEAPOLIS, Pioneer Building, St. Paul
OKLAHOMA CITY, State National Bank Building
BIRMINGHAM, ALA., Brown-Marx Building
DENVER, First National Bank Building
SALT LAKE CITY, Walker Bank Building

EXPORT REPRESENTATIVES, UNITED STATES STEEL PRODUCTS Co., 30 Church Street, New York

PACIFIC COAST REPRESENTATIVES, UNITED STATES STEEL PRODUCTS Co., San Francisco, Los Angeles, Portland, Seattle

Products.

All kinds of WIRE ROPE in the following qualities: Iron, Crucible Cast Steel, Extra Strong Crucible Cast Steel, Plow Steel and Monitor Plow Steel or Tico Special.

A full line of Wire Rope Fittings: Slings, Thimbles, Clips, Clamps, Sockets, Hooks, Turnbuckles, Shackles, Blocks, Sheaves, etc.

For Concrete Reinforcement, see pages 158-63; for Wire Fencing, see pages 378-79; for Electric Wires and Cables, see pages 1092-1108.

Qualities of Wire Rope and Their Uses.

Wire rope is made in the following 5 qualities:

IRON ROPE—The wires are made from the best quality iron, being soft, tough and flexible. They are of low tensile strength, approximately 85,000 lbs. per sq. in. Iron hoisting rope is most generally used for elevator hoisting, where the strength is sufficient. It is almost universally employed for counterweight ropes, except on traction elevators. For traction elevators this company recommends mild steel hoisting rope.

CRUCIBLE CAST STEEL ROPE—This is a medium strength material, tough and pliable, of moderate cost and general utility. Weighs only about half as much as iron for same strength; is harder, and better resists external wear. This rope is applicable to a great variety of uses, among which may be noted mine hoisting, logging, elevators, derricks, hay presses, dredges, cableways, inclined planes, coal hoists, conveyors, ballast unloaders, skip hoists and many other uses.

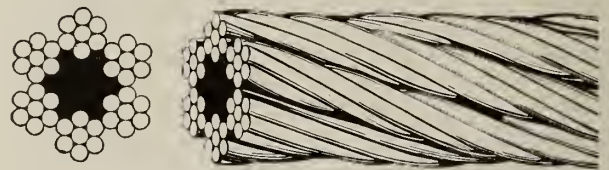
EXTRA STRONG CRUCIBLE CAST STEEL ROPE—Of higher tensile strength than the crucible steel, and is tough, pliable, a little lighter for the same strength than crucible steel, and about two and one-half times the strength of iron. It has been found particularly useful for oil well drilling and tubing lines. Its other general uses are similar to those of the crucible steel, except that it may be used where loads are somewhat heavier.

PLOW STEEL ROPE—Combines lightness and great strength; is somewhat stiffer than crucible steel and nearly three times as strong. Used particularly for heavy mine hoisting, derricks, inclined planes, dredges, cableways, for heavy logging and similar uses. It is the most economical rope to use where the weight of the rope has to be considered, or where the capacity of the machinery is to be increased without a corresponding increase in sheaves and drums.

MONITOR PLOW STEEL ROPE—This is the highest strength rope made. It is somewhat stiffer in the same diameter than the plow and crucible steel grades, but, strength for strength, it is equally flexible. Very useful where great strength, lightness and abrasive resisting qualities are required.

Transmission, Haulage or Standing Rope.

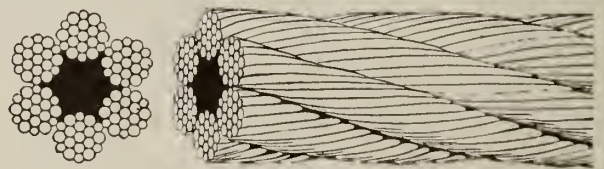
The coarsest rope, *i. e.*, 6 by 7 construction, a relatively stiff rope with large wires, capable of resisting external wear or abrasion; but it is the least flexible.



TRANSMISSION, HAULAGE OR STANDING ROPE (6x7)

Hoisting Rope.

Composed of 6 strands of 19 wires each, with hemp core. Used for elevators, mine hoisting, derricks, dredges, cableways, inclined planes, coal hoists, conveyors, ballast unloaders, skip hoist, oil well drilling and tubing lines.

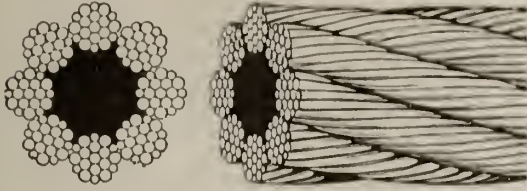


HOISTING ROPE (6x19)

Extra Flexible Hoisting Rope.

This rope is composed of 8 strands of 19 wires each, laid around a hemp core. The addition of these 2 strands over the standard hoisting rope increases the flexibility and permits the rope being used over comparatively smaller sheaves and drums.

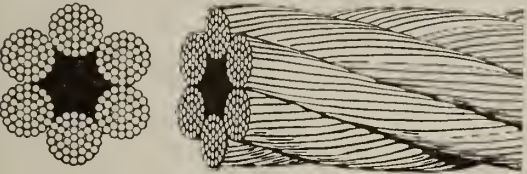
Adaptable for derricks, steam dredges, coal and ore handling machinery, pile drivers, and also for logging purposes, as well as tubing lines for oil wells.



EXTRA FLEXIBLE STEEL HOISTING ROPE (8 x 19)

Special Flexible Hoisting Rope.

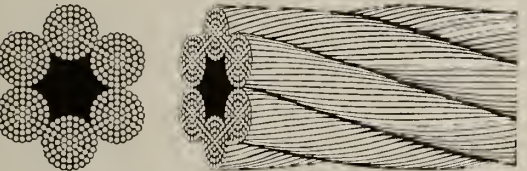
This rope is composed of 6 strands of 37 wires each, laid around a hemp core. This is a very flexible rope, and used largely on cranes and similar machinery where sheaves, of a necessity, are small.



SPECIAL FLEXIBLE STEEL HOISTING ROPE (6 x 37)

Extra Special Flexible Hoisting Rope.

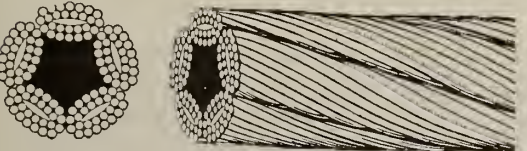
Composed of 6 strands of 61 wires each, with 1 hemp core, and recommended for dredging purposes, for which it is usually made with special wire center.



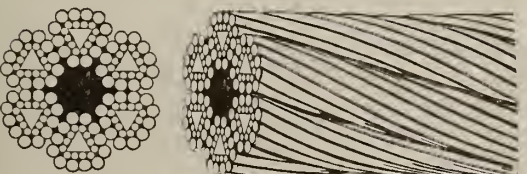
EXTRA SPECIAL FLEXIBLE HOISTING ROPE (6 x 61)

Flattened Strand Hoisting Ropes.

These ropes compare in flexibility with the standard hoisting rope, but possess about 150% greater wearing surface than the round strand ropes of same diameter, and have been used generally in the same places. (For data see following page.)



Type A (5 x 28)



Type B (6 x 25)

FLATTENED STRAND HOISTING ROPES

DATA, VARIOUS CONSTRUCTIONS AND GRADES OF WIRE ROPE

IRON					CRUCIBLE CAST STEEL		EXTRA STRONG CRUCIBLE CAST STEEL		FLOW STEEL		MONITOR FLOW STEEL		
Diam. in ins.	Weight per ft. in lbs.	Proper working load in tons of 2000 lbs.	Diam. of drum or sheave in ft. advised	List price per ft.	Proper working load in tons of 2000 lbs.	Diam. of drum or sheaves in ft. advised	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.
TRANSMISSION, HAULAGE OR STANDING ROPE—6 STRANDS, 7 WIRES TO STRAND, 1 HEMP CORE													
1 1/2	3.55	6.4	16	\$0.51	12.6	11	\$0.60	14.6	\$0.75	16.4	\$0.90	18	\$1.05
1 3/8	3	5.6	15	.43	10.6	10	.51	12.6	.64	14.4	.76	16	.88
1 1/4	2.45	4.6	13	.36	9.2	9	.43	10.8	.53	12	.62	13	.72
1 3/16	2	3.8	12	.30	7.4	8	.36	8.6	.44	9.4	.51	10	.58
1 1/8	1.58	3	10.5	.24	6.2	7	.29	7	.35	7.6	.41	8.4	.48
7/8	1.20	2.4	9	.18 1/2	4.8	6	.22 1/2	5.6	.27	6.2	.32	6.6	.37
3/4	.89	1.7	7.5	.14	3.7	5	.17	4.2	.20	4.6	.24 1/2	5	.28 1/2
11/16	.75	1.5	7.25	.12	3.1	4 3/4	.14 1/2	3.3	.17	3.6	.21	4	.24 1/2
5/8	.62	1.2	7	.10	2.6	4 1/2	.12	2.9	.14 1/4	3.2	.17 1/2	3.5	.20 1/2
1/2	.50	.96	6	.08 3/4	2	4	.10	2.2	.12	2.4	.14 1/2	2.6	.17
3/8	.39	.74	5.5	.06 1/2	1.5	3 1/2	.08	1.8	.09 1/2	2	.11 1/2	2.2	.13 1/2
7/16	.30	.52	4.5	.05 1/2	1.1	3	.06 1/2	1.25	.07 1/2	1.4	.09	1.5	.11 1/2
3/16	.22	.44	4	.04 1/2	.92	2 3/4	.05 1/2	1.05	.06	1.2	.06 3/4	1.3	.08 3/4
1/8	.15	.34	3.5	.03 3/4	.70	2 1/4	.04 1/2	.79	.05 1/2	.88	.06	1	.11 1/2
1/16	.12 1/2	.24	3	.03 1/4	.50	1 3/4	.04	.59	.05	.68	.05 1/2		

HOISTING ROPE—6 STRANDS, 19 WIRES TO STRAND, 1 HEMP CORE														
2 3/4	11.95	22.2	17	\$1.70	42.2	11	\$2.10	48.6	\$2.55	55	\$3.00	63	\$3.45	
2 1/2	9.85	18.4	15	1.40	34	10	1.75	40	2.10	46	2.50	53	2.80	
2 1/4	8	14.4	14	1.17	26.6	9	1.44	32	1.70	37	2.00	42	2.50	
2	6.30	11	12	.95	21.2	8	1.16	24.6	1.34	28	1.58	33	1.85	
1 3/4	5.55	10	12	.88	19	8	1.02	22.4	1.25	25	1.46	30	1.75	
1 3/8	4.85	8.8	11	.80	17	7	.90	19.8	1.10	22	1.30	27	1.60	
1 1/2	4.15	7.6	10	.65	14.4	6.5	.77	16.6	.94	19	1.08	22	1.30	
1 1/4	3.55	6.6	9	.57	12.8	6	.66	14.6	.80	16	.93	20	1.10	
1 3/16	3	5.6	8.5	.49	11.2	5.5	.56	12.8	.68	14	.79	17	.90	
1 1/8	2.45	4.56	7.5	.40	9.4	5	.46	10.6	.56	12	.65	14	.75	
1 1/16	2	3.72	7	.33	7.6	4.5	.38	8.6	.46	9.4	.54	11	.62	
1	1.58	2.90	6	.26	6	4	.31	6.80	.37	7.6	.43	9	.50	
3/4	1.20	2.36	5.5	.20	4.6	3.5	.24	5.20	.29	5.8	.34	7	.39	
7/8	.89	1.70	4.5	.16	3.5	3	.19	4.04	.22	4.6	.26	5.3	.31	
5/8	.62	1.20	4	.12	2.5	2.5	.14	2.80	.16 1/2	3.1	.19	3.8	.22 1/2	
3/8	.50	.94	3.5	.10	2	2.25	.12	2.24	.14	2.4	.16	2.9	.19	
1/2	.39	.78	3	.08 1/2	1.68	2	.11	1.84	.12 1/2	2	.14	2.4	.17	
7/16	.30	.58	2.75	.07 1/2	1.30	1.75	.10	1.45	.11 1/2	1.6	.13	1.9	.15 1/2	
3/16	.22	.48	2.25	.07	.96	1.50	.09 1/2	1.06	.11	1.15	.12 1/2	1.35	.14 1/2	
1/8	.15	.30	2	.06 3/4	.62	1.25	.09 1/4	.70	.10 3/4	.76	.12 1/4	.9	.13 1/2	
1/16	.10	.22	1.50	.06 1/2	.44	1.00	.09	.49	.10 3/4	.53	.12	.63	.13	

EXTRA FLEXIBLE HOISTING ROPE—8 STRANDS, 19 WIRES TO STRAND, 1 HEMP CORE														
1 1/2	3.19				11.6	3.75	\$0.73	13	\$0.88	14.8	\$1.03	16	\$1.19	
1 3/8	2.70				10.2	3.5	.62	11	.75	12.8	.87	13	.98	
1 1/4	2.20				8.4	3.2	.51	9.4	.62	10.4	.72	11	.82	
1 3/16	1.80				6.8	2.83	.42	7.6	.51	8.6	.60	9.2	.68	
1	1.42	3.1	6.	\$0.29	5.2	2.5	.34	5.9	.41	6.6	.48	7.2	.55	
3/4	1.08	2.6	5.5	.22	4	2.16	.27	4.6	.32	5.2	.38	5.6	.43	
7/8	.80	1.9	4.5	.18	3.06	1.83	.21	3.5	.25	4	.29	4.4	.34	
5/8	.56	1.4	4.	.14	2.18	1.75	.16	2.5	.18 1/2	2.8	.21	3	.25	
3/8	.45	1.2	3.5	.11 1/2	1.74	1.5	.14	2	.16	2.32	.18	2.4	.22	
1/2	.35	1.	3.	.09 1/2	1.46	1.33	.12	1.6	.14	1.74	.16	1.9	.19	
7/16	.27				1.14	1.16	.11	1.26	.13	1.38	.15			
3/16	.20				.84	1	.10 1/2	.93	.12 1/4	1.02	.14			
1/8	.13				.55	.83	.10 1/4	.61	.12	.67	.13 1/2			
1/16	.09				.36	.75	.10	.40	.11 3/4	.45	.13 1/4			

SPECIAL FLEXIBLE HOISTING ROPE—6 STRANDS, 37 WIRES TO STRAND, 1 HEMP CORE														
2 3/4	11.95				40		\$2.30	47	\$2.80	53	\$3.30	55	\$3.75	
2 1/2	9.85				32		1.92	37	2.35	43	2.75	45	3.15	
2 1/4	8				25		1.60	30	1.90	35	2.20	37	2.50	
2	6.30				21		1.35	23	1.55	26	1.80	27	2.10	
1 3/4	5.55				18.8		1.20	21.2	1.41 1/2	23.8	1.65	25	1.92 1/2	
1 3/8	4.85				17		1.05	19	1.28	22	1.50	23	1.75	
1 1/2	4.15				14		.89	16	1.07	18	1.25	19	1.45	
1 1/4	3.55				12	3.75	.79	14	.95	16	1.10	17	1.25	
1 3/16	3				11	3.5	.65	12	.78	14	.91	14	1.05	
1 1/8	2.45				9	3.2	.55	10	.65	11	.75	11	.86	
1 1/16	2				7	2.83	.46	8	.55	9	.64	9.2	.75	
1	1.58				6	2.5	.37	6.4	.44	7	.50	7.4	.59	
3/4	1.20				5	2.16	.28	5	.34	5	.40	5.8	.46	
7/8	.89				3.5	1.83	.23	3.8	.27	4	.31	4.6	.36	
5/8	.62				2.2	1.75	.18	2.5	.21	3	.24	3.2	.27	
3/8	.50				1.9	1.5	.15	2.1	.17 1/2	2.3	.20	2.5	.23	
1/2	.39				1.45	1.33	.13	1.65	.15	1.85	.17	1.9	.20	
7/16	.30				1.1	1.16	.12 1/2	1.27	.14	1.4	.16	1.5	.18 1/2	
3/16	.22				.84	1	.12	.93	.13	1	.15	1.06	.17 1/2	

Diameter of drum advised for extra strong crucible cast steel, plow steel and monitor plow steel ropes is same as for crucible cast steel.
The tensile strength is 5 times the proper working load given above.

EXTRA SPECIAL FLEXIBLE HOISTING ROPE—6 STRANDS, 61 WIRES TO EACH, 1 HEMP CORE

Diam. in ins.	Weight per ft. in lbs.	Diam. of drum or sheave in ft. advised	Proper working load in tons of 2000 lbs.	List price per ft.	CRUCIBLE CAST STEEL		EXTRA STRONG CRUCIBLE CAST STEEL		FLOW STEEL		MONITOR FLOW STEEL	
					Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.
3 1/4	16.60	11	56		63		70		74		74	
3	14.20	10	48		55		62		65		65	
2 3/4	11.95	9	40	\$2.53	47	\$3.08	53	\$3.63	56	\$4.12	56	\$4.12
2 1/2	9.85	8	32	2.11	37	2.58	43	3.02	45	3.46	45	3.46
2 1/4	8.00	7	25	1.76	30	2.09	35	2.42	37	2.75	37	2.75
2	6.30	6	21	1.48	23	1.70	26	1.98	27	2.31	27	2.31

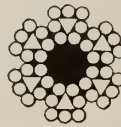
DATA, FLATTENED STRAND HOISTING ROPES

Diam. ins.	IRON				CRUCIBLE CAST STEEL					EXTRA STRONG CRUCIBLE CAST STEEL*			MONITOR PLOW STEEL			
	Type A				Type A	Type B		Types A and B		Type A	Type B	Types A and B	Type A	Type B	Types A and B	
	Proper working load in tons of 2000 lbs.	Weight per ft. in lbs.	Diam. of drum or sheave in ft. advised	List price per ft.	Proper working load in tons of 2000 lbs.	Proper working load in tons of 2000 lbs.	Weight per ft. in lbs.	Diam. of drum or sheave in ft. advised	List price per ft.	Proper working load in tons of 2000 lbs.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	Proper working load in tons of 2000 lbs.	Diam. of drum or sheave in ft. advised	List price per ft.
2 1/4	14.4	8.00	11 1/4	\$1.52	26.6	29.2	9.20	8 1/2	\$1.82	32	35.2	\$2.20	42	46.2	12	\$2.85
2 3/4	11	6.30	10 3/4	1.20	21.2	23.4	7.25	8	1.44	24.6	27	1.77	33.2	36.6	11	2.25
1 1/2	8.8	4.85	9	1.04	17.0	18.8	5.60	7 1/4	1.21	19.8	21.8	1.55	26.6	29.2	9	2.08
1 3/4	7.6	4.15	7 1/2	.82	14.4	15.8	4.75	6 3/4	.96	16.6	18.2	1.30	22	24.2	8 1/2	1.56
1 1/2	6.6	3.55	6 3/4	.74	12.8	14.0	4.00	5 3/4	.86	14.6	16	1.05	19.6	21.6	8	1.37
1 1/4	5.6	3.00	6 1/4	.625	11.2	12.4	3.45	5 1/2	.73	12.8	14	.90	16.8	18.4	7 1/2	1.12
1 1/4	4.56	2.45	5 3/4	.52	9.4	10.4	2.80	5	.595	10.6	11.6	.70	13.8	15.2	7	.89
1 1/8	3.72	2.00	5 1/4	.43	7.6	8.4	2.30	4 1/2	.50	8.6	9.4	.59	11.2	12.4	6	.71
1	2.99	1.58	4 3/4	.34	6.0	6.6	1.80	4	.395	6.8	7.4	.48	9	10.0	5	.60
7/8	2.36	1.20	4	.26	4.6	5.0	1.38	3 1/2	.30	5.2	5.8	.38	7	7.8	4 1/2	.49
3/4	1.70	.89	3 1/2	.21	3.5	3.86	1.00	3	.24	4.04	4.44	.30	5.26	5.8	4	.375
5/8	1.20	.62	3	.155	2.5	2.76	.72	2 1/2	.18 1/4	2.80	3.08	.225	3.8	4.2	3 1/2	.28
1/2	.94	.50	2 1/2	.13	2	2.2	.58	1 3/4	.165	2.24	2.46	.195	2.9	3.2	3	.25
3/8	.78	.39	2	.105	1.68	1.86	.45	1 1/2	.145	1.84	2.02	.175	2.42	2.7	2 3/4	.20 3/4
5/16	.48	.22	1	.095												

Weight, for Types A and B respectively are the same for all constructions. Standard Plow Steel grade is also furnished if desired.
 *Diameters of drums are the same as for Crucible Cast Steel.



FLATTENED STRAND HAULAGE OR TRANSMISSION ROPE
Type C (5 x 9)



FLATTENED STRAND HAULAGE OR TRANSMISSION ROPE
Type D (6 x 8)

Flattened Strand Haulage or Transmission Ropes.

These ropes are designed to give increased wearing surface above that to be obtained from a round strand rope. Used in logging, coal dock haulage and similar plans.

Tiller or Hand Rope.

Used for starting and stopping elevators, and also for steering lines on yachts and motor boats.

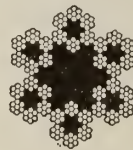
DATA, FLATTENED STRAND HAULAGE OR TRANSMISSION ROPES

TYPE C—5 STRANDS OF 9 WIRES EACH, 1 HEMP CORE
 TYPE D—6 STRANDS OF 8 WIRES EACH, 1 HEMP CORE

Diam. in ins.	Diam. of drum or sheave in ft. advised	CRUCIBLE CAST STEEL					EXTRA STRONG CRUCIBLE CAST STEEL					MONITOR PLOW STEEL					Diam. of drum or sheave in ft. advised.			
		Type C		Type D		Both Types	Type C		Type D		Both Types	Type C		Type D		Both Types				
		Proper working load in tons of 2000 lbs.	Weight per ft. in lbs.	Proper working load in tons of 2000 lbs.	Weight per ft. in lbs.		List price per ft.	Proper working load in tons of 2000 lbs.	Weight per ft. in lbs.	Proper working load in tons of 2000 lbs.		Weight per ft. in lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	Weight per ft. in lbs.			Proper working load in tons of 2000 lbs.	Weight per ft. in lbs.	List price per ft.
1 1/2	8 1/2	12.6	3.65	13.6	4.00	\$0.75	14.6	3.65	15.8	4.00	\$0.93									
1 3/8	8	10.6	3.10	11.4	3.45	.64	12.6	3.10	13.6	3.45	.80									
1 1/4	7 1/4	9.2	2.55	10	2.80	.54	10.8	2.55	11.6	2.80	.68	13.4	2.55							
1 1/8	6 3/4	7.4	2.05	8	2.30	.45	8.6	2.05	9.2	2.30	.54	10.4	2.05							
1	5 3/4	6.2	1.65	6.8	1.80	.35	7.0	1.65	7.6	1.80	.45	8.4	1.65							
7/8	4 3/4	4.8	1.24	5.2	1.38	.275	5.6	1.24	6.0	1.38	.35	6.6	1.24							
3/4	4 1/8	3.72	.92	4	1.00	.205	4.2	.92	4.54	1.00	.27	5.0	.92							
5/8	3 1/2	2.6	.64	2.8	.72	.14	2.9	.64	3.14	.72	.18	3.5	.64							
3/8	2 3/8	1.54	.40	1.66	.45	.10	1.77	.40	1.92	.45	.14	2.2	.40							
5/16	2	.92	.23	1	.25	.07	1.05	.23	1.14	.25	.11									

DATA, TILLER OR HAND ROPE 6 STRANDS OF 42 WIRES EACH, 7 HEMP CORES

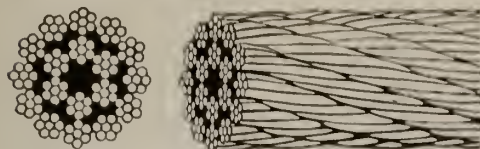
Diam. ins.	Weight per ft. in lbs.	Diam. of drum or sheave in ft. advised	IRON		CRUCIBLE CAST STEEL	
			Approx. Breaking strength, in lbs.	List price per ft.	Approx. Breaking strength, in lbs.	List price per ft.
1 1/2	1.10	24	22000	\$0.33	35000	\$0.43
1 3/8	.84	21	15500	.27	26000	.36
1 1/4	.62	18	11000	.22	18000	.30
1 1/8	.43	15	7000	.17	13500	.24
1 1/4	.35	13 1/2	6300	.14	11000	.20
1 1/8	.28	12	5800	.11 1/2	9000	.17
1 1/4	.21	10 1/2	4000	.10	6500	.15
1 1/8	.16	9	3000	.09	4800	.14
3/4	.11	7 1/2	1900	.08	3600	.12 1/2
5/8	.07	6	1300	.07 1/2	2500	.11
3/8	.04	5	750	.07	1350	.10



TILLER OR HAND ROPE (6 x 42)

Non-spinning Hoisting Rope.

This type of rope is so constructed that it prevents the rotating of a free load suspended on the end of a single line. It is recommended for "back haul" or single line derricks.

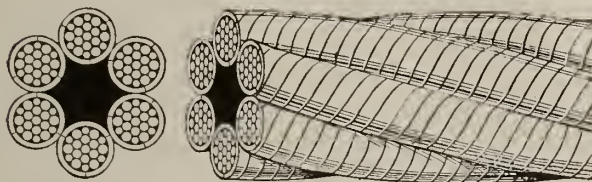


NON-SPINNING HOISTING ROPE (18 x 7)

Steel Clad Hoisting Rope.

Each strand is spirally wound with flat steel strips, which gives considerable wearing surface over the ordinary type. When the flat strips of a steel clad rope have worn through, there still remains the complete hoisting rope with unimpaired strength. Where ropes wear out quickly, this feature is a distinct advantage.

Made in 3 constructions: 6 by 19 wires each; special flexible, 6 strands of 37 wires each; and extra special flexible, 6 strands of 61 wires each.

STEEL CLAD HOISTING ROPE
6 STRANDS, 19 WIRES TO STRAND

Diam., in ins.	Weight per ft., in lbs.	Diam. of drum or sheave in ft. advised	CRUCIBLE CAST STEEL		EXTRA STRONG CRUCIBLE CAST STEEL		FLOW STEEL		MONITOR FLOW STEEL	
			Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.
2 1/4	8.45	8	21.2	\$1.56	24.6	\$1.74	28	1.98	33	\$2.25
2 1/2	6.70	7.5	19.2	1.29	22.4	1.52	25	1.73	30	2.02
2 3/4	6.02	7	17.0	1.16	19.8	1.36	22	1.56	27	1.86
1 3/4	5.25	6.5	14.4	1.01	16.6	1.18	19	1.32	22	1.54
1 1/2	4.62	6	12.8	.89	14.6	1.03	16	1.16	20	1.33
1 1/4	3.95	5.5	11.2	.78	12.8	.90	14	1.01	17	1.12
1 1/8	3.30	5	9.4	.67	10.6	.77	12	.86	14	.96
1 1/2	2.80	4.5	7.6	.57	8.6	.65	9.4	.73	11	.81
1 1/4	2.12	4	6.0	.49	6.8	.55	7.6	.61	9	.68
1 1/8	1.72	3.5	4.6	.41	5.2	.46	5.8	.51	7	.56
1 1/2	1.30	3	3.5	.36	4.04	.39	4.6	.43	5.3	.48
1 1/4	1.00	2.5	2.5	.30	2.80	.32	3.1	.35	3.8	.38
1 1/8	.70	2	1.68	.26	1.84	.27	2.0	.29	2.4	.32

Galvanized Iron Ship's Rigging or Guy Rope.

In the ship building industry, standard hoisting ropes as shown on the foregoing pages are in general use for handling materials.

The ropes described are used as part of the mechanical equipment of ships, besides being employed for other purposes.

Galvanized iron ship's rigging or guy rope is used for ship's rigging, guys for derricks, smokestacks, and for general standing rope service; it is not designed to run over drums or sheaves.

Construction, 6 strands, 7 or 12 wires to strand, 1 hemp core.

DATA, NON-SPINNING HOISTING ROPE
18 STRANDS, 7 WIRES EACH, 1 HEMP CORE

Diam., in ins.	Weight per ft., in lbs.	Diam. of drum or sheave in ft. advised	IRON		CRUCIBLE CAST STEEL		EXTRA STRONG CRUCIBLE CAST STEEL		FLOW STEEL		MONITOR FLOW STEEL	
			Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.
1 3/4	5.50	7.00	9.1	\$0.80	17.1	\$0.90	20.2	\$1.10	22.2	\$1.30	24.4	\$1.60
1 1/2	4.90	6.50	7.9	.65	14.8	.77	17.5	.94	19.2	1.08		
1 1/4	4.32	6.00	6.8	.57	12.7	.66	15.0	.80	16.5	.93	18.1	1.10
1 1/8	3.60	5.50	5.6	.49	10.4	.56	12.4	.68	13.7	.79	15.1	.90
1 1/4	2.80	5.00	4.6	.40	8.7	.46	10.3	.56	11.3	.65	12.5	.75
1 1/8	2.34	4.50	3.9	.33	7.3	.38	8.6	.46	9.5	.54	10.4	.62
1 1/4	1.73	4.00	2.9	.26	5.6	.31	6.6	.37	7.2	.43	7.8	.50
1 1/8	1.44	3.50	2.3	.20	4.5	.24	5.3	.29	6.3	.34	7.0	.39
1 1/4	1.02	3.00	1.7	.16	3.3	.19	3.9	.22	4.9	.26	5.4	.31
1 1/8	.70	2.50	1.1	.12	2.2	.14	2.6	.16 1/2	3.1	.19	3.4	.22 1/2
1 1/4	.87	2.25	.97	.10	1.8	.12	2.1	.14	2.5	.16		
1 1/8	.42	2.00	.73	.08 1/2	1.3	.11	1.6	.12 1/2	1.9	.14	2.1	.17
1 1/4	.31	1.75	.52	.07 1/2	.98	.10	1.1	.11 1/2	1.3	.13		
1 1/8	.25	1.50	.42	.07	.78	.09 1/2	.92	.11	1.1	.12 1/2	1.2	.14 1/2

DATA, STEEL CLAD, SPECIAL FLEXIBLE HOISTING ROPE
6 STRANDS, 37 WIRES TO STRAND, 1 HEMP CORE

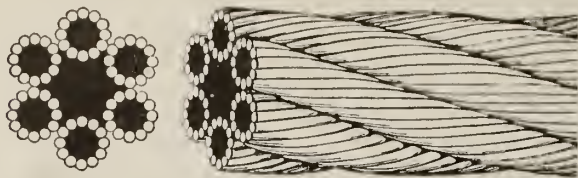
Diam., in ins.	Weight per ft., in lbs.	Diam. of drum or sheave in ft. advised	CRUCIBLE CAST STEEL		EXTRA STRONG CRUCIBLE CAST STEEL		FLOW STEEL		MONITOR FLOW STEEL	
			Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.
2 3/4	12.05	8	32	\$2.52	37	\$2.95	43	\$3.35	45	\$3.75
2 1/2	9.90	7	25	2.10	30	2.40	35	2.70	37	3.00
2 1/4	8.00	6	21	1.75	23	1.95	26	2.20	27	2.50
2	6.60	5.25	18.8	1.47	21.2	1.68	23.8	1.92	25	2.19
1 7/8	5.90	4.75	17	1.31	19	1.54	22	1.76	23	2.01
1 3/4	4.90	4.25	14	1.13	16	1.31	18	1.49	19	1.69
1 1/2	4.30	3.75	12	1.02	14	1.18	16	1.33	17	1.48
1 1/4	3.75	3.5	11	.87	12	1.00	14	1.13	14	1.27
1 1/8	3.05	3.2	9	.76	10	.86	11	.96	11	1.07
1 1/4	2.40	2.83	7	.65	8	.74	9	.83	9	.94
1 1/8	2.00	2.5	6	.55	6.4	.62	7	.69	7.4	.77
1 1/4	1.75	2.16	5	.45	5	.51	5	.57	5.8	.63

DATA, STEEL CLAD, EXTRA SPECIAL FLEXIBLE HOISTING ROPE
6 STRANDS, 61 WIRES TO STRAND, 1 HEMP CORE

Diam., in ins.	Weight per ft., in lbs.	Diam. of drum or sheave in ft. advised	CRUCIBLE CAST STEEL		EXTRA STRONG CRUCIBLE CAST STEEL		FLOW STEEL		MONITOR FLOW STEEL	
			Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.	Proper working load in tons of 2000 lbs.	List price per ft.
3 1/4	16.80	10	48	\$3.90	55	\$4.55	62	\$5.10	65	\$5.70
3 1/2	14.35	9	40	3.23	47	3.78	53	4.33	55	4.82
3 3/4	12.05	8	32	2.71	37	3.18	43	3.62	45	4.06
2 3/4	9.90	7	25	2.26	30	2.59	35	2.92	37	3.25
2 1/4	8.45	6	21	1.88	23	2.10	26	2.38	27	2.71

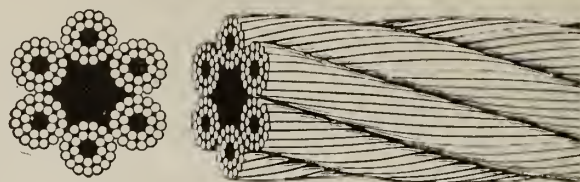
Galvanized Crucible Cast Steel Yacht Rigging or Guy Rope.

Made of crucible cast steel in 2 constructions: 6 strands, 7 wires to strand, 1 hemp core, for ship's or yacht's standing rigging and derrick guys; 6 strands, 19 wires to strand, 1 hemp core, for running rigging and mooring lines.

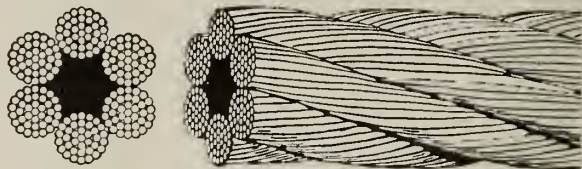


GALVANIZED IRON AND CRUCIBLE CAST STEEL RUNNING ROPE
6 STRANDS, 12 WIRES EACH, 7 HEMP CORES

Diam. in ins.	Approximate weight per ft. in lbs.	Approximate strength in tons of 2000 lbs.	
		Iron	Cast steel
1 1/16	1.18	10.1	22.5
1 1/8	1.05	5.7	19.5
1 1/4	.80	6.9	15.5
1 1/2	.68	6	13.5
1 3/4	.59	8.1	11.5
2	.42	3.6	8
2 1/8	.33	2.8	6.5
2 1/4	.26	2.2	5
2 1/2	.20	1.7	3.9
2 3/4	.14	1.3	2.85
3	.10	.82	1.98



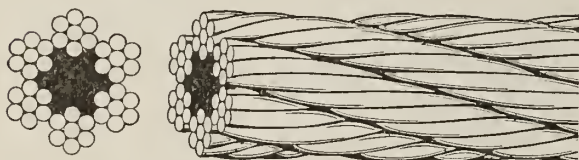
GALVANIZED STEEL HAWASERS AND MOORING LINES
6 strands, 12 or 24 wires each, 7 hemp cores



GALVANIZED STEEL DEEP SEA TOWING HAWASERS
6 strands, 37 wires each, 1 hemp core

DATA, GALVANIZED STEEL HAWASERS

Diam. in ins.	6 STRANDS, 12 WIRES EACH, 7 HEMP CORES		6 STRANDS, 24 WIRES EACH, 7 HEMP CORES		6 STRANDS, 37 WIRES EACH, 1 HEMP CORE	
	Approximate weight per ft. in lbs.	Approximate strength in tons of 2000 lbs.	Approximate weight per ft. in lbs.	Approximate strength in tons of 2000 lbs.	Approximate weight per ft. in lbs.	Approximate strength in tons of 2000 lbs.
2 3/8					8.82	188
2 3/4					8.36	182
2 1/2					8	171
2 1/4					7.06	155
2 1/8	4.43	83	5.81	113	6.65	140
2 1/16	4.20	77	5.51	106	6.30	132
2	3.89	71	5.09	98	5.84	125
1 15/16	3.42	66	4.48	88	5.13	112
1 13/16	3.23	61	4.24	82	4.85	104
1 11/16	2.94	57	3.86	76	4.42	97
1 9/16	2.76	53	3.63	74	4.15	87
1 7/16	2.36	45	3.10	63	3.55	76
1 5/16	2.16	41	2.92	55	3.24	72
1 3/16	2	38	2.62	50	3	66
1 1/16	1.63	31	2.15	42	2.45	54
1 1/8	1.47	28	1.93	38	2.21	47
1 1/4	1.33	26	1.75	34	2	42
1 1/8			1.54	27	1.77	38
1 1/16			1.38	25	1.58	31.5
1 1/8			1.05	20	1.20	26
1 1/16			.90	17	1.03	22
1 1/8			.78	14	.89	20
1 1/16			.54	10.5		
1 1/8			.34	6.6		
1 1/16			.21	4		



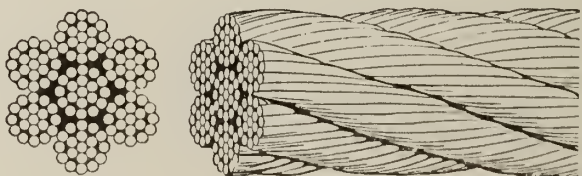
GALVANIZED IRON SHIP'S RIGGING OR GUY ROPE (6 x 7 or 6 x 12)
AND GALVANIZED CRUCIBLE CAST STEEL YACHT ROPE
(6 x 7 or 6 x 19)

IRON 6 STRANDS, 7 OR 12 WIRES EACH, 1 HEMP CORE			CRUCIBLE CAST STEEL 6 STRANDS, 7 OR 19 WIRES EACH, 1 HEMP CORE		
Diam. in ins.	Weight per ft. in lbs.	Strength in tons of 2000 lbs.	Diam. in ins.	Weight per ft. in lbs.	Strength in tons of 2000 lbs.
1 3/4	4.85	42	1 1/4	2.45	42
1 11/8	4.42	38	1 1/8	2.21	38
1 5/8	4.15	35	1 1/8	2	34
1 1/2	3.55	30	1 1/8	1.77	31
1 1/4	3.24	28	1 1/8	1.58	28
1 3/8	3	26	1 1/8	1.20	22
1 1/4	2.45	23	1 1/8	1.03	19
1 1/8	2.21	19	1 1/8	.89	16.8
1 1/8	2	18	1 1/8	.62	11.7
1 1/8	1.77	16.1	1 1/8	.50	9
1 1/8	1.58	14.1	1 1/8	.39	7
1 1/8	1.20	11.1	1 1/8	.34	6
1 1/8	1.03	9.4	1 1/8	.30	5
1 1/8	.89	7.8	1 1/8	.22	4.2
1 1/8	.62	5.7	1 1/8	.15	3.2
1 1/8	.50	4.46			
1 1/8	.39	3.39			
1 1/8	.30	2.35			
1 1/8	.22	1.95			
1 1/8	.15	1.42			
5 STRANDS					
1 1/2	.125	1.20			
1 1/8	.09	.99			
1 1/4	.063	.79			
1 1/8	.04	.61			

List prices furnished on application.

Galvanized Steel Cables for Suspension Bridges.

Cables are supplied fitted with special bridge sockets ready for attaching to anchorage bolts.



GALVANIZED STEEL CABLE FOR SUSPENSION BRIDGES

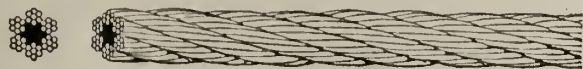
6 STRANDS, WIRE CORE

DATA, STEEL CABLE FOR SUSPENSION BRIDGES

Diam. in ins.	3	2 3/4	2 5/8	2 1/2	2 3/8	2 1/4	2 1/8	2	1 7/8	1 3/4	1 5/8	1 1/2	1 3/8	1 1/4	1 1/8	1
Weight per ft. in lbs.	16.0	12.7	11.6	10.5	9.50	8.52	7.60	6.73	5.90	5.10	4.34	3.70	3.10	2.57	2.00	1.65
Strength in tons of 2000 lbs.	360	310	283	256	232	208	185	164	140	121	106	90	75	62	42	32

Sash Cord.

Made "dead soft" unless ordered to the contrary. Used principally for window weights, bell cords, automobile brakes and whistles. $\frac{3}{32}$ -in. diameter galvanized sash cord is used on electric open car curtain fixtures; $\frac{1}{8}$ -in. galvanized sash cord is used on car curtain fixtures.



SASH CORD (6 x 7)

6 STRANDS OF 7 WIRES EACH, 1 COTTON CORE

Trade number	Diam., in ins.	Weight per ft. in lbs.		Approximate breaking strength in lbs.			List price per ft.		
		Iron	Copper	Bright iron	Annealed iron	Bright copper	Iron annealed or bright	Tinned or galvanized iron	Copper
26	$\frac{1}{4}$	.101	.115	2200	1650	1320	\$0.03	\$0.04	\$0.09
27	$\frac{3}{16}$	.077	.087	1800	1411	1080	.02 $\frac{3}{4}$	.03 $\frac{1}{2}$	.07 $\frac{1}{2}$
27 $\frac{1}{2}$	$\frac{3}{16}$	.056	.064	1400	1100	840	.02 $\frac{1}{4}$	.03	.06
28	$\frac{1}{8}$	.025	.029	550	425	350	.01 $\frac{3}{4}$	.02 $\frac{1}{4}$	.04 $\frac{1}{2}$
28 $\frac{1}{2}$	$\frac{1}{8}$	.014	.016	320	250	200	.01 $\frac{1}{2}$	.02	.03 $\frac{1}{2}$
29	$\frac{1}{8}$	.006	.007	140	110	90	.01 $\frac{1}{4}$	.01 $\frac{3}{4}$	.03

Tinned High Strength Aeroplane Strand.

For reliable strength, light weight, flexibility, toughness, and elasticity, this strand is unrivaled. May be readily fastened and resists sudden strains and vibration better than a single stay wire.



TINNED HIGH STRENGTH AEROPLANE STRAND

Diam. in ins.	Number of wires	Approximate weight per 100 ft. in lbs.	Breaking strength in lbs.
$\frac{1}{8}$	19	20.65	12,500
$\frac{1}{16}$	19	13.50	8,000
$\frac{3}{32}$	19	10.00	6,100
$\frac{1}{4}$	19	7.70	4,600
$\frac{5}{16}$	19	5.50	3,200
$\frac{3}{8}$	19	3.50	2,100
$\frac{7}{16}$	19	2.60	1,600
$\frac{1}{2}$	19	1.75	1,100
$\frac{5}{8}$	19	1.21	780
$\frac{3}{4}$	19	.78	500
$\frac{7}{8}$	7	.30	185

Galvanized or Tinned Flexible Aeroplane or Motor Boat Cord.

Designed to meet the demand for a light weight, flexible steel cord, with a minimum amount of stretch, to connect the control levers or wheel with the flexible



GALVANIZED OR TINNED FLEXIBLE AEROPLANE OR MOTOR BOAT CORD

Diam in ins.	Approximate weight per 100 ft. in lbs.	Breaking strength in lbs.
$\frac{3}{32}$	26.45	14,400
$\frac{1}{8}$	22.53	12,500
$\frac{3}{16}$	17.71	9,800
$\frac{1}{4}$	14.56	8,000
$\frac{5}{16}$	12.00	7,000
$\frac{3}{8}$	9.50	5,600
$\frac{1}{2}$	6.47	4,200
$\frac{5}{8}$	4.44	2,800
$\frac{3}{4}$	2.88	2,000

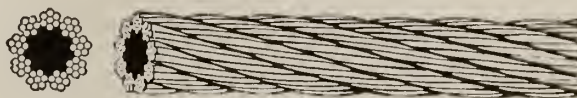
wing tips, ailerons, elevating planes and rudder in an aeroplane, or for small motor boat steering cord.

Tinned Aeroplane Cord.

In addition to the foregoing types, this company makes tinned aeroplane cord 7 by 7 construction, also 6 by 7 with cotton center.

Galvanized Mast Arm or Arc Light Rope.

More durable than manila rope and does not shrink.



GALVANIZED MAST ARM OR ARC LIGHT ROPE

Diam. in ins.	$\frac{1}{2}$	$\frac{7}{16}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{3}{16}$
Construction	9 x 7	9 x 7	9 x 7	9 x 4	9 x 4
Weight per ft. in lbs.	.335	.245	.163	.107	.077
Breaking strength in lbs.	4700	3400	2200	1530	1125

List prices furnished on application.

Stone Sawing Strand.

Suitable for sawing blocks of sandstone or similar soft stone, but should not be used for marble or granite.



STONE SAWING STRAND

3 wires twisted together

Diam. in ins.	.25	.184	.16	.144	.126
Approximate gage of wire	12	13	14	15	16
Weight per 1000 ft. in lbs.	106	70	50	45	35
List price per 1000 ft.	\$19.00	16.50	14.00	12.00	10.50

Galvanized Steel Wire Strand.

Composed of 7 or 19 steel wires twisted into a single strand, galvanized or extra galvanized.

Used for guying stacks, telegraph and telephone poles; signal strand, for suspending trolley wire; messenger strand, for telephone cables.



STEEL WIRE STRAND

Diam. in ins.	Sizes of wire American Steel & Wire Co.'s steel wire gage	Weight per 1000 ft. in lbs.	Strength in lbs.	List price per 100 ft.
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7 STEEL WIRES TWISTED INTO A SINGLE STRAND, GALVANIZED OR EXTRA GALVANIZED

Diam. in ins.	Sizes of wire American Steel & Wire Co.'s steel wire gage	Weight per 1000 ft. in lbs.	Strength in lbs.	List price per 100 ft.
$\frac{3}{4}$	3	1200	18000	\$14.00
$\frac{1}{2}$	6	800	14000	8.50
$\frac{3}{8}$	8	650	11000	7.00
$\frac{1}{4}$	9	510	8500	5.50
$\frac{3}{16}$	11	415	6500	4.50
$\frac{1}{8}$	12	295	5000	3.50
$\frac{3}{32}$	13	210	3800	2.50
$\frac{1}{16}$	14	160	2800	2.25
$\frac{3}{64}$	15	125	2300	1.75
$\frac{1}{32}$	16	95	1800	1.50
$\frac{3}{128}$	17	75	1400	1.25
$\frac{1}{64}$	18	55	900	1.15
$\frac{3}{256}$	19	40	700	1.10
$\frac{1}{32}$	21	32	500	1.00
$\frac{3}{512}$	22	20	400	.80
$\frac{1}{16}$		13	300	.70

19 WIRES TWISTED INTO A SINGLE STRAND, GALVANIZED OR EXTRA GALVANIZED

1	.200	2100	32000	\$26.00
$\frac{7}{8}$	.175	1610	24000	20.70
$\frac{3}{4}$	.150	1200	18000	16.80
$\frac{5}{8}$	.125	800	14000	11.00
$\frac{1}{2}$	.110	650	11000	9.25
$\frac{3}{8}$	.100	510	8500	7.30

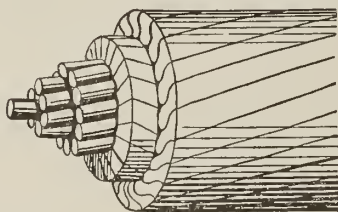
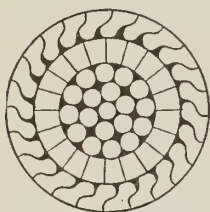
DATA, EXTRA GALVANIZED SPECIAL STRAND
7 OR 19 STEEL WIRES TWISTED INTO SINGLE STRAND

Diam. in ins.	7 WIRES			19 WIRES			Diam. in ins.	7 WIRES			19 WIRES		
	Tensile strength in lbs.	List price per 100 ft.		Tensile strength in lbs.	List price per 100 ft.			Tensile strength in lbs.	List price per 100 ft.		Tensile strength in lbs.	List price per 100 ft.	
SIEMENS-MARTIN													
1	.....	....		51,000	\$22.50		1	4,860	\$2.50		.....	....
7/8	.....	....		38,000	16.65		3/8	.....	.....		.....	....
3/4	.....	....		28,400	13.35		5/16	4,380	2.05		.....	....
5/8	19,000	\$8.25		20,000	10.00		3/4	3,060	1.70		.....	....
15,000	6.00			15,000	8.25		7/8	.....	.....		.....	....
11,000	5.25			11,000	6.75		1	2,000	1.35		.....	....
9,000	4.30			9,000	5.60		1 1/8	900	.90		.....	....
6,800	3.25			6,800	4.50		1 1/4	.....	.....		.....	....
HIGH STRENGTH													
1	.....	....		87,400	30.00		3/8	11,500	4.40		11,500	\$5.25	
7/8	.....	....		64,000	23.50		5/16	8,100	3.20		.....	....
3/4	.....	....		47,400	17.50		3/4	7,300	2.80		.....	....
5/8	25,000	12.00		33,000	12.25		7/8	5,100	2.25		.....	....
15,000	9.50			22,000	10.65		1	3,300	1.80		.....	....
11,000	7.25			18,000	9.00		1 1/8	1,500	1.20		.....	....
9,000	6.00			15,000	7.00		1 1/4	.....	.....		.....	....
EXTRA HIGH STRENGTH													
1	.....	....		120,000	37.00		3/8	17,250	5.25		17,250	\$6.50	
7/8	.....	....		90,000	28.50		5/16	12,100	4.25		.....	....
3/4	.....	....		70,000	22.00		3/4	10,900	3.50		.....	....
5/8	42,500	14.60		47,000	15.50		7/8	7,600	2.85		.....	....
15,000	11.70			38,000	13.25		1	4,900	2.40		.....	....
11,000	8.80			27,000	11.00		1 1/8	2,250	1.60		.....	....
9,000	7.20			22,500	8.50		1 1/4	.....	.....		.....	....

When either intermediate sizes or strengths are called for, if they are exactly midway between 2 sizes provided for, the average price of the 2 sizes shall apply; otherwise the price of the nearest size and strength shall apply.

Round Wire Track Cable and Locked Wire Cable for Aerial Tramways and Cableways.

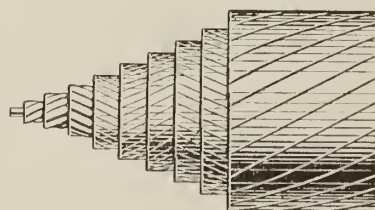
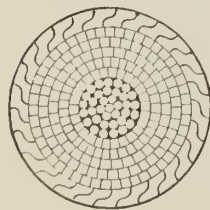
There have been devised these 2 special cables which present fairly smooth surfaces for wheels to run upon. The better is the locked type, as it presents the smoother external surface.



LOCKED WIRE TRACK CABLE FOR AERIAL TRAMWAYS

Crucible cast steel

Diam. in ins.	1 5/8	1 1/2	1 3/8	1 1/4	1 1/8	1	3/4
Weight per ft. in lbs.	6.30	5.30	4.40	3.70	3.00	2.35	1.80
Strength in tons of 2000 lbs.	103	89	75	62	50	40	30
List price per ft.	\$1.17	1.00	0.85	0.72	0.60	0.49	0.37

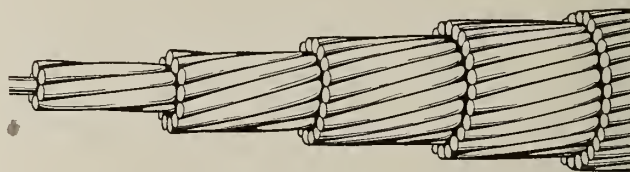


LOCKED WIRE TRACK CABLE FOR AERIAL TRAMWAYS

Crucible cast steel

DATA, LOCKED WIRE CABLE FOR AERIAL TRAMWAY

Diam. in ins.	Approximate weight per ft. in lbs.	Approximate breaking stress in tons of 2000 lbs.	List price per ft.
2 1/2	15.60	240	\$3.00
2 1/4	12.50	190	2.20
2	10.00	160	1.75
1 3/4	7.65	120	1.35
1 1/2	6.60	103	1.17
1 1/4	5.70	89	1.00
1 3/8	4.75	75	.85
1 1/2	3.80	62	.72
1 1/8	3.15	50	.60
1	2.50	40	.49
7/8	1.88	30	.37
3/4	1.30	22	.27
5/8	.92	15.5	.18
1/2	.57	12.5	.16
		10	.14



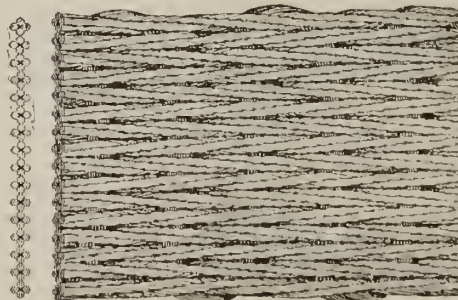
1 Wire 7 Wires 19 Wires 37 Wires 61 Wires 91 Wires

ROUND TRACK CABLE FOR AERIAL TRAMWAYS

Diam. in ins.	Number of wires in strand	Weight per 100 ft. in lbs.	CRUCIBLE STEEL		PLOW STEEL	
			Breaking stress in tons of 2000 lbs.	List price per 100 ft.	Breaking stress in tons of 2000 lbs.	List price per 100 ft.
2 1/2	91	1310	285.00	\$176.00	335.00	\$246.50
2 1/4	91	1036	233.00	137.50	266.00	192.50
2 1/8	91	935	204.00	123.25	240.00	172.50
2	61	840	185.00	115.50	218.00	161.75
1 7/8	61	728	161.00	101.50	189.00	142.00
1 3/4	61	659	145.80	87.75	171.00	122.75
1 5/8	61	563	124.00	76.00	146.00	106.50
1 1/2	37	488	108.40	68.00	127.50	95.25
1 3/8	37	401	88.80	53.00	105.00	74.25
1 1/4	37	323	71.80	44.25	84.60	62.00
1 1/8	37	270	60.00	38.25	70.70	53.50
1	19	220	49.20	31.25	58.00	43.75
7/8	19	169	37.60	24.75	44.40	34.75
3/4	19	124	27.60	19.00	32.50	26.50
5/8	19	86	19.20	14.75	22.30	20.75

Flat Rope.

A remarkably strong hoisting rope, used to a great extent by the large mines of the West. It is composed of a number of wire ropes called "flat rope strands" of alternate right and left lay, placed side by side, then secured or sewed together with soft Swedish iron wire, thus forming a complete rope.



FLAT ROPE

Crucible steel—plow steel

WICKWIRE SPENCER STEEL CORPORATION

Manufacturers of Wire Rope and Fittings

WORCESTER, MASS.

BUFFALO, N. Y.

BRANCH OFFICES

NEW YORK, N. Y., 120 Broadway
CHICAGO, ILL., 33 West Austin Avenue

SAN FRANCISCO, CAL., 111 Townsend Street
PHILADELPHIA, PA., 410 Commerce Street

Products.

WIRE ROPE.

A full line of Wire Rope and Fittings.

For Electrically Welded Wire Fabric, see page 165.

Uses of Wire Ropes.

Wire ropes are made for the following purposes: hoisting, haulage, derricks, cranes, dredges, elevators, power transmission, cableways, tramways, rigging, etc.

Quality and Workmanship.

Long experience in manufacturing wire rope for all purposes, and a thorough knowledge of the exacting requirements due to the various uses to which it is put, warrant the statement that Grey Strand and Excelsior wire ropes are unexcelled for uniformly high tensile strength, torsion and ductility, which insure, beyond security and safety, maximum life of the rope.

Grades of Wire Rope.

We furnish rope of iron, crucible cast steel, extra strong crucible cast steel, plow steel and Grey Strand high grade plow steel, as described hereafter:

IRON ROPE—Soft, tough and pliable, particularly adapted for drum type passenger elevators and similar service where tendency to abrasion is slight and drums are designed to prevent undue bending. The wires, softer than those of steel ropes, will not wear grooves in drums to the same extent.

A higher factor of safety is recommended for elevator service than for general hoisting.

CAST STEEL ROPE—Recommended for general hoisting, such as mine hoists, derricks, coal hoists, cableways, conveyors, freight elevators, etc. This rope, being tough and pliable, will bend over comparatively small sheaves and resist abrasion which tends to result from rapid hoisting. The wire in cast steel rope has nearly twice the strength of that in iron rope and much higher elastic limit.

EXTRA STRONG CAST STEEL ROPE—Occupies an intermediate place between cast steel and plow steel rope. It is used in place of cast steel when desirable to increase factor of safety for given diameter. May be used to advantage for general hoisting, the wire being carefully selected to insure high degree of strength, ductility and toughness.

PLOW STEEL ROPE—Made of wire drawn from especially selected high strength steel, to produce rope of great strength and toughness, capable of resisting severe abrasive tendencies. Can be used in place of cast steel rope to reduce the dead weight of the rope itself, or where it is necessary to use a much stronger rope without increasing its diameter.

Recommended for logging lines, scraper, dredge and wrecking ropes, heavy cranes, ballast unloader ropes, and for all rough uses requiring maximum strength and toughness.

GREY STRAND ROPE—A special rope for special purposes, recommended as the best rope for exceptional service where extreme conditions produce extraordinarily severe and unexpected strains. Made from an extra high grade of steel, and excels all other wires for strength, toughness and uniformity.

Rope with strands of this wire is the latest and most improved product of the selection of metals and drawing wire for rope making.

This rope can be used to advantage in place of standard hoisting rope where extra severe strains and hard conditions of service tend to overtax the latter.



GREY STRAND ROPE

Construction and Adaptability.

TRANSMISSION, HAULAGE OR STANDING ROPE—6 strands, 7 wires to strand, 1 hemp center, recommended for transmission of power, winding, mine and other haulage, oil well drilling and sand lines, and where sheaves and pulleys are of large diameter, and where rope is not liable to reverse bends.

HOISTING ROPE—6 strands, 19 wires to strand, 1 hemp center, recommended for colliery and mine hoisting, elevators, derricks, ballast unloaders, railway switching ropes, dredges, steam shovels, oil well purposes, such as drilling, casing, tubing, dead lines, and where drums, sheaves and pulleys are not undersized for the particular size of rope used.

This construction in the grade of plow steel is used extensively for main line hauling and skidding operations in logging camps.

EXTRA FLEXIBLE HOISTING ROPE—8 strands, 19 wires to the strand, 1 hemp center, is much more flexible than the standard 6 strands, 19 wires, and can be used to advantage where conditions are such that sheaves of smaller diameter must be employed.

SPECIAL FLEXIBLE HOISTING ROPE—6 strands, 37 wires to strand, 1 hemp center, recommended for large electric cranes, on dredges, for cargo falls on steamers, and other purposes where very flexible rope in large diameter is required.

GALVANIZED GUY ROPE—6 strands, 7 wires to strand, 1 hemp center, is better for guys for derricks than hemp rope or rods linked together.

TILLER OR HAND ROPES—Used for steering ropes on river steamers, for hand ropes on elevators, and in any place where a smooth and extremely flexible rope is required. Composed of 252 wires, and made up of a hemp core, around which are twisted 6 ropes, each consisting of 6 strands, 7 wires to strand, enclosing a hemp center.

A. LESCHEN & SONS ROPE COMPANY

ST. LOUIS, MO.

BRANCH STORES

NEW YORK

CHICAGO

DENVER

SAN FRANCISCO

Products.

WIRE ROPE.

HERCULES HOISTING WIRE ROPE

6 Strands—25 Wires Each—1 Hemp Center (Fig. 1)

Diameter in inches	List price per foot	Approx. breaking strength in tons of 2000 lbs.	Usual working load in tons of 2000 lbs.	Approx. weight per foot	Diameter of drum or sheave in feet advised
3/8	\$0.18 1/4	7.4	1.5	.25	2
1/2	.20 3/4	13.3	2.7	.45	2.75
5/8	.25	16	3.2	.58	3
3/4	.28	21	4.2	.72	3.50
7/8	.37 1/2	29	5.8	1.00	4
1	.49	39	7.8	1.38	4.50
1 1/8	.60	50	10.0	1.80	5
1 1/4	.71	62	12.4	2.30	6
1 1/2	.89	76	15.2	2.80	7
1 3/8	1.12	92	18.4	3.45	7.50
1 1/2	1.37	108	21.6	4.00	8
1 3/4	1.56	121	24.2	4.75	8.50
1 7/8	2.08	146	29.2	5.60	9
2	2.25	183	36.6	7.25	11

HERCULES HOISTING WIRE ROPE

6 Strands—19 Wires Each—1 Hemp Center (Fig. 2)

Diameter in inches	List price per foot	Approx. breaking strength in tons of 2000 lbs.	Usual working load in tons of 2000 lbs.	Approx. weight per foot	Diameter of drum or sheave in feet advised
1/4	\$0.13	3.15	.63	.10	1
3/8	.13 1/2	4.50	.9	.15	1.25
1/2	.14 1/2	6.75	1.35	.22	1.50
5/8	.15 1/2	9.4	1.9	.30	1.75
3/4	.17	12.1	2.4	.39	2
7/8	.19	14.5	2.9	.50	2.25
1	.22 1/2	19	3.8	.62	2.50
1 1/8	.31	26.3	5.3	.89	3
1 1/4	.39	35	7	1.20	3.50
1 1/2	.50	45	9	1.58	4
1 3/8	.62	56	11	2	4.50
1 1/2	.75	69	14	2.45	5
1 3/4	.90	84	17	3	5.50
1 7/8	1.10	98	20	3.55	6
2	1.30	110	22	4.15	6.50
2 1/8	1.60	133	27	4.85	7
2 1/4	1.75	150	30	5.55	8
2 1/2	1.85	166	33	6.30	8

HERCULES HOISTING WIRE ROPE

6 Strands—37 Wires Each—1 Hemp Center (Fig. 3)

Diameter in inches	List price per foot	Approx. breaking strength in tons of 2000 lbs.	Usual working load in tons of 2000 lbs.	Approx. weight per foot	Diameter of drum or sheave in feet advised
3/8	\$0.17 1/2	5.30	1.06	.22	1
1/2	.18 1/2	7.50	1.5	.30	1.15
5/8	.20	9.75	1.9	.39	1.33
3/4	.23	12.50	2.5	.50	1.50
7/8	.27	16	3.2	.62	1.75
1	.36	23	4.6	.89	1.83
1 1/8	.46	29	5.8	1.20	2.16
1 1/4	.59	37	7.4	1.58	2.50
1 1/2	.75	46	9.2	2	2.83
1 3/8	.86	58	11	2.45	3.20
1 1/2	1.05	71	14	3	3.50
1 3/4	1.25	84	17	3.55	3.75
1 7/8	1.45	95	19	4.15	...
2	1.75	113	23	4.85	...
2 1/4	2.10	137	27	6.30	...

HERCULES HOISTING WIRE ROPE

8 Strands—19 Wires Each—1 Hemp Center (Fig. 4)

Diameter in inches	List price per foot	Approx. breaking strength in tons of 2000 lbs.	Usual working load in tons of 2000 lbs.	Approx. weight per foot	Diameter of drum or sheave in feet advised
1/2	\$0.19	9.5	1.9	.35	1.33
5/8	.22	12	2.4	.45	1.5
3/4	.25	15	3	.56	1.75
7/8	.34	22	4.4	.80	1.83
1	.43	28	5.6	1.08	2.15
1 1/8	.55	36	7.2	1.42	2.5
1 1/4	.68	46	9.2	1.80	2.83
1 1/2	.82	56	11	2.20	3.2
1 3/8	.98	68	13	2.70	3.5
1 1/2	1.19	80	16	3.19	3.75

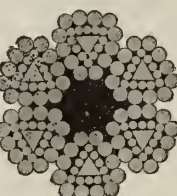


Fig. 1
HOISTING ROPE
Patent flattened strand
(6 x 25)

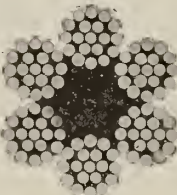


Fig. 2
HOISTING ROPE
Round strand
(6 x 19)

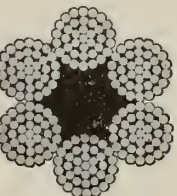


Fig. 3
HOISTING ROPE
Round strand
(6 x 37)

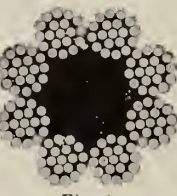


Fig. 4
HOISTING ROPE
Round strand
(8 x 19)



Fig. 5
HAULAGE AND GUY ROPE
Round strand
(6 x 7)

PLOUGH STEEL HOISTING WIRE ROPE

6 Strands—19 Wires Each—1 Hemp Center (Fig. 2)

Diameter in inches	List price per foot	Approx. breaking strength in tons of 2000 lbs.	Usual working load in tons of 2000 lbs.	Approx. weight per foot	Diameter of drum or sheave in feet advised
3/8	\$0.12 1/2	5.75	1.15	.22	1.50
1/2	.14	10	2	.39	2
5/8	.19	15.5	3.1	.62	2.5
3/4	.26	23	4.6	.89	3
7/8	.34	29	5.8	1.20	3.5
1	.43	38	7.6	1.58	4
1 1/8	.54	47	9.4	2	4.5
1 1/4	.65	58	12	2.45	5
1 1/2	.79	72	14	3	5.5
1 3/8	.93	82	16	3.55	6
1 1/2	1.08	94	19	4.15	6.5
1 3/4	1.30	112	22	4.85	7
1 7/8	1.46	127	25	5.55	8
2	1.58	140	28	6.3	8

SPECIAL STEEL HOISTING WIRE ROPE

6 Strands—19 Wires Each—1 Hemp Center (Fig. 2)

Diameter in inches	List price per foot	Approx. breaking strength in tons of 2000 lbs.	Usual working load in tons of 2000 lbs.	Approx. weight per foot	Diameter of drum or sheave in feet advised
1/4	\$0.10 1/2	2.43	.49	.10	1
3/8	.10 3/4	3.50	.70	.15	1.25
1/2	.11	5.30	1.06	.22	1.50
5/8	.11 1/2	7.25	1.45	.30	1.75
3/4	.12 1/2	9.2	1.84	.39	2
7/8	.14	11.2	2.24	.50	2.25
1	.16 1/2	14	2.80	.62	2.5
1 1/8	.22	20.2	4.04	.89	3
1 1/4	.29	26	5.20	1.20	3.5
1 1/2	.37	34	6.80	1.58	4
1 3/8	.46	43	8.6	2	4.5
1 1/2	.56	53	10.6	2.45	5
1 3/4	.68	64	12.8	3	5.5
1 7/8	.80	73	14.6	3.55	6
2	.94	83	16.6	4.15	6.5
2 1/8	1.10	99	19.8	4.85	7
2 1/4	1.25	112	22.4	5.55	8
2 1/2	1.34	123	24.6	6.3	8

CAST STEEL HOISTING WIRE ROPE

6 Strands—19 Wires Each—1 Hemp Center (Fig. 2)

Diameter in inches	List price per foot	Approx. breaking strength in tons of 2000 lbs.	Usual working load in tons of 2000 lbs.	Approx. weight per foot	Diameter of drum or sheave in feet advised
3/8	\$0.09 1/2	4.8	.96	.22	1.50
1/2	.10	6.5	1.30	.30	1.75
5/8	.11	8.4	1.68	.39	2
3/4	.12	10	2	.50	2.25
7/8	.14	12.5	2.5	.62	2.5
1	.19	17.5	3.5	.89	3
1 1/8	.24	23	4.6	1.20	3.5
1 1/4	.31	30	6	1.58	4
1 1/2	.38	38	7.6	2	4.5
1 3/8	.46	47	9.4	2.45	5
1 1/2	.56	56	11.2	3	5.5
1 3/4	.66	64	12.8	3.55	6
1 7/8	.77	72	14.4	4.15	6.5
2	.90	85	17	4.85	7
2 1/8	1.02	96	19	5.55	8
2 1/4	1.16	106	21.2	6.30	8

GALVANIZED IRON WIRE ROPE

6 Strands—7 Wires Each—1 Hemp Center (Fig. 5)

Diameter in inches	List price per foot	Circumference in inches	Approx. breaking strength in tons of 2000 lbs.	Approx. weight per foot, lbs.
1/4	\$0.06	1 1/2	3.39	.39
3/8	.07	1 3/4	4.46	.50
1/2	.08	2	5.7	.62
5/8	.09	2 1/4	7.8	.89
3/4	.13	2 3/4	11.1	1.20
7/8	.15	3	14.1	1.58
1	.17 1/2	3 1/4	16.1	1.77
1 1/8	.19 1/2	3 3/4	18	2
1 1/4	.22 1/2	4	19	2.21
1 1/2	.25	4	23	2.45

GEO. C. MOON COMPANY, INC.

Manufacturers of Wire Rope

GARWOOD, N. J.

NEW YORK, N. Y., 124 White Street

SAN FRANCISCO, CAL., PORTLAND, ORE., and SEATTLE, WASH., ROLPH MILLS & Co.

BRANCH OFFICES

CLEVELAND, OHIO, Rockefeller Building

Products.

CRESCENT WIRE ROPE, standard and special, for all purposes, made of Swedes Iron, Crucible Cast Steel, Mild Plow Steel, Plow Steel and Improved Plow Steel.

CRESCENT HEMP CLAD WIRE ROPE, ROPE ACCESSORIES, and WIRE.

Standard and Special Ropes.

Crescent Standard Ropes are made and kept in stock in sufficient quantity and variety to meet all the needs of average service. Customers can almost invariably secure immediate shipment from stock of ropes exactly suited to their requirements.

Special ropes can be furnished to order for unusual requirements which can not be met properly with standard ropes.

Qualities and Uses of Standard Ropes.

The 5 grades of Crescent Standard Ropes, in the order of increasing strength, are:

SWEDES IRON ROPE—Used exclusively for elevator hoisting.

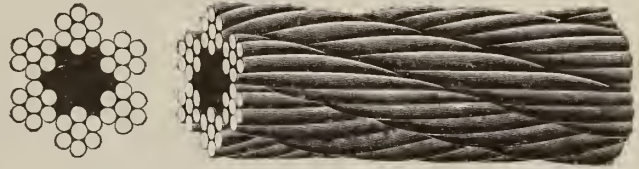
CRUCIBLE CAST STEEL ROPE—For haulage and hoisting, sand lines, derricks, dredges, cableways, inclined railways, conveying, drilling, pile driving, guying and running rope.



MILD PLOW STEEL ROPE—Serves the same purposes as ropes made of crucible cast steel, and, being stronger, in some cases allows of smaller sizes being used.

PLOW STEEL ROPE—Can be used where greater strength is required without any increase in the rope's diameter. It is employed for heavy hoisting, cableways, skidders, derricks and for long hoists. This company makes a special flexible rope of this material and recommends the smaller sizes for use on electric traveling hoists and the larger sizes for dredges.

IMPROVED PLOW STEEL ROPE—The highest grade rope manufactured. It combines great tensile strength, the highest degree of ductility, and unsurpassed toughness. Applicable for the heaviest haulage, dredging, derricks and sand lines.



CRESCENT WIRE ROPE FOR HAULAGE, ETC.

Hemp Clad Ropes.

These are generally made by spirally binding 5 wire strands with the highest grades of tarred yacht marline. This prevents friction between the strands and affords protection against moisture, acid, water, and foreign matter. The wire is of the same grades as are used in our standard ropes. Hemp clad rope is greatly superior to manila rope, being flexible, as easily handled, three to five times stronger, size for size, and 50% lighter when strengths are equal. There is no swelling when wet, as in the case of manila rope, and ice in winter does not affect it.

Galvanized Rope.

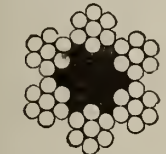
Rope that is to be subjected to severe corrosion, such as salt water or damp sea air, corroding fumes from smokestacks, etc., should be galvanized. It should never be employed for hoisting, for which service, where abrasion is a factor, hemp clad rope is most suitable.

Rope Accessories.

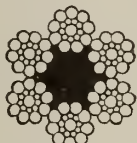
The accessories kept in stock include thimbles, clips, closed and open sockets, shackles, hooks, turnbuckles, etc. They are furnished plain or galvanized and either loose or properly fitted to the ends of ropes. When ordering, state complete details regarding thimbles, splicing, etc.

Catalogue.

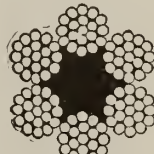
The Moon catalogue gives complete details of all types of Crescent wire rope and accessories and contains much interesting and instructive general data for rope users. A copy will be sent on request.



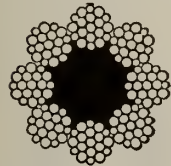
6x7 Transmission, Haulage or Standing Rope



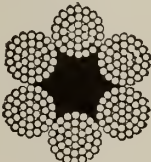
6x19 Seale Lay Hoisting Rope



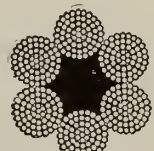
6x19 Hoisting Rope



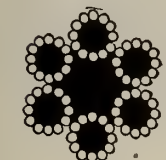
8x19 Extra Flexible Hoisting Rope



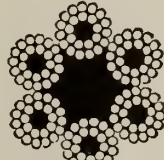
6x37 Special Flexible Hoisting Rope



6x61 Extra Special Flexible Hoisting Rope



6x12 Hawfers and Mooring Lines



6x24 Hawfers and Mooring Lines



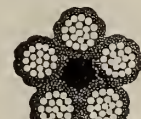
6x6x7 Tiller or Hand Rope



9x7 Mast-Arm or Arc Light Rope



6x7 Sash Cord



5x19 Hemp Clad Hoisting Rope

CRESCENT STANDARD WIRE ROPES

JOHN A. ROEBLING'S SONS COMPANY

ENGINEERS

Makers of Iron, Steel and Copper Wire Rope and Wire; Wire Rope Fittings;
Insulated Wires and Cables

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WIRE ROPE and BARE WIRES; INSULATED WIRES and CABLES.

A full line of WIRE ROPE FITTINGS, such as Hooks, Clamps, Clips, Pulleys, Sheaves, Sockets, Tackle Blocks, Thimbles, Turnbuckles, Slings; Alligator Wrenches, Reels for Hawsers, Riggers' Vise; Track Rollers, etc.

Our Engineering Department specializes in designing and constructing Suspension Bridges, Tramways, Cableways, and installations for the Transmission of Power by Wire Rope.

Uses of Wire Rope and Cables.

Wire rope and cables are made for the following purposes: conveyors, tramways, power transmission, suspension bridges, cableways, elevators, airplanes, for drilling, dredges, steam shovels, rigging, and all hoists and haulages where wire rope can be advantageously used.

Blue Center Steel Rope.

Blue center steel rope is a special rope for special purposes and is recommended as the very best rope for exceptional service where extreme conditions tend to produce extraordinarily severe and unexpected strains.

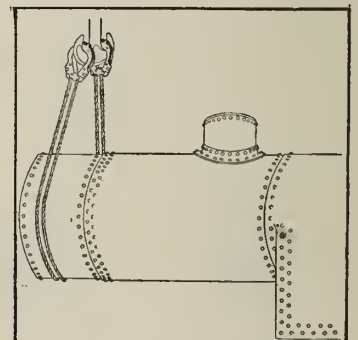
Wire Rope Slings for Industrial Plant and Construction.

Roebling wire rope slings are the ideal practical equipment for the safe and efficient hoisting of heavy materials in shop and field. They are made from our blue center steel; are compact, light and adjustable, and through equalizing features in certain types the stress of the load lifted is distributed throughout the entire sling. Forgings in tension are eliminated wherever possible. The slings are made in the anchor, bridle

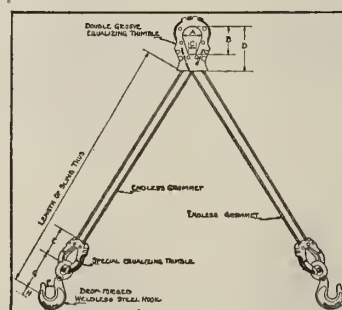
and many special industrial types. Complete information gladly furnished.
Send for Catalogue A-247.



ANCHOR SLING



WIRE ROPE SLING CS-160
"Blue Center Steel" equalizing grommet slings for handling large circular bodies



WIRE ROPE SLING CS-175



ROEBLING WIRE ROPE CLIP

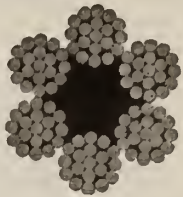
WIRE ROPE CLIP TESTS ON 6 X 19 PLOW STEEL ROPE

Diameter of rope, ins.	Number of clips	Length of wrench, ins.	Ultimate strength of rope, lbs.	Clip strength, lbs.	Efficiency, per cent
1 1/2	3	12	20,000	15,800	79.00
1 3/8	4	12	31,000	23,900	77.09
1 1/4	5	18	46,000	35,600	77.39
1 1/8	5	18	58,000	45,900	79.13
1	5	24	76,000	59,200	77.89
1 1/8	5	24	94,000	75,200	80.00
1 1/4	6	24	116,000	95,300	82.15

COMPARATIVE BREAKING STRENGTHS OF WIRE ROPE PER GIVEN DIAMETER IN TONS OF 2000 LBS.

ROEBLING STANDARD HOISTING ROPE (6 x 19).

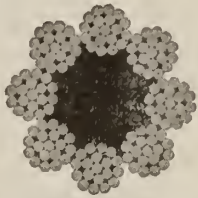
Diameter in ins.	2¾	2½	2¼	2	1¾	1½	1¼	1⅜	1¼	1⅜	1	¾	¾	⅝	½	⅜	⅜	⅜	¼
Iron, approx. strength. .	111	92	72	55	50	44	38	33	28	22.8	18.6	14.5	11.8	8.5	6.	4.7	3.9	2.9	2.4
Cast steel " " " " " "	211	170	133	106	96	85	72	64	56	47	38	30	23	17.5	12.5	10	8.4	6.5	4.8
Ex. strong cast steel, approx. strength	243	200	160	123	112	99	83	73	64	53	43	34	26	20.2	14.	11.2	9.2	7.25	5.30
Plow steel " " " " " "	275	229	186	140	127	112	94	82	72	58	47	38	29	23	15.5	12.3	10	8	5.75
Blue center steel, approx. strength	315	263	210	166	150	133	110	98	84	69	56	45	35	26.3	19	14.5	12.1	9.4	6.75
Appr. wt. per ft. in lbs.	11.95	9.85	8.	6.30	5.55	4.85	4.15	3.55	3.	2.45	2.	1.58	1.2	.89	.62	.50	.39	.30	.22



ROEBLING HOISTING ROPE (6 X 19)

ROEBLING EXTRA PLIABLE HOISTING ROPE (8 x 19).

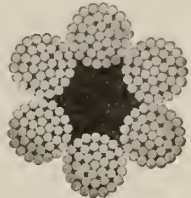
Diameter in ins.	1½	1⅜	1¼	1⅜	1	¾	¾	⅝	⅝	½	⅜	⅜	⅜	⅜	¼
Cast steel, approx. strength	58	51	42	34	26	20	15.3	10.9	8.7	7.3	5.7	4.2	2.75	1.8	
Extra strong cast steel, approx. strength	66	57	47	38	29.7	23	17.6	12.4	10.1	8	6.3	4.66	3.05	2.02	
Plow steel " " " " " "	74	64	52	43	33	26	20	14	11.6	8.7	6.9	5.12	3.35	2.25	
Blue center steel, approx. strength	80	68	56	46	36	28	22	15	12	9.5					
Approx. wt. per ft. in lbs.	3.19	2.70	2.20	1.80	1.42	1.08	.80	.56	.45	.35	.27	.20	.13	.09	



ROEBLING HOISTING ROPE (8 X 19)

ROEBLING EXTRA PLIABLE HOISTING ROPE (6 x 37).

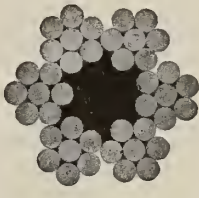
Diameter in ins.	2¾	2½	2¼	2	1¾	1½	1¼	1⅜	1¼	1⅜	1	¾	¾	⅝	½	⅜	⅜	⅜	¼
Cast steel, approx. strength.	200	160	125	105	84	71	63	55	45	34	29	23	17.5	11.2	9.5	7.25	5.5	4.2	
Extra strong cast steel, approx. strength.	233	187	150	117	95	79	71	61	50	39	32	25	19	12.6	10.5	8.25	6.35	4.65	
Plow steel, " " " " " "	265	214	175	130	108	90	80	68	55	44	35	27	21	14	11.5	9.25	7.2	5.1	
Blue center steel, approx. strength	278	225	184	137	113	95	84	71	58	46	37	29	23	16	12.5	9.75	7.50	5.30	
Approx. wt. per ft. in lbs.	11.95	9.85	8	6.30	4.85	4.15	3.55	3	2.45	2	1.58	1.20	.89	.62	.50	.39	.30	.22	



ROEBLING HOISTING ROPE (6 X 37)

ROEBLING STANDARD COARSE LAID ROPE (6 x 7).

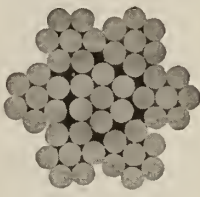
Diameter in ins.	1½	1⅜	1¼	1⅜	1	¾	¾	⅝	⅝	½	⅜	⅜	⅜	⅜	¼
Iron, approx. strength.	32	28	23	19	15	12	8.8	7.3	6	4.8	3.7	2.6	2.2	1.7	1.2
Cast steel, " " " " " "	63	53	46	37	31	24	18.6	15.4	13	10	7.7	5.5	4.6	3.5	2.5
Extra strong cast steel, approx. strength	73	63	54	43	35	28	21	16.7	14.5	11	8.85	6.25	5.25	3.95	2.95
Plow steel, " " " " " "	82	72	60	47	38	31	23	18	16	12	10	7	5.9	4.4	3.4
Blue center steel, approx. strength	90	79	67	52	42	33	25	20	17.5	13	11	7.75	6.5		
Approx. wt. per ft. in lbs.	3.55	3	2.45	2	1.58	1.20	.89	.75	.62	.50	.39	.30	.22	.15	.125



ROEBLING COARSE LAID ROPE (6 X 7)

ROEBLING GALVANIZED SUSPENSION BRIDGE CABLES

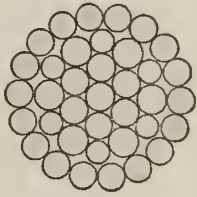
Diameter in ins.	2¾	2½	2¼	2 ⅝	2¼	2⅜	2	1⅝	1¾	1⅝	1½	1⅜	1¼
Approximate strength.	310	283	256	232	208	185	164	144	124	106	90	75	62
Approx. wt. per ft. in lbs.	12.7	11.6	10.5	9.50	8.52	7.60	6.73	5.90	5.10	4.34	3.70	3.10	2.57



ROEBLING BRIDGE CABLE (7 X 7)

ROEBLING TRAMWAY STRAND (19 TO 55 WIRES, ACCORDING TO DIAMETER OF STRAND)

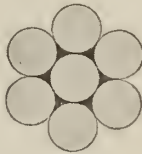
Diameter in ins.	1⅝	1½	1⅜	1¼	1⅝	1	¾	¾	⅝
Cast steel, approx. strength.	124.	108.4	88.8	71.8	60.	49.2	37.6	27.6	19.2
Plow steel, " " " " " "	146.	127.5	105.	84.6	70.7	58.0	44.4	32.5	22.3
Weight per 100 ft. in lbs.	563	488	401	323	270	220	169	124	86



ROEBLING TRAMWAY STRAND (19 TO 55)

ROEBLING GALVANIZED STEEL WIRE STRAND (7 WIRES).

Diameter in ins.	½	⅜	⅜	⅜	¼	⅜	⅜	⅜	⅜	⅜
Approximate breaking strength in lbs.	8,500	6,500	5,000	3,800	2,300	1,800	1,400	900	500	400
Approx. wt. per 1,000 ft. in lbs.	510	415	295	210	125	95	75	55	32	20



ROEBLING STEEL WIRE STRAND (7)

WILLIAMSPORT WIRE ROPE COMPANY

MAIN OFFICE AND WORKS

WILLIAMSPORT, PA.

AGENCIES IN ALL PRINCIPAL CITIES

Products.

WIRE ROPE.
Rope Accessories.

General Information.

Standard wire rope is composed of 6 strands and a hemp center, each strand containing 7 wires for haulage and transmission rope, and 19 wires for hoisting rope. Where greater flexibility is required, hoisting ropes are made of 6 strands containing 37 wires to the strand or 8 strands containing 19 wires each. In some cases a wire center is used, but this is not advisable except when absolutely necessary.

The life of a wire rope depends principally upon the speed at which it travels and the diameter of the drums and sheaves over which it works. The larger the diameter of the drums and sheaves, the longer the rope will last. The wear increases with speed, therefore it is better to increase the load, within the safety limit, than to increase the speed.

Working loads are usually calculated at one-fifth of the breaking strain, but it should be understood that this factor of safety is not recommended for all cases, especially in shafts and elevators. Where passengers are to be raised and lowered, the working load should not be more than one-tenth of the breaking strain of the rope.

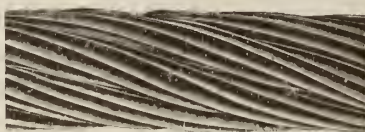
The strain or weight to be lifted should not be applied to wire rope with a sudden jar or a jerk, as the resultant strain may equal many times the weight to be lifted and the resistance to be overcome. A new rope may be easily broken in this manner. Such sudden strains cause rapid deterioration, if not actual breakage.

The proper lubrication of wire rope has not received the attention that it deserves. A thorough and continuous application of good lubricating oil, of a consistency that will penetrate to the center of the rope and heavy enough to remain as a coating upon the outside, is the ideal lubrication. Wire rope should be coated with grease when not in service, as otherwise the ropes will rust very rapidly.

The diameter of a wire rope is expressed by the diameter of a circle which will enclose it, therefore in using a calliper rule be careful to avoid measuring across two strands side by side. Measure rather from the top of any one strand to the top of the strand directly opposite.



STANDARD LAY WIRE ROPE



LANG LAY WIRE ROPE

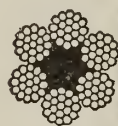
Materials.

The strength of the wire from which this company's ropes are made ranges from 85,000 to 280,000 lbs. per sq. in. depending upon the base material from which it is drawn and the treatment to which it is subjected. The wire is carefully selected for its chemical and physical qualities, careful consideration being given to the requirements of each individual case. The breaking strengths are arrived at by actual tests and represent the average of many tests.

Both ends of each coil of wire used in the manufacture of these ropes are carefully tested and it is therefore impossible for inferior wire to get into the product.

Standard Flexible Hoisting Rope.

Standard flexible hoisting rope is composed of 6 strands and a hemp center, each strand containing 19 wires. It is the rope most commonly used for general hoisting purposes and is made from five different materials, namely: Swedish iron, crucible cast steel, extra strong crucible cast steel, plow steel and improved plow steel.



STANDARD FLEXIBLE HOISTING ROPE

BREAKING STRENGTHS FOR STANDARD FLEXIBLE HOISTING ROPE

Diam., in.	Approx. weight per ft., lbs.	Approx. strength in tons of 2,000 lbs.				
		Swedish iron	Crucible cast steel	Extra strong crucible steel	Plow steel	Improved plow steel
2 3/4	11.95		211	243	275	315
2 1/2	9.85		170	200	229	263
2 1/4	8.00		133	160	186	210
2	6.30		106	123	140	166
1 7/8	5.55		96	112	127	150
1 3/4	4.85		85	99	112	133
1 1/2	4.15		72	83	94	110
1 1/4	3.55	33	64	73	82	98
1 3/8	3.00	28	56	64	72	84
1 1/8	2.45	22.8	47	53	58	69
1 1/4	2.00	18.6	38	43	47	56
1 1/8	1.58	14.5	30	34	38	45
1	1.20	11.8	23	26	29	35
7/8	.89	8.5	17.5	20.2	23	26.3
5/8	.62	6.0	12.5	14.0	15.5	19.0
3/4	.50	4.7	10.0	11.2	12.3	14.5
1/2	.39	3.9	8.4	9.2	10.0	12.1
3/8	.30	2.9	6.5	7.25	8.0	9.4
5/16	.22	2.4	4.8	5.30	5.75	6.75
1/4	.15	1.5	3.1	3.50	3.80	4.50
3/16	.10	1.1	2.2	2.43	2.65	3.15

Extra Flexible Hoisting Rope.

This rope is used for the same purpose as standard hoisting rope where extra flexibility is necessary. It has 2 more strands and smaller wires than the standard construction of 6 x 19 rope of the same diameter.

The breaking strength of this rope is less than the 6 x 19 construction, but for light loads it gives splendid service owing to its ability to withstand severe bending. When made of extra strong crucible cast steel, extra flexible hoisting rope is intermediate in quality between crucible cast steel and plow steel rope.



EXTRA FLEXIBLE HOISTING ROPE

BREAKING STRENGTHS FOR EXTRA FLEXIBLE HOISTING ROPE

Diam., in.	Approx. weight per ft., lbs.	Approx. strengths in tons of 2000 lbs.			
		Crucible cast steel	Extra strong crucible cast steel	Plow steel	Improved plow steel
1 1/2	3.19	58	66	74	80
1 3/8	2.70	51	57	64	68
1 1/4	2.20	42	47	52	56
1 1/8	1.80	34	38	43	46
1	1.42	26	29.7	33	36
7/8	1.08	20	23.0	26	28
3/4	.80	15.3	17.6	20	22
5/8	.56	10.9	12.4	14	15
1/2	.45	8.7	10.1	11.6	12
3/8	.35	7.3	8.0	8.7	9.5
5/16	.27	5.7	6.3	6.9	
1/4	.20	4.2	4.66	5.12	
3/16	.13	2.75	3.05	3.35	
1/8	.09	1.80	2.02	2.25	

Special Flexible Hoisting Rope.

This rope consisting of 222 wires, smaller than those used in standard hoisting rope, will not stand the same wear and therefore should not be subjected to high speed. Where the bending stresses are severe, it is, however, an economical installation.



SPECIAL FLEXIBLE HOISTING ROPE

BREAKING STRENGTHS FOR SPECIAL FLEXIBLE HOISTING ROPE

Diam., in.	Approx. weight per ft., lbs.	Approx. strengths in tons of 2000 lbs.			
		Crucible cast steel	Extra strong crucible cast steel	Plow steel	Improved plow steel
2 3/4	11.95	200	233	265	278
2 1/2	9.85	160	187	214	225
2 1/4	8.00	125	150	175	184
2	6.30	105	117	130	137
1 3/4	4.85	84	95	108	113
1 1/2	4.15	71	79	90	95
1 1/4	3.55	63	71	80	84
1 1/8	3.00	55	61	68	71
1 1/4	2.45	45	50	55	58
1 1/8	2.00	34	39	44	46
1	1.58	29	32	35	37
7/8	1.20	23	25	27	29
3/4	.89	17.5	19	21	23
5/8	.62	11.2	12.6	14	16
1/2	.50	9.5	10.5	11.5	12.5
3/8	.39	7.25	8.25	9.25	9.75
5/16	.30	5.50	6.35	7.20	7.50
1/4	.22	4.20	4.65	5.10	5.30

Standard Coarse Laid Rope.

This rope, made of 6 strands of 7 wires each around

a hemp center, is especially recommended for standing rope, ferry rope, sand lines, guys, rigging and underground haulage in coal mines.



STANDARD COARSE LAID ROPE

BREAKING STRENGTHS FOR STANDARD COARSE LAID ROPE

Diam., in.	Approx. weight per ft., lbs.	Approx. strengths in tons of 2000 lbs.				
		Swedish iron	Crucible cast steel	Extra strong crucible cast steel	Plow steel	Improved plow steel
1 1/2	3.55	32	63	73	82	90
1 3/8	3.00	28	53	63	72	79
1 1/4	2.45	23	46	54	60	67
1 1/8	2.00	19	37	43	47	52
1	1.58	15	31	35	38	42
7/8	1.20	12	24	28	31	33
3/4	.89	8.8	18.6	21	23	25
5/8	.75	7.3	15.4	16.7	18	20
1/2	.62	6.0	13.0	14.5	16	17.5
3/8	.50	4.8	10.0	11.0	12	13.0
5/16	.39	3.7	7.7	8.85	10	11.0
1/4	.30	2.6	5.5	6.25	7	7.75
3/16	.22	2.2	4.6	5.25	5.9	6.50
1/8	.15	1.7	3.5	3.95	4.4	
3/32	.125	1.2	2.5	2.95	3.4	

Wire Rope Transmission.

Round, endless rope, running between two grooved sheaves, constitutes transmission by wire rope, and may be successfully operated at distances of 50 ft. to several miles. Division into two or more transmissions is necessary in distances greater than 400 ft.

Wire rope of 6 strands of 7 wires each is generally used, though frequently one of 6 strands of 19 wires each is selected. Crucible cast steel has displaced the iron wire rope formerly used for transmission.

On short transmission use the next larger diameter cable than that shown in the table, for satisfactory results; and it is advisable to keep the speed within the limit given in the transmission table. Unnecessary sheaves should be avoided, as each extra sheave adds to the wear of the rope.

For extra friction use larger sheaves or heavier rope of the 6 x 19 construction.

In ordering endless rope be careful to give exact measurements of distance from center to center of shafts and the diameter of terminal sheaves at bottom of grooves.

DATA FOR WIRE ROPE TRANSMISSION

Diam. of sheave, ft.	R.p.m.	Diam. of rope, in.	Horse- power	Diam. of sheave, ft.	R.p.m.	Diam. of rope, in.	Horse- power
3	100	3/8	3 1/2	9	120	1/8	82
3	140	3/8	4 1/2	10	80	5/16	64
4	100	3/8	5	10	80	1/4	68
4	140	3/8	7	10	100	3/8	80
5	100	1/2	11	10	100	1/2	85
5	140	1/2	15	10	120	5/8	96
6	100	1/2	17	10	120	3/4	102
6	140	1/2	23	12	80	1 1/8	93
7	100	1/2	25	12	80	1 1/4	99
7	140	1/2	35	12	100	1 1/2	116
8	100	5/8	32	12	100	1 3/4	124
8	140	5/8	45	12	120	1 3/4	140
9	80	5/8	48	12	120	2	149
9	80	1/2	58	12	120	2 1/8	173
9	100	5/8	60	14	80	1	141
9	100	1/2	69	14	80	1 1/8	148
9	120	1/2	73	14	100	1	176
						1 1/8	185

WATERBURY COMPANY

Manufacturers of Wire and Fiber Rope

63 Park Row
NEW YORK, N. Y.

CHICAGO, ILL., 1315-21 West Congress Street
SAN FRANCISCO, CAL., 151-61 Main Street

BRANCHES
NEW ORLEANS, LA., 1018 Maison-Blanche Building
DALLAS, TEX., A. T. POWELL & Co., Southwestern Life Building
FACTORY, BROOKLYN, N. Y.

Products.

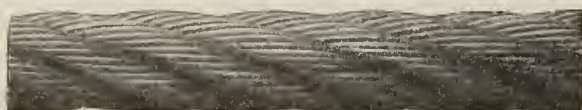
WIRE ROPE; ARMORED WIRE ROPE; FIBERCLAD (Marline Covered) WIRE ROPE; MANILA and SISAL ROPE; MANILA TRANSMISSION ROPE; DRILLING CABLE.

Non-spinning Wire Hoisting Rope, Mining Rope, Wire Transmission Rope.



Waterbury Wire Rope.

Made in grades known as Swedish Iron, Crucible Cast Steel, Extra Strong Cast Steel, Plow Steel and Green Strand Giant Steel, the latter being the highest grade of improved plow steel.

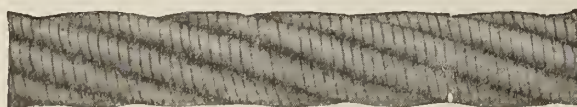


WATERBURY WIRE ROPE

Waterbury Armored Wire Rope (Gore Patent, March 14, 1911).

Made 6 strands, 19 wires, 37 wires or 61 wires to the strand, according to size and conditions of use. Furnished in crucible cast steel, extra strong cast steel, plow steel or Giant improved plow steel stock.

The initial factor of safety is maintained longer in Waterbury armored rope than in any other class of rope. The strands are wound or served with flat wires having convex edges, which wires take the abrasion on the crown strands. This gives a great advantage over rope of ordinary construction, inasmuch as wear on crown strands does not occur until this serving has worn down, and after that period such wire serving becomes packed into the interstices of the rope, making it cylindrical and thus materially increasing the efficiency of the rope.



WATERBURY ARMORED WIRE ROPE

Waterbury Fiberclad Rope.

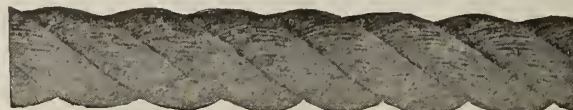
A wire rope, each strand of which is served with the best grade of tarred Russian hemp marline. The tarred marline affords protection against acid fumes, moisture or foreign matter, such as coal dust and residue. Fiberclad rope is not affected by atmospheric conditions, as in the case of manila or wire rope; is about one-third the diameter of manila rope of the same strength; is flexible and will coil down as readily as manila rope, and will outwear bare wire rope or manila rope under all ordinary working conditions.



WATERBURY FIBERCLAD ROPE

Waterbury Manila and Sisal Ropes (for general use).

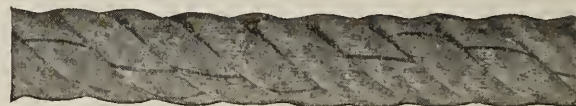
Made in the several standard grades of manila and sisal, and may be depended upon to be of the very highest quality in their respective grades.



WATERBURY MANILA AND SISAL ROPE

Waterbury Manila Transmission Rope.

A special rope for power transmission purposes, made from the best selected Cebu manila hemp. Made 4 strands with heart, unless otherwise ordered. The yarns are treated with a special composition, which thoroughly lubricates the strands and individual fibers, making the rope practically waterproof. Especially adapted for rope driving and made as nearly perfect as the best machinery, superior quality of material and workmanship can produce.

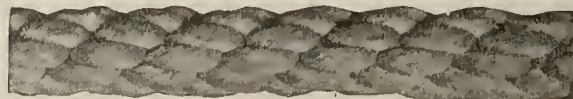


WATERBURY MANILA TRANSMISSION ROPE

Waterbury "Drillwell" Manila Drilling Cable.

Made from carefully chosen grades of fiber, graded for toughness and general wearing quality. Drilling cables are 3 ropes laid into 1 (or 9 strands), so formed as to be thoroughly uniform, of correct lay and tension in each of the 3 ropes forming the finished cable. Drill-in cables are referred to as hawser-laid rope, i.e., 3 ropes twisted together, the twist being in opposite direction to the twist of the ropes, usually left hand. The advantages in a properly made hawser-laid rope over other types of rope are greater elasticity or springiness and greater wearing surface.

All Waterbury drilling cables are especially lubricated to prevent internal friction and to keep the fiber from becoming very dry, this preventing disintegration.



WATERBURY "DRILLWELL" MANILA DRILLING CABLE

Waterbury Wire Drilling Cables.

Are generally made left lay, in all standard sizes, 6x19, 6x8, or 6x7 construction. The line includes crucible cast steel stock, extra strong and plow steel stock. Also sand lines, tubing, casing and sucker rod lines, pumping lines, cleaning out cables and steel wire dead lines.

Prices, Handbook, etc.

Ask for prices, samples and the 220-page cloth bound Rope Handbook, containing valuable rope data and describing the complete Waterbury line.

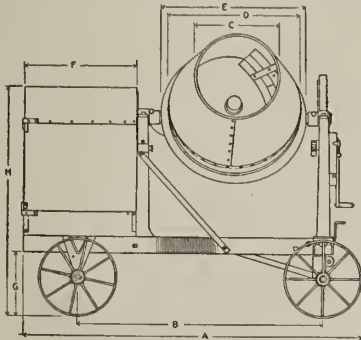
THE JAEGER MACHINE CO.

Manufacturers of Concrete Mixers

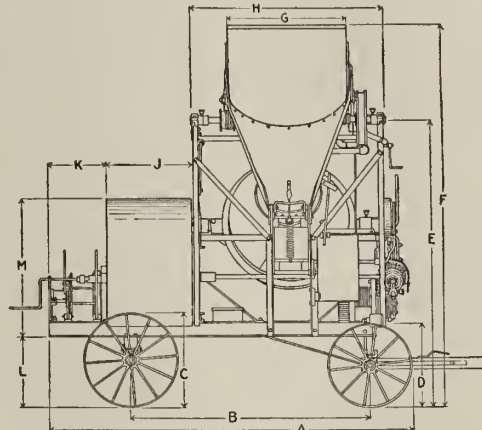
COLUMBUS, OHIO

Products.

JAEGER CONCRETE MIXERS,
PAVERS and PLACING PLANTS.



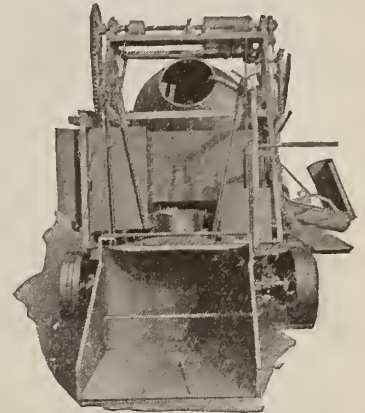
Without Loader



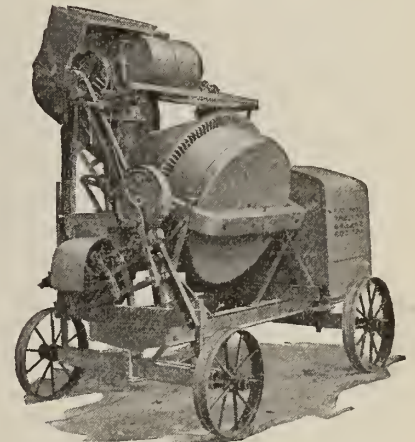
With Loader

DIMENSION DIAGRAMS OF JAEGER MIXERS

	A	B	C	D	E	F	G	H	J	K	L	M	N	P	S	T
WITHOUT LOADER																
No. 4-E	82	60	20	34	38	25	14	52	41	66	46	26	45	...	...	...
No. 3-E	70	49	16	27	30	22	15	52	40	57	40	26	41	...	...	...
WITH LOADER																
No. 7-L	...	65	28	24	88	114	37	60	28	..	18	40	16	64	118	30
No. 7-H	120	73	28	24	88	114	37	60	28	23	18	40	16	64	118	30
No. 4-L	...	54	24	20	80	96	32	50	25	..	15	38	..	59	96	28
No. 4-H	109	64	24	20	80	96	32	50	28	21	15	38	..	59	96	28



NO. 7-P JAEGER PAVER
Capacity, 12 cu. ft. unmixed materials per batch, or up to 8 cu. ft. mixed concrete

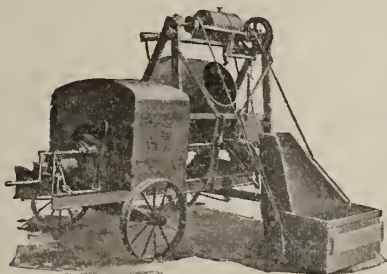


NO. 7-L JAEGER MIXER WITH
POWER LOADER
Capacity, 12 cu. ft. unmixed materials per batch, or about 8 cu. ft. mixed concrete



JAEGER PLACING PLANT

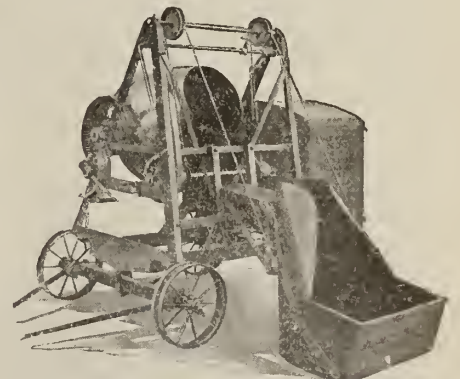
Consists of incline track made of 5 sections, each 10 ft. Skip car ample size for full batch. Hopper at end of track to receive batch. Spouts are 25 ft. long. Additional track and spout furnished extra. Built in two sizes



NO. 7 JAEGER TILTING DRUM MIXER
WITH POWER LOADER AND HOIST
Capacity, 12 cu. ft. unmixed materials per batch, or about 8 cu. ft. mixed concrete



NO. 4-H JAEGER TILTING DRUM MIXER
WITH POWER LOADER AND HOIST
Capacity, 7 cu. ft. unmixed materials per batch, or about 4½ cu. ft. mixed concrete



NO. 4-L JAEGER TILTING DRUM MIXER
WITH POWER LOADER
Capacity, 7 cu. ft. unmixed materials per batch, or about 4½ cu. ft. mixed concrete

KOEHRING MACHINE CO.

Concrete Mixers, Bar Benders and Cutters

MILWAUKEE, WIS.

BRANCH OFFICES AND AGENCIES

ATLANTA, GA., ATLANTIC EQUIPMENT Co., 4th National Bank Building
BALTIMORE, MD., THOS. M. BROWN, 20 Knickerbocker Building
BOSTON, MASS., KOEHRING MACHINE Co., R. D. Houghton, 141 Milk Street
BUFFALO, N. Y., H. B. TREVOR Co., 705 D. S. Morgan Building
CHICAGO, ILL., KOEHRING MACHINE Co., G. E. Hillsman, District Manager, 849 Peoples Gas Building
CLEVELAND, OHIO, BACON ENGINEERING SALES Co., 3rd Floor, Rose Building
COLUMBUS, OHIO, W. W. WILLIAMS Co., 507 Brunson Building
INDIANAPOLIS, IND., KOEHRING MACHINE Co., H. W. Taylor, Representative, 1009 Fletcher Trust Building
KANSAS CITY, MO., KOEHRING MACHINE Co., K. W. Lewis, Direct Factory Representative, 708 Commerce Trust Building
LOS ANGELES, CAL., HARRON, RICKARD & McCONE, 225 South San Pedro Street

MINNEAPOLIS, MINN., THORMAN W. RSHOLT Co., Builders Exchange
NASHVILLE, TENN., WILSON, WEESNER & Co., 177 Second Avenue, N.
NEW YORK, N. Y., R. E. BROOKS Co., 50 Church Street
NORFOLK, VA., LEWTER F. HOBBS, Seaboard National Bank Building
PHILADELPHIA, PA., LEE T. WARD Co., 617-619 Filbert Street
PITTSBURGH, PA., GEO. W. ZIEGLER MACHINERY Co., 515 First Avenue
PORTLAND, ORE., KOEHRING MACHINE Co., Northwest, A. L. Denney, District Manager, 254 Hawthorne Avenue
ST. LOUIS, MO., KOEHRING MACHINE Co., C. F. Rabbeitt, District Manager, A-20 Railway Exchange Building
SAN FRANCISCO, CAL., HARRON, RICKARD & McCONE, 139 Townsend Street
SEATTLE, WASH., KOEHRING MACHINE Co., Northwest, L. A. Snow, District Manager, 1525 Tenth Avenue

Products and Service.

HEAVY DUTY CONSTRUCTION CONCRETE MIXERS; HEAVY DUTY PAVING MIXERS; DANDIE LIGHT MIXER; MIXER LOADER; HOT MIXERS—Construction and Paver Type.

Rotary Grader; Bar Benders and Cutters.

Koehring Sales and Service Branches, and warehouses in every principal city insure responsible, quick service.

Standardized Concrete.

The Koehring re-mixing action and automatic water measuring tank make it easy to standardize mix for uniformity and consistency.

The re-mixing action is secured by means of the discharge chute pivoted well inside the drum, sloping inward in mixing position, and out through the opening when discharging. Diagonal blades cut through the mixture, carrying it up the drum sides to a point where it spills backward, in a rolling action. Pick-up buckets then carry mixture to the top of drum, spilling it down on the insloping discharge chute in a cascade action which prevents aggregate gathering according to size. From the discharge chute it is hurled back to the diagonal blade on the charging side of the drum for repeated trips through the mixing action.

This re-mixing action is only possible because of the Koehring patent, which pivots the discharge chute inside the drum far enough to return aggregate to the charging side of the drum. Design of pick-up buckets gives fast discharge.

Fast Operation.

High speed operation is secured by automatic actions which permit operator to maintain top capacity operation every minute of the day; and to heavy duty construction which permits continuous high speed operation without breakdowns and delay.

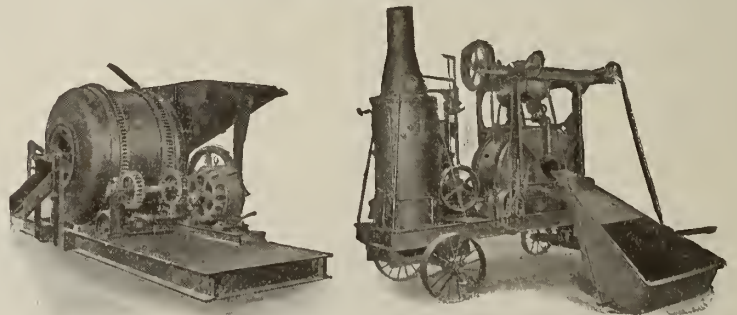
Fast, clean charging is due to high speed elevation of charging skip, which goes to extreme angle by passing between the skip cable sheaves, chuting charge into drum in one swift, clean slide.

Charging skip automatically stops in discharge posi-

tion until released. Size and design of pick-up buckets insure fast discharge of drum during the time the skip with new charge raises to charging position.

Drum.

Drumheads and runways are single castings of special close grained metal. Rounded corners prevent clogging. Flanges are turned true, to secure watertight joint with heavy boiler plate center shell. Double gear drive minimizes vibration, and furnishes reserve drive.



KOEHRING CONCRETE MIXERS

Trunnion Rollers.

Trunnion rollers are fixed to shaft, and shaft revolves in big babbitted bearings easily accessible on frame, and constructed so wear may be taken up. This construction eliminates wobbly drums and preserves perfect alignment of driving mechanism.

Frame and Trucks.

Trucks have 3-point suspension, and with superstructure are built of extra heavy pressed steel members, riveted and gusseted at joints.

Friction Clutch.

Consists of housing with sleeve for gear, in which are front plate and master disc, separated by friction disc. Maple block frictions inserted through opening in disc receive wear on end of grain. Winding drums have bronze bushing with graphite embedded for lubrication.

Power.

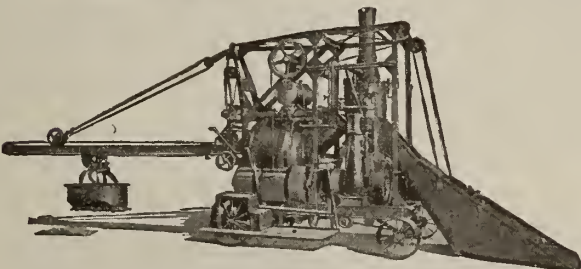
Gasoline, steam or electric motor of standard high grade manufacture. Boilers to conform with laws of any state. Surplus power on all sizes.

Equipment.

Low charging platforms, batch or standard hopper, power charging skips, automatic water measuring tank; also on pavers, boom and bucket concrete distributing system, and gravity spouts.

Koehring Pavers.

The fastest paving unit with boom and bucket distribution. Narrow design, giving liberal working room around the mixer. Low center of gravity. Boom swings on arc of 180°. May be had with loading derrick for lifting batch boxes over charging skip. Caterpillar traction or round road wheels. The biggest paver line—5 sizes.



KOEHRING STREET PAVERS

QUANTITY OF AGGREGATE STANDARD PROPORTION PER BATCH, KOEHRING PAVERS AND CONSTRUCTION MIXERS

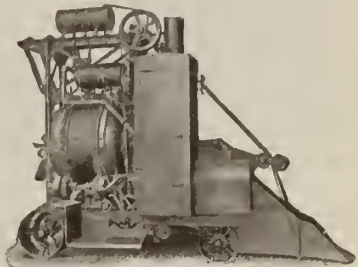
Construction Paving	Proportion	No. 7S No. 7E	No. 10S No. 10E	No. 14S No. 14E	No. 21S No. 21E	No. 28S No. 28E
Cement, bag.....	1	2	3	4	6	8
Sand, cu. ft.	1½	3	4½	6	9	12
Stone, cu. ft.	3	6	9	12	18	24
Cement, bag.....	1	1½	2½	3½	5	7
Sand, cu. ft.	2	3	5	7	10	14
Stone, cu. ft.	3	4½	7½	10½	15	21
Cement, bag.....	1	1½	2½	3	5	6½
Sand, cu. ft.	2	3	5	6	10	13
Stone, cu. ft.	3½	4¾	8¾	10½	16¾	22¾
Cement, bag.....	1	1½	2	3	4½	6½
Sand, cu. ft.	2	3	4	6	9	13
Stone, cu. ft.	4	6	8	12	18	26
Cement, bag.....	1	1	2	2½	4	5½
Sand, cu. ft.	2½	2½	5	6¼	10	13¾
Stone, cu. ft.	4	4	8	10	16	22
Cement, bag.....	1	1	2	2½	4	5½
Sand, cu. ft.	2	2	4	5	8	11
Stone, cu. ft.	5	5	10	12½	20	27
Cement, bag.....	1	1	1½	2½	4	5
Sand, cu. ft.	2½	2½	3¾	6¼	10	12½
Stone, cu. ft.	5	5	7½	12½	20	25
Cement, bag.....	1	1	1½	2	3½	4½
Sand, cu. ft.	3	3	4½	6	10½	13½
Stone, cu. ft.	5	5	7½	10	17½	22½
Cement, bag.....	1	1	1½	2	3	4½
Sand, cu. ft.	3	3	4½	6	9	13½
Stone, cu. ft.	6	6	9	12	18	27
Cement, bag.....	1	1	1½	2	3	4
Gravel, cu. ft.	6	6	9	12	18	24

To obtain best results the size of batch should not exceed the quantity as listed in the column under size of mixer. The rating is based on using 1½-in., or larger, crushed rock and full bag batches.

Koehring Hot Mixers.

Koehring hot mixers are combination heating plants and mixers for bituminous road mixtures, sheet asphalt, rock asphalt, mastic floor, and for cement concrete.

Combustion takes place in double burner oil furnace with brick lined chamber, and lined conduit. Heated gases and air are injected into drum by blower. Fuel oil or kerosene may be used.



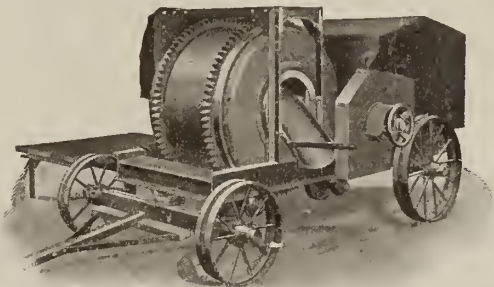
HOT MIXER

To use as hot mixer, make connection with blower and asphalt tank; to use with concrete cement, disconnect asphalt tank and blower and connect water tank.

Koehring hot mixers are built both in side charging type and paver end charging type.

Dandie Light Mixers.

A light mixer for general work such as culverts, footings, foundations, sidewalks, etc. Double drum drive, single section discharge chute, steel engine house, ball and socket bearings. A strong, dependable light mixer, built in big volume, every part standardized, 4- and 7-cu. ft. capacities, mixed concrete. May be equipped with low charging platform, batch hopper, or power charging skip, automatic water measuring tank and light duty hoist.



DANDIE LIGHT MIXER

Koehring Mixer Loaders.

A belt conveyor, on a portable frame, self-driven by gasoline engine. Hopper bins above belt are adjustable for any size mixer and any proportion of "mix." Striking off materials at top of bins accurately measures materials. Lever opens bottom of bins, allowing materials to drop on belt conveyor, moving 100 ft. per minute, delivering materials into charging skip of mixer. Hopper bins movable along frame to any point. Cuts out all wheeling—delivers materials from any point within 60 ft. of mixer.



MIXER LOADER

RANSOME CONCRETE MACHINERY CO.

Concrete Mixers, Chutes and Equipment

DUNELLEN, N. J.

BRANCH OFFICES AND REPRESENTATIVES

BOSTON, MASS., R. B. CAMPBELL Co., 6 Beacon Street
 NEW YORK, N. Y., RANSOME CONCRETE MACHINERY Co.,
 150 Nassau Street
 PHILADELPHIA, PA., GILES & RANSOME, Commonwealth
 Building
 PITTSBURGH, PA., GEO. C. VIDETTO MACHINERY Co., Bes-
 semer Building
 BALTIMORE, MD., GILES & RANSOME, Builders Exchange
 NORFOLK, VA., W. L. ROCKE, Law Building
 RICHMOND, VA., HENRY W. O'GRADY, Mutual Building
 HUNTINGTON, W. VA., BANKS SUPPLY COMPANY
 ATLANTA, GA., PIEDMONT MOTOR & MACHINERY Co., 38 South
 Forsyth Street
 BIRMINGHAM, ALA., HENRY C. ASHMEAD, Brown-Marx
 Building
 JACKSONVILLE, FLA., E. W. BENTLEY
 CHICAGO, ILL., RANSOME CONCRETE MACHINERY Co., 218
 North Clinton Street
 CINCINNATI, OHIO, H. M. BRITTAN, Grand Hotel

DETROIT, MICH., W. H. ANDERSON TOOL & SUPPLY Co.,
 Brush and Macomb Streets
 ST. PAUL, MINN., RAYMER HARDWARE COMPANY, 56 East
 Fifth Street
 DES MOINES, IOWA, DES MOINES STEEL COMPANY
 ST. LOUIS, MO., HENRY K. ROBINSON, 804 Federal Reserve
 Bank Building
 KANSAS CITY, MO., H. C. DARNELL & Co., 15th and Elm-
 wood Avenues
 MEMPHIS, TENN., PIGEON-THOMAS IRON COMPANY
 NEW ORLEANS, LA., OLE K. OLSEN
 HOUSTON, TEX., ALEXANDER HARRISON, 2007 Shearn Street
 SAN FRANCISCO, CAL., C. A. GARFIELD & Co., Hearst
 Building
 EL PASO, TEX., BROWNFIELD & CAMPTON, Mills Building
 MONTREAL, CAN., F. H. HOPKINS & Co., Imperial Bank
 Chambers
 TORONTO, CAN., F. H. HOPKINS & Co., Mail Building
 HAVANA, CUBA, THRALL ELECTRIC COMPANY

Products.

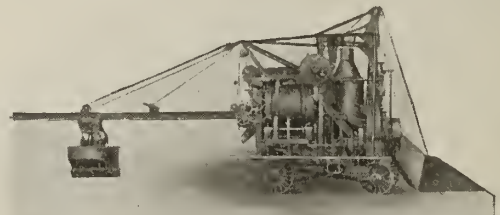
CONCRETE MIXERS, PAVING MIXERS, GROUT MIXERS and PLACERS, PNEUMATIC CONCRETE MIXERS and PLACERS, HOIST BUCKETS, BIN GATES, COMPLETE CHUTING PLANTS including STEEL TOWERS and all ACCESSORIES, CONCRETE CARTS and CARS, PORTABLE WOODWORKING MILLS.

Dry Mixers, Concrete Charging Barrows, Concrete Tampers and Axes, Bar Cutters and Benders.



TRADE-MARK

The Ransome Engineering Department, composed of engineers, of long and wide experience in construction work, will co-operate with contractors and engineers in the solution of concrete equipment problems, upon receipt of plans, location of material piles and how the aggregate is delivered to the job. This service is free to clients.



RANSOME 21-E PAVER

CAPACITY—21 cu. ft. mixed concrete per batch; 30 cu. ft. unmixed loose material per batch.

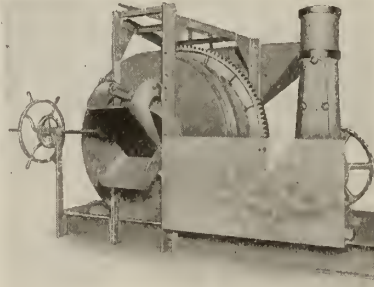
EQUIPMENT—Steam engine and boiler, power loader, automatic water tank, 20-ft. distributing boom and bottom dumping bucket or distributing chute with 3-point discharge. Mounted on self-traction trucks or crawling traction



RANSOME STANDARD BUILDING MIXER, SIZE 21-S

CAPACITY—21 cu. ft. mixed concrete per batch; 30 cu. ft. unmixed loose material per batch.

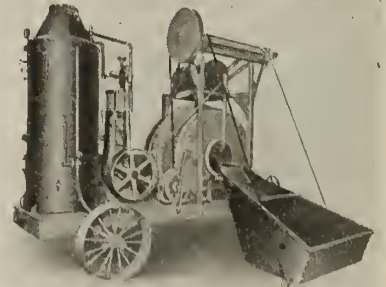
EQUIPMENT—Charging chute, batch hopper, power loader, with or without automatic water tank. On trucks or skids. Steam, electric or gasoline operated, or belt drive



RANSOME STANDARD BUILDING MIXER, SIZE 28-S

CAPACITY—28 cu. ft. mixed concrete per batch; 45 cu. ft. unmixed loose material per batch.

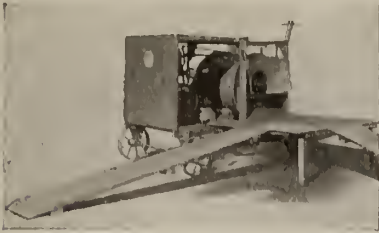
EQUIPMENT—Charging chute, batch hopper, automatic water tank. On skids only. Steam or electric operated or belt drive



RANSOME STANDARD BUILDING MIXER, SIZE 14-S

CAPACITY—14 cu. ft. mixed concrete per batch; 22 cu. ft. unmixed loose material per batch.

EQUIPMENT—Charging chute, batch hopper, power loader with automatic water tank. On trucks or skids. Steam, electric or gasoline operated, or belt drive



IMPROVED RANSOME BANTAM MIXER

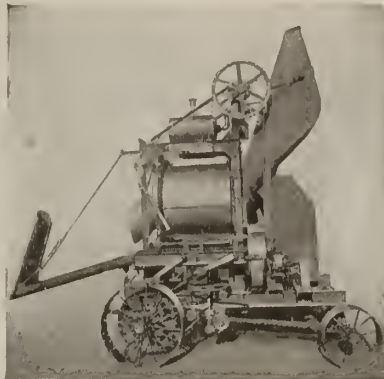
On trucks, with gasoline engine, platform and runways.

Made in two sizes, 7-S and 10-S.

7-S CAPACITY—7 cu. ft. mixed concrete per batch; 10 cu. ft. unmixed loose material per batch.

10-S CAPACITY—10 cu. ft. mixed concrete per batch; 14 cu. ft. unmixed loose material per batch.

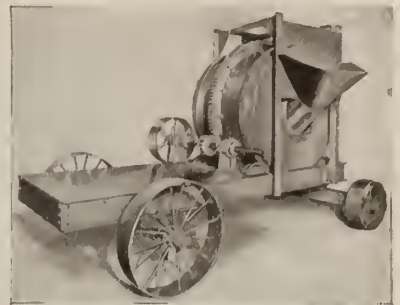
EQUIPMENT—Both mixers are furnished with charging chute; with or without platform and runways; batch hopper; power loader and with automatic water tank. On trucks or skids. Steam, electric or gasoline operated.



RANSOME 7-E HIGH DRUM PAVER

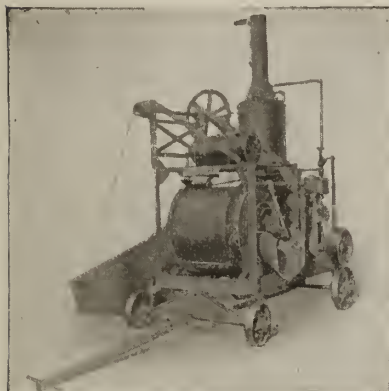
CAPACITY—7 cu. ft. mixed concrete per batch; 10 cu. ft. unmixed loose material per batch.

EQUIPMENT—Gasoline engine, power loader, automatic water tank, 10 ft. 3-point discharge distributing chute, slope 21°. Mounted on self-traction trucks.



RANSOME CHARGING CHUTE

Guides material into opening of drum. Usually limited to use with wheelbarrows and in connection with platforms and runways.



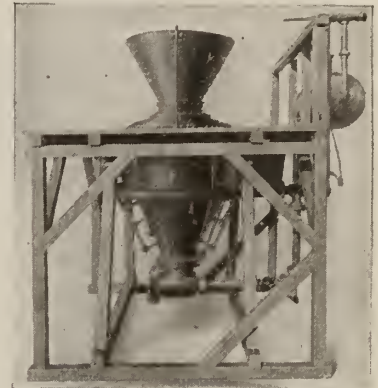
IMPROVED RANSOME BANTAM MIXER

On trucks, with steam engine, boiler, power loader and with automatic water tank.



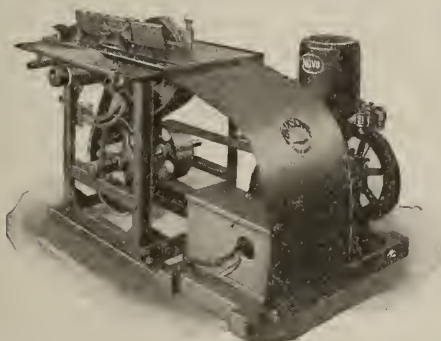
RANSOME POWER LOADER

Avoids use of overhead bins, runways, etc. Bucket is loaded directly from wheelbarrows or cars on ground level. Loading time speeded up by compensating sheaves in overhead framework, which increase speed as bucket rises. Ransome automatic water tank is regularly included with power loader.



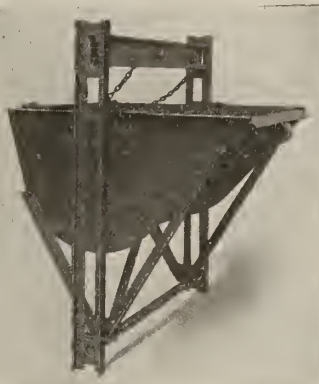
RANSOME-CANNIFF PNEUMATIC CONCRETE MIXER AND PLACER

Will mix and place concrete in tunnel jobs at 40% of the cost for handwork. Stock sizes handle a batch of 14 cu. ft. of loose aggregates or 10 cu. ft. of mixed concrete. Other sizes made to order. Will successfully convey concrete half a mile. Up to 500 ft., will place 50 batches per hour; to 750 ft. 40 and up to 1000 ft., 28 batches per hour under average conditions.



RANSOME SOLID TOP PORTABLE WOOD-WORKING MILL

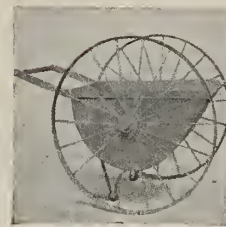
Designed and built for contractor's use. Table top is solid casting, machined true on top and sides. Operated by gasoline engine. Saw is mounted on movable arbor and is raised and lowered so that lumber always runs horizontally. A wood turning lathe may be attached. Send for Bulletin 300 for details.



RANSOME HOIST BUCKET

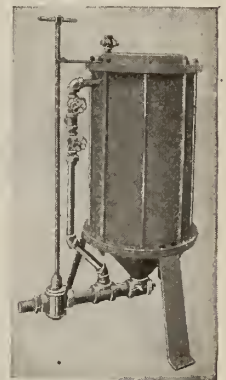
Operates quickly in direct vertical lift and equally well in wooden or steel towers. Automatic discharge at any desired point in tower. No catches or trips.

CAPACITY—8, 12, 18, 27, 36 and 66 cu. ft.



RANSOME CONCRETE CARTS

More economical than wheelbarrows because of greater capacity—6 cu. ft. Handles may be quickly changed to either end. Contour of body facilitates quick, clean dumping. Furnished with or without legs.



RANSOME-CANNIFF PNEUMATIC GROUT MIXER AND PLACER

Designed to mix and place grout under pressure by means of compressed air. Particularly adapted to sealing fissures, closing voids in concrete where absolutely watertight work is essential, etc. Size of batch is 2 sacks of cement and 2 cu. ft. of sand with whatever amount of water is required. Will place on an average of 40 batches per hour under ordinary conditions against a head of 175 ft. or less. 3 types: Standard, adapted to pressure up to 150 lbs.; High Pressure, to 300 lbs.; Extra High Pressure, to 600 lbs.



RANSOME SKIP CARS

These cars dump automatically and return to the loading position by gravity. May be used economically on the larger installations.

CAPACITY—1, 1½, and 2 cu. yds.

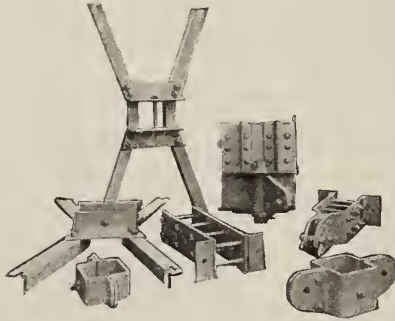


RANSOME BIN GATES

Both vertical and bottom type built with radial cut-off. Work easily and positively in all materials. When ordering, specify whether for steel or wooden bins. Made in 2 sizes, 12 by 15 in., and 20 by 20 in.

Ransome Concrete Chutes and Accessories.

The design of Ransome concrete chutes is the result of years of experience and experiments in the handling of concrete. This practical knowledge finds expression in the size and shape of the trough, the slope or angle, and the over-size hopper heads which compensate for the momentary check in flow caused by a change in direction. Standardization and interchangeable unit construction facilitate replacement of parts, dismantling, shipping and setting up of Ransome chutes. The body of the chute is made of No. 14 gage, high carbon steel, insuring rigidity, strength and long service.



RANSOME OPEN WOODEN BOOM IRONS

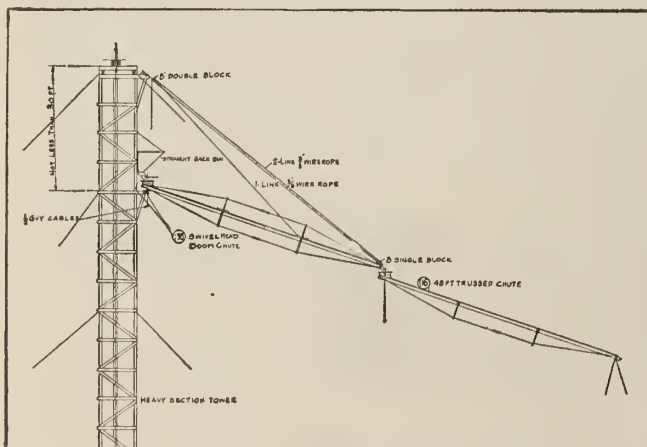
RANSOME OPEN WOODEN BOOM IRONS—Made of steel and specially designed to take the strains and stresses peculiar to their work. The irons for the 48-ft. 6-by 6-in. open wooden beams are designed for use with the standard open wooden boom plants. The boom irons for the 48-ft. 8-by 8-in. open wooden booms used in connection with counterweight chutes, are made extra heavy.



Closed



Open
RANSOME LINE GATE



RANSOME BOOM CHUTE PLANT

RANSOME LINE GATE—Designed to draw concrete from various points in a continuous line chute by simply pulling a rope. One chute with a hopper head, or a line hopper with flexible drop chutes attached, may be used under the line gates. For exceedingly long drops, 8-ft. lengths of 8-in. diameter chutes are preferable to the shorter lengths of 8-in. flexible drop chutes.

Ransome Swivel Head Chutes, Plain and Trussed.

The simplicity of construction of Ransome chutes is shown by the ease with which the various items may be combined to make various units. To make a 16-ft. swivel head chute, bolt a hopper head on the upper end, and a splash hood with a swivel hook on the lower end of a 16-ft. trough unit. A 32-ft. swivel head chute is made by joining two 16-ft. trough units together and strengthening the joint by bolting a splice plate and attaching a hopper head, splash hood and swivel hook. A 48-ft. swivel head trussed chute is made up by joining three 16-ft. trough units together with two splice plates, and at each joint, bolting through the standard holes in the connecting flanges, one truss strut, and putting in place two truss rods by passing these through standard holes in the flanges. The hopper head, splash hood and swivel hook are then added as before.



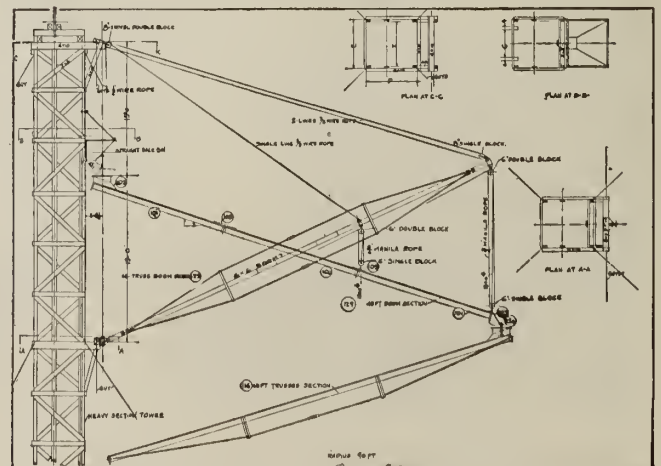
16-ft. Swivel Head Chute



32-ft. Swivel Head Chute

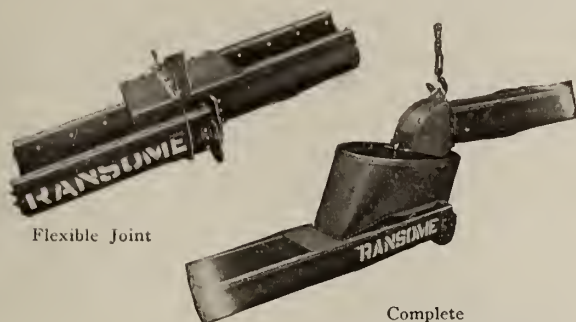


48-ft. Swivel Head Trussed Chute
RANSOME SWIVEL HEAD CHUTES



RANSOME OPEN WOODEN BOOM PLANT

RANSOME SWIVEL JOINT—The view of a complete swivel joint shows the oversize hopper head which takes care of the momentary checking of velocity of flow of the concrete, due to the change in direction, and also the swivel hook located outside the splash hood, which is an advantage, as it does not obstruct the flow of the concrete.



RANSOME CONTINUOUS LINE CHUTE JOINTS

Ransome Continuous Line Chute.

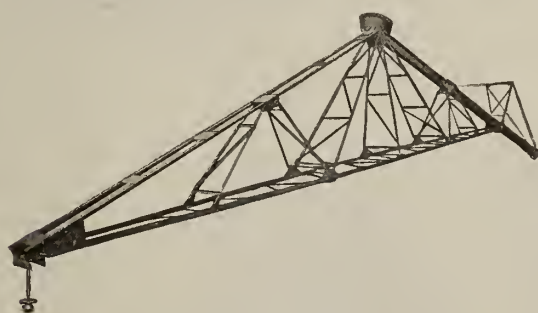
A 32-ft. continuous line chute is made the same as a 32-ft. swivel head chute, except that the hopper head, splash hood and swivel hook are omitted, and a flexible joint is attached at the lower end.

Ransome Counterweight Chutes.

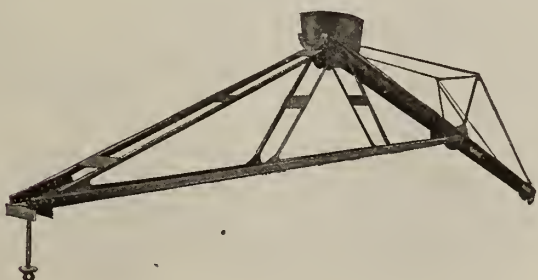
Made in two lengths, 32 ft. and 48 ft. The 32-ft. section will carry a 32-ft. swivel head section and the 48-ft. section is strong enough to carry a 48-ft. swivel head trussed section at its lower end. This means that a Ransome counterweight chute is stronger and naturally heavier than a chute which will carry only the load of concrete within itself.

On practically every job, instances arise where it is advantageous to carry another section of chute on the lower end of the counterweight section.

It will always be an economy to buy a counterweight chute strong enough to do this.

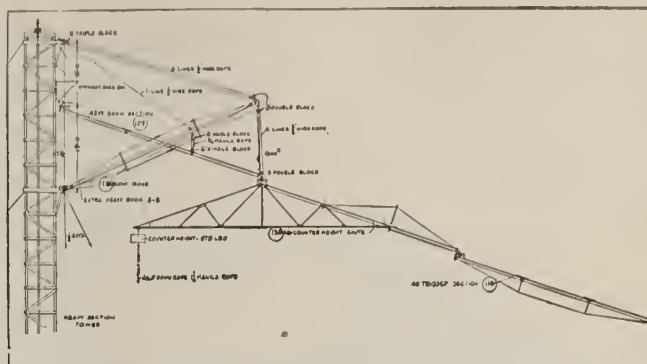


32-ft. Chute



48-ft. Chute

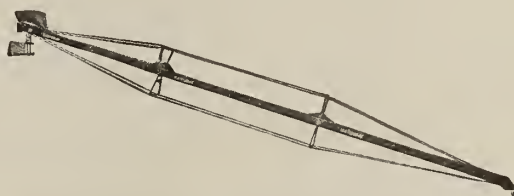
RANSOME COUNTERWEIGHT CHUTES



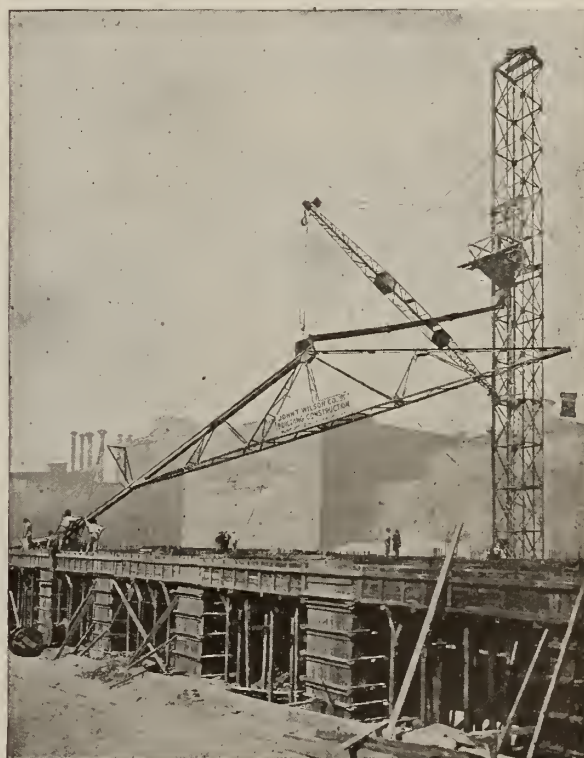
RANSOME COMBINATION OPEN WOODEN BOOM AND COUNTERWEIGHT CHUTE PLANT

Ransome Swivel Head Boom Chutes.

These chutes are standard equipment and are made in two lengths, 32 ft. and 48 ft. They serve the same purpose as the open wooden boom plants and it is often cheaper to install them; the economy depending upon whether it costs less money to build the tower 15 ft. higher, than it does to purchase open wooden boom irons and build an open wooden boom. It should be borne in mind that in the installation of a swivel head boom chute, the distance from the boom seat end of the chute, when the bin is at its highest point, to the top of the tower, must be at least 30 ft. The boom chutes are double trussed and equipped with liners to insure stiffness. At the upper, or hopper head end of the boom chute, a special swivel bracket is attached.



RANSOME 48-FT. SWIVEL HEAD BOOM CHUTE



RANSOME STEEL TOWER AND BOOM CHUTE IN OPERATION

THE STANDARD SCALE & SUPPLY CO.

Manufacturers of Concrete Mixers

1631 Liberty Avenue
PITTSBURGH, PA.

STORES AND WAREHOUSES

CHICAGO, ILL., 169 North May Street
PHILADELPHIA, PA., 523 Arch Street

NEW YORK, N. Y., 145 Chambers Street
CLEVELAND, OHIO, 1547 Columbus Road
DALLAS, TEX., 3027 Elm Street

Products.

"THE STANDARD" LOW CHARGING CONCRETE MIXERS, and "THE STANDARD" SPECIAL ROAD and STREET PAVING MIXERS.

Also, Contractors' Equipment.

For Scales, see page 940.

Concrete Mixers.

The most important feature in "The Standard" concrete mixer is the patented low charging design which enables the drum to be charged from the low platform that is attached to the machine, and portable with the outfit.

In the new model, no deflector blades or plows are used around the charging opening. Lifting pockets running from end to end provide greater agitation. In fact, a single revolution of the drum causes the bunched contents to rise and fall cataractlike six or seven times.

The large opening in the drum permits the mixing operation to be easily watched; and high grade, uniform concrete is secured without depending on guesswork.

The drums have been shortened as to length and considerably increased in diameter. In these short drums of large diameter, the mixing operation is much simplified and for that reason quicker in action. There is only one mixing zone. The materials are from the start bunched together so that no special means are required to cause end-to-end movements. No separate mixing blades are required. The lifting pockets, reaching from end to end of the drum, set up a vigorous mixing action and the whole mass of the contents, not merely one single mixing zone, rises and falls from six to seven times at each turn of the drum.

The folding platform affords larger space for charging, and enables cement and water to be supplied without interfering with the wheelers. It is folded up for moving, and the complete outfit can be loaded in an ordinary box car without removing any parts.

The result is that poor mixing is impossible and that perfectly mixed concrete can be had in shorter time than ever before. In the thorough blending of materials, the improved drum design of "The Standard" guarantees a grade of concrete that is perfectly mixed and always uniform in quality.

Advantages of Low Charging Mixers.

The low, compact design of "The Standard" avoids the necessity of any kind of mechanical charging device; there is practically nothing to get out of order, and no skilled attendant is neces-

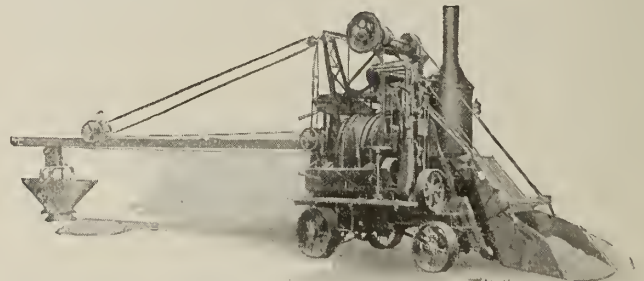
sary. It can be moved rapidly from one point to another, takes up but small space, and the folding platform is always ready for immediate use.

For some classes of concrete work, a mixer equipped with side loader is preferred. This feature is incorporated in a new mixer, complete information on which is contained in Catalogue No. 60 that will be sent on request.

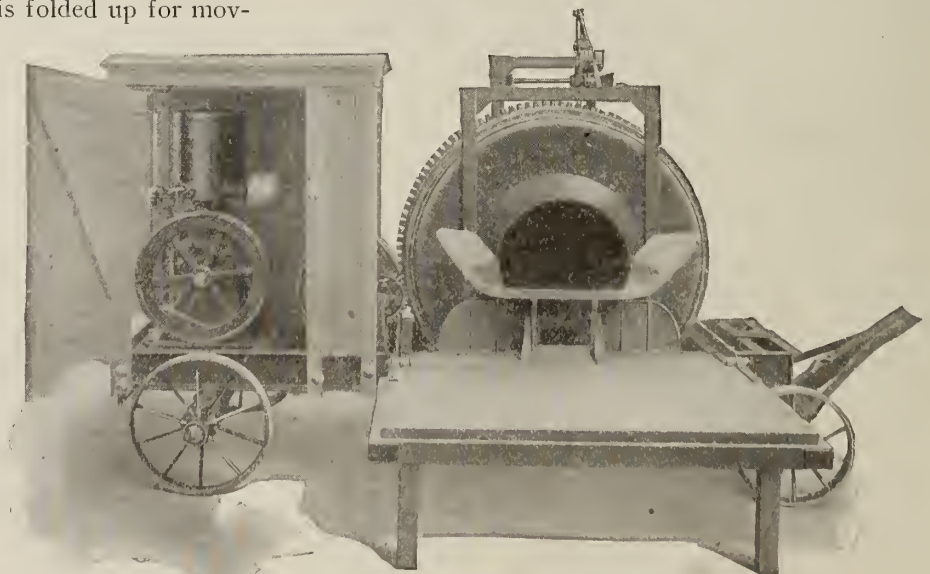
Machines for Street and Road Work.

"The Standard" street paving concrete mixer is mounted on steel truck with steam engine and boiler. Equipped with wide mouth, open end, skip charging hopper; automatic measuring water bucket, and forward and reverse traction. Carefully designed to equalize the weight on four ground wheels. Made throughout of heavy steel construction to meet severe requirements of street work. Front end of charging skip is covered to prevent material from spilling. Unique construction of the open end drum with wide drum chute permits elevating the charging skip to a steep discharge angle.

Complete information in Catalogue No. 60 which will be furnished on request.



ROAD PAVING MIXER WITH DISTRIBUTING SPOUT, STEAM POWER AND TRACTION



LOW CHARGING CONCRETE MIXER WITH FOLDING PLATFORM

WATERLOO CONSTRUCTION MACHINERY COMPANY

Concrete Mixers, Pavers, Hoists, Backfillers and Pumps

CABLE ADDRESS:
"POLYGON"

95 Vinton Street
WATERLOO, IOWA

CODE USED:
Western Union

REPRESENTATIVES IN ALL IMPORTANT CITIES

Products.

WONDER CONCRETE MIXERS; WATERLOO GASOLINE HOISTS; WATERLOO BACKFILLERS; WATERLOO DIAPHRAGM PUMPS.

Wonder Concrete Mixers.

These machines are a distinctive type of mixers with single opening drum, extremely rapid in charging and discharging with very thorough mixing action. Owners everywhere testify that they are the fastest mixers on the market. They are made in four sizes, with capacities of 3, 4, 5 and 7 cu. ft. of mixed concrete in each batch.



WONDER 3 MIXER

AUXILIARY HOISTING EQUIPMENT—Wonders 4, 5 and 7 can be had with either light duty or heavy duty auxiliary hoist built-in over the center of gravity. All the pull is from the center of gravity of the machine.



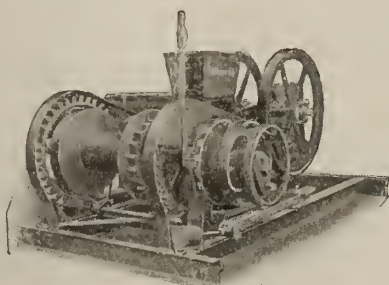
WONDER 5 MIXER

QUICK CONVERTIBLE—The quick convertible can be had in the Wonders 4, 5 and 7. These machines have an auxiliary frame which swivels on the main frame so they will discharge at either side or at front or rear without moving their trucks. Four bolts are removed and replaced again when the machine is changed to a new position.

Waterloo Hoists.

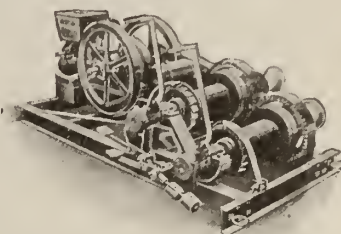
SINGLE REVERSIBLE DRUM AND ELEVATOR SHEAVE—Equipped with an elevator sheave on the same shaft with drum, and other side of drum has a fixed winch head. Drum may be operated in either direction with sheave stationary; same is true of sheave, or both drum and sheave may be operated together in either direction. Specially adapted for building contractors, and used in operating single or double platform material elevators. A single hand lever, within easy reach of operator, controls reversing operation.

Two crank shaft driving sprockets are furnished and are quickly interchangeable, permitting 2 line speeds and load capacities from one output at practically no expense.



SINGLE DRUM REVERSIBLE HOIST

WATERLOO DOUBLE DRUM HOIST—This hoist has 2 fixed winch heads and is adapted to general hoisting operations requiring two drums. Specially suited to derrick work; one drum for hoisting load, other for raising and lowering boom. Also for industrial plant material. Construction is simple, rigid and of first quality materials with standard equipment, same as single drum hoist.



DOUBLE DRUM HOIST

WATERLOO SINGLE DRUM HOIST—Specially well adapted around industrial plants for single platform material elevators; light and medium pile driving. Equipped with fixed winch head. Mounted on heavy selected timbers, 6 in. by 6 in., bolted together and cross braced with steel plates and bars. The engagement of loose running drum is made by an improved helix thrust, forcing drum laterally along shaft thus engaging friction surface. It is simple, powerful and quick acting.

Waterloo Backfillers.

Waterloo backfillers are made in 2 styles, the Double Quick, which has an auxiliary frame swiveling on the main frame and turning toward the direction of the pull without any assistance from the operator; and the Traction Machine, which is supplied with traction and pulls always in one direction.



TRACTION BACKFILLER

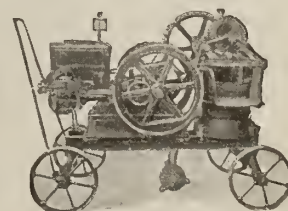
The Double Quick machine is adaptable to any job of hoisting and pulling, and has been used by many contractors for a utility machine on their jobs. The Traction Machine called "Old Indispensable" has proved its indispensability on any kind of construction work.



NON-TRACTION BACKFILLER

Waterloo Diaphragm Pumps.

These pumps are chain driven and the flexible drive prevents all injury to the pump mechanism. The single pump is close coupled and is an exceedingly compact machine. It will deliver 3500 gals. of water per hour. The double pump, however, consists of 2 pumps mounted on the same frame and driven by the same engine either singly or together, delivering 8000 gals. of water per hour. A compensating link keeps the connecting rod working in a vertical position and eliminates side bending on the diaphragm.



SINGLE PUMP OUTFIT

BLAW-KNOX COMPANY

Manufacturers of Steel Products

GENERAL SALES OFFICES
PITTSBURGH, PA.

EXECUTIVE OFFICES
HOBOKEN, PA.

DISTRICT SALES OFFICES

NEW YORK, N. Y., 165 Broadway
BOSTON, MASS., Little Building
CHICAGO, ILL., People's Gas Building

SAN FRANCISCO, CAL., Monadnock Building
DETROIT, MICH., Lincoln Building
SHEFFIELD, ENGLAND

WORKS: HOBOKEN, PA.

Products.

BLAW STEEL FORMS for concrete construction of every description.

BLAW FABRICATED STRUCTURAL STEEL: Bridges, Manufacturing Plants, Poles, Transmission Towers, Trusses, etc.

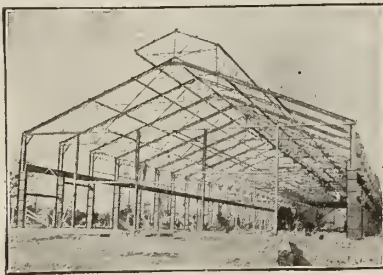
STEEL PLATE WORK and PRESSED and WELDED CONSTRUCTION.

KNOX WATER COOLED FURNACE EQUIPMENT: Buckstays, Doors, Door Frames, Floors, Ports, Reversing Valves, Shields, Skewbacks, Bulkhead Coolers, etc.

For Blaw Buckets and Cableway Carriages, see pages 62-63.

Fabricated Structural Steel and Transmission Towers.

This company turns out a very large annual tonnage of highly fabricated products of all kinds, such as mill buildings, manufacturing plants, aeroplane hangars, crane runways, etc., also transmission towers of which they are one of the largest manufacturers in the United States.



Structural Steel Building
STEEL STRUCTURES DESIGNED AND FABRICATED BY BLAW-KNOX COMPANY



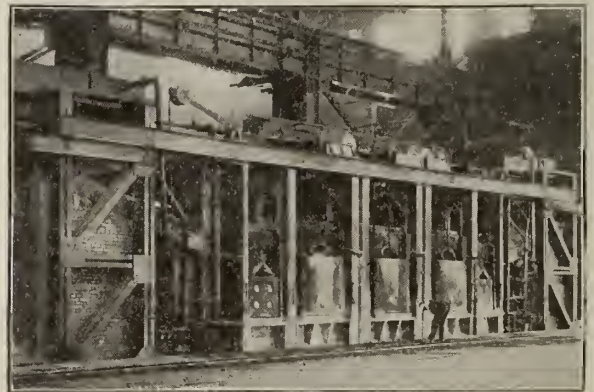
Transmission Tower



TRADE-MARK

Knox Water Cooled Furnace Equipment.

All types of water cooled equipment used around furnaces, particularly of the open hearth type, are included, such as doors, door frames, shields, buckstays, ports, reversing valves, floors, etc.



KNOX COOLED 75-TON OPEN HEARTH FURNACE

Blawforms.

There are Blaw steel forms for every type of concrete construction, from sewers to subways, from sidewalks to skyscrapers. Blawforms—the first steel forms to be used commercially—have been used on every engineering project of note undertaken during the past decade and a half. On the other hand, engineers and contractors are finding Blawforms almost indispensable in the erection of foundations, warehouses, retaining walls, culverts, etc.

There are few types of concrete construction in which Blawforms can not be used with economy.

Submit problems to the Blawforms engineers.

Steel Plate Construction.

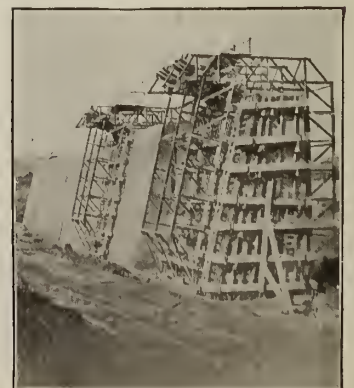
BLAW-KNOX COMPANY is one of the largest users of acetylene and electric welding processes. The following is a partial list of articles it is prepared to furnish:

Air receivers; oil and refining agitators; water boshes; annealing and condensing boxes; bulkhead coolers; boiler breechings; flumes; galvanizing kettles; gas containers; creosoting or wood preserving cylinders; digestors; oil filters; melting pots; palm oil melting plants; evaporating and spelter pans; steam jacketed kettles.

Tanks: alkali, brine, chemical or acid, distillate, filter, galvanized, gasoline, lubricating oil, mixing, oil, pressure, settling, compressed air, tar, water.

Traveling Forms.

The economy of Blawforms is apparent in this illustration of a large concrete wall built by Stone & Webster Corporation, at the plant of the Brier Hill Steel Company, Youngstown, Ohio. The wall is approximately 34 ft. high, 18 ft. thick at the bottom, tapering to 10 ft. at the top and is about 1000 ft. long.



TRAVELING FORMS

Alternate blocks are cast in the traveling form in the foreground (which is equipped with swinging bulkheads weighing about 10 tons each), the blocks between being cast in the form shown in the background.



LIGHT WALL FORMS

Light Wall Forms.

Standard panels are 2 ft. square and are keyed together and handled in large units, as illustrated. Panels of other dimensions are furnished, to facilitate adjustment to any dimension.

Culvert Forms.

The rectangularly shaped culvert requires less headroom to get the correct opening to secure proper carrying capacity. As a result this type of culvert is being universally employed.

Blaw adjustable rectangular culvert forms can be used over and over. They make economical concrete culvert construction possible.

Tunnel Forms.

Blaw tunnel forms and tunnel liner plates are adapted to every type of construction.

By their use, the amount of excavating is greatly lessened, the element of danger materially decreased, and maximum working space is assured.

Concrete can be placed either by the pneumatic process or by hand.

Column Moulds.

Blaw column moulds offer many advantages over ordinary moulds, particularly in regard to adjustability, tightness, simplicity, interchangeability, strength and completeness.

Submit column schedules to the Blawforms engineers.

Sewer Forms.

Blaw sewer forms are furnished in all shapes, half round, elliptical, egg shape, circular, etc., and in all sizes, from the very small hand handled sewer forms to the massive collapsible and traveling forms for conduits, aqueducts, etc.

Pipe Moulds.

Although Blawforms for concrete pipe are particularly adapted for use in central manufacturing plants which can be designed to handle the materials and forms to the very best advantage, they are being used to a great extent for manufacturing pipe in the field.

Blawforms are strong, durable and ultimately the most economical.

BLAW-KNOX COMPANY is prepared to furnish all kinds of concrete pipe forms, either of the Blaw patented design or other design, whether cast on end or on side, round, oval or elliptical, standard or special.

Road, Sidewalk and Curb Forms.

The same equipment of Blaw Universal rails can be used on sidewalk, curb, combined curb and

gutter, integral curb and base and road construction of all kinds.

As they are set up by unskilled laborers in a fraction of the time and with a great deal less labor than ordinary forms, Blawforms effect a very great saving in time, labor and money.

Being made of steel, Blawforms will not warp, crack, swell or spring out of shape, nor is it possible to damage the patented slip joint connection in the ordinary course of handling.

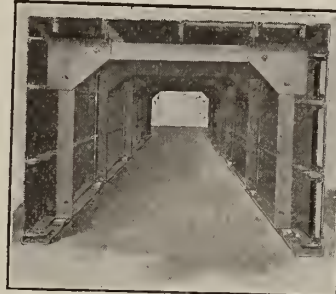
Co-operative Service.

BLAW-KNOX COMPANY offers the services of a notable engineering organization of highly trained men and a shop organization equipped with the most modern machinery.

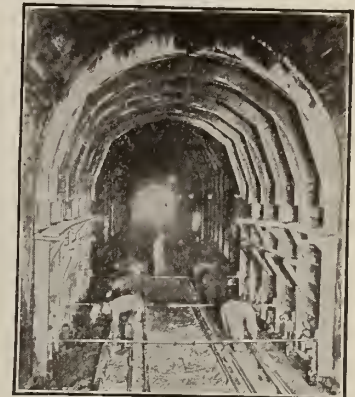
The same engineering thought that designed the forms for the Panama Canal, the Calumet Sag Channel, the New York and Boston Subways, the Catskill and Winnipeg Aqueducts, the sewer systems in the leading cities, etc., is back of every Blawform.

The company's structural engineers will consult with engineers and others at any time.

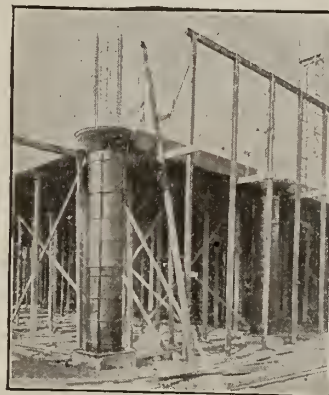
Write for literature and data.



CULVERT FORMS



TUNNEL FORMS



COLUMN MOULDS



SEWER FORMS



PIPE MOULDS



ROAD, SIDEWALK AND CURB FORMS

METAL FORMS CORPORATION

Metal Forms for Monolithic Concrete Construction

1436-1440 Booth Street
MILWAUKEE, WIS.

Product.

METAFORM INTERLOCKING STEEL FORMS for Monolithic Concrete Construction (Straight Walls, Angular and Circular).

Adaptability.

Metaforms take the place of wood forms on all types of monolithic concrete work—large industrial plants, buildings, residences, walls, etc. Metaform circular equipment is used in the construction of tanks, grain elevators, silos, chimneys, and coal pockets.

Advantages.

Metaforms effect large savings in form costs, speed up construction and turn out better work. As they are permanent equipment and can be used year after year with practically no depreciation, they eliminate the costly wastage that results from the use of wood forms. They reduce labor costs substantially, as a few common laborers can set them up as fast as the pouring proceeds, thus taking several skilled form carpenters off the payroll. Metaform tight joints and smooth surfaces result in smooth, better looking walls.

For circular-walled structures (silos, water tanks, grain elevators, etc.) Metaform adjustable circular equipment offers the only practical construction methods. On this class of work, continuous built-up forms are wholly impractical, while the common substitutes (clumsy slip-forms) are too slow, unwieldy and inflexible to meet the present day necessity for speed and economy.

Description.

Metaforms are built on the interchangeable unit idea. Each individual unit is built of a steel plate, heavily reinforced, and equipped with all necessary interlocking and clamping devices. Each unit is self-contained, there are no clamps, bolts, wedges or other separate parts to be applied. By combining a few of

the fractional and adjustable units to courses of the standard units, the form is made readily adjustable to varying lengths and specifications of concrete walls. Metaform equipment is unapproached in simplicity and versatility.

Metaform circular construction outfits are built on the same principles of standardization, with the added equipment necessary through the peculiar nature of circular work.

Operation.

Erecting Metaform units into a form set-up is almost automatic in its simplicity. The workman takes the units successively off the bottom course (three courses of plate being ordinarily used) and places them in position on the top course, the aligning pins automatically insuring accurate alignment. The two hand clamps with which each unit is equipped are then closed, and the unit becomes an integral part of the form.

Investment Value.

No other equipment that a contractor buys can be considered so permanent as Metaforms. Units which were built fifteen years ago are still in constant use, and are apparently good for an indefinite number of years to come. So highly standardized is Metaform equipment that these old units fit perfectly among the standard units of today.

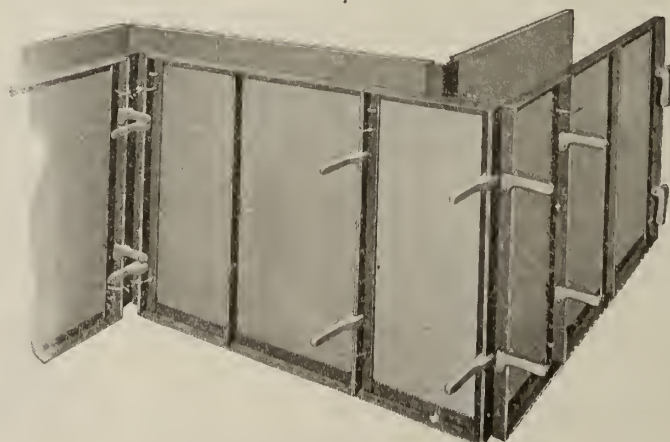
Metaforms are in use in every state in the Union, and every country in the world. The acceptance of Metaform methods is becoming universal.

Service Department.

All contractors are offered the assistance of this company's Engineering Service Department, in helping to determine the amount of Metaform equipment necessary to do the work most efficiently and economically. Any desired estimates will be furnished without obligation.



STANDARD METAFORM UNIT, SHOWING CLAMPS

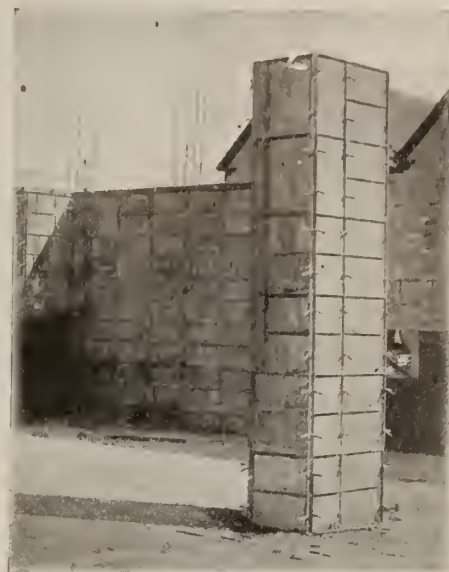


ILLUSTRATING METAFORM SET-UP

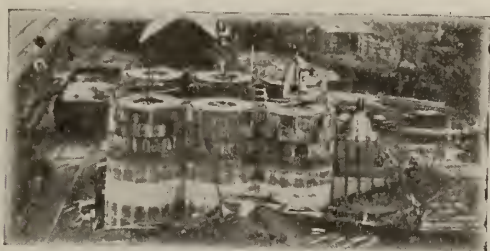
Many jobs of peculiar nature, such as the construction of sewer manholes, can be executed at a great reduction of cost through the use of standard Metaform equipment specially designed and adapted to the work. Suggestions and plans on such work will be furnished by the Engineering Department without obligation.

Literature.

Metaform equipment and methods are described clearly and graphically in two informative books. One book describes and illustrates the Metaform idea as applied to straight monolithic concrete construction; its companion edition is a valuable handbook on the most efficient and cost saving methods for building concrete silos, grain elevators, water tanks, chimneys, coal pockets, etc. Either or both books will be sent free on request.



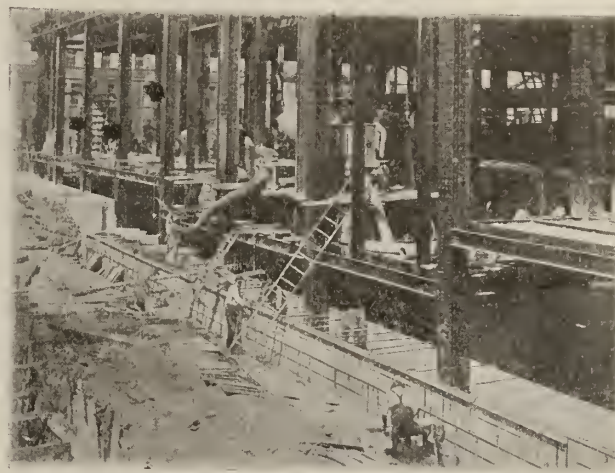
COMBINATION OF METAFORM STANDARD AND FRACTIONAL UNITS



METAFORMS ON GRAIN ELEVATOR



METAFORMS ON BASEMENT FOUNDATION



METAFORMS ON LARGE OFFICE BUILDING



METAFORM SILO BUILDING OUTFIT



METAFORM BUILT HOUSES



METAFORMS ON FACTORY STRUCTURE

FRANKLIN L. ROGERS, PRES.

LEO MEYER, SEC. AND TREAS.

GEO. F. NEWTON, CHIEF ENGINEER

CONCRETE DEVICES CORPORATION

Standardized System of Devices for Concrete Reinforcement and the Locking of Forms

280 Broadway
NEW YORK, N. Y.

FACTORY AND WAREHOUSE, 204 Lafayette Street, NEW YORK, N. Y.
EXCLUSIVE U. S. AGENTS FOR THE CONCRETE SPECIALTIES CORPORATION

Products.

DEVICES for PLACING STEEL REINFORCING and the LOCKING of FORMS:

Outside Form Clamps, Steel Bar Locks, Steel Bar Hangers, Steel Bar Spacers, Steel Bar Clips, Washers, Form Ties, Form Spreaders, "C" and "S" Hooks, Beam Saddles, Floor Chairs, Concrete Inserts.

Service.

For assistance in the speedy and accurate solution of special or ordinary problems concerning the placing of steel reinforcing and forms, this corporation maintains a force of engineers who are specialists in this line, and who will take over all such problems, furnish any designs or setting-up plans required, so that workmen may proceed efficiently and with the maximum economy of time, cost and waste of materials.

Advantages.

Contractors, engineers and builders have been quick to realize the value of standardization principles applied to construction and to the building trades. By standardizing the devices used in steel reinforcing and forms, this corporation makes better work possible at a saving of labor, money and materials.

The facts following will demonstrate a few of the many advantages that devices and systems of the CONCRETE DEVICES CORPORATION have over most of the intricate and costly systems now in use:

(1) Rigidity of reinforcement—no movement of the steel while the concrete is being poured. This means 100% adherence to specifications.

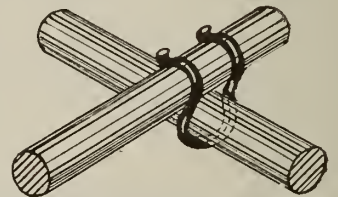
(2) Devices made by this corporation can be applied by unskilled as well as skilled labor. Especially under present conditions, this means a vast saving of time and money.

(3) An unskilled workman using this standardized system can set up steel reinforcing or lock forms many times more rapidly than a skilled workman who uses any of the old impractical methods involving nails, twisted wire, etc.

(4) When the concrete is set and the forms removed, the form ties and form clamps, washers and keys can be

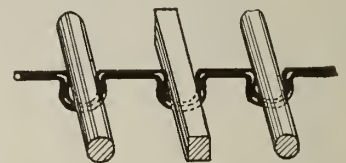
used over and over again.

(5) A simple key in the form of a wedge makes the outside form clamps perform a feat never before accomplished in the history of concrete construction. A blow with a hammer is all that is necessary to *tighten and also hold* the forms in place. This is done in *one* operation, rendering the device foolproof and making inspection of forms possible at a glance.



STEEL BAR CLIPS

Made of steel, for round or square bars. Snap on by hand. No tools necessary. Bars can not slip. Put on three times as fast as by any other method, and *cost less*. Can be applied at any intersection.



BAR SPACER

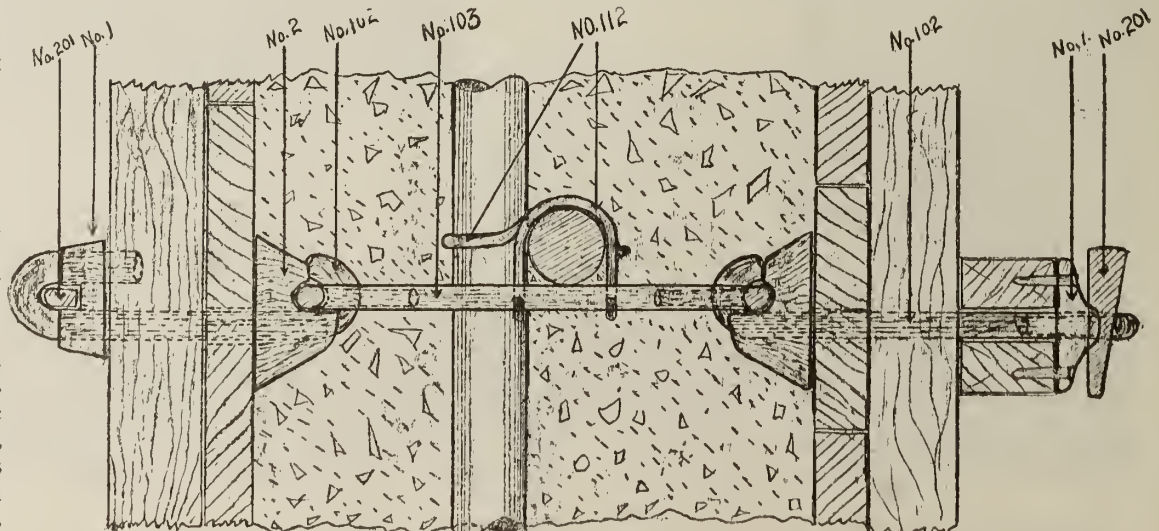
Made of steel wire for round or square bars. Snap on by hand. No tools necessary. Bars can not slip. Put on three times as fast as by any other method, and *cost less*. Can be applied at any intersection.

Form Tie and Washer.

The form tie and washer, being put on the market by this corporation, offer the same dependability of staying steadfastly wherever placed, and the economy of possible installation by unskilled labor. The form ties may be removed by simply sliding the washer away from the wall along the form tie and unhooking the tie from the spreader inside the wall, the washers having left on either side of wall a slight recess which may or may not be pointed with cement, at the discretion of the builder.

Specifications, Samples, Literature and Estimates.

Specifications will be furnished on steel reinforcement and the locking of forms. Samples, catalogue and estimates will be furnished on request.



CROSS SECTION OF FORM, SHOWING OUR METHOD OF LOCKING FORM AND STEEL REINFORCEMENT

SYMONS CLAMP CO.

Column Clamps

TELEPHONE:
LAWDALE 652

2112-2116 South Sawyer Avenue
CHICAGO, ILL.

REPRESENTATIVES IN LEADING CITIES

Products.

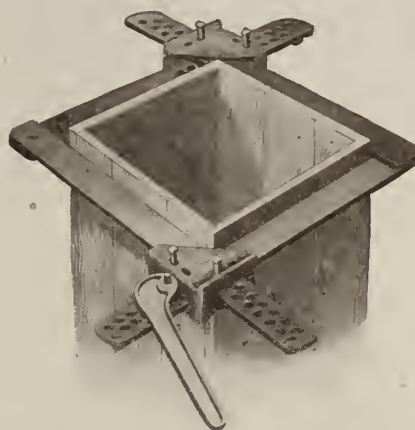
SYMONS COLUMN CLAMPS.
Symons Bar-ties and Bar-tie Supports.

Description.

Symons column clamps have been designed to save time in erecting forms for concrete columns, and have so effectively accomplished their purpose that they are now recognized by most of the leading contractors in this country to be one item of their standard equipment.

They are made of mild steel, and are suitable for both square and rectangular columns. Are very quickly applied and removed from a form. One size clamp usually suitable for all the columns in a construction. There are no loose parts to become lost, and the wear and tear are negligible.

The savings derived from their use is so pronounced that the company devised a means for putting them out on rental orders, making shipment from warehouse stock, located in principal cities.



APPLICATION OF SYMONS COLUMN CLAMPS
Showing also tightening wrench

Rental Proposition.

The clamps may be rented on terms that insure or guarantee a saving. All rental contracts contain a 90-day option of purchase, the paid rentals to apply. This rental proposition guarantees satisfactory results even when figured on a rental basis, and with the privilege of purchasing in 90 days, has proved so attractive to contractors, that within the last five years Symons clamps have come into almost universal use and seldom need an introduction in a contractor's office.

Symons clamps made good when form lumber was selling for \$25.00 and \$30.00 per thousand, and carpenters were being paid 50c and 60c per hour. Surely they ought to make good under present conditions.

SIZES AND SPECIFICATIONS OF SYMONS COLUMN CLAMPS

Size of clamp, in.*	Arms (mild steel), in.	Adjustment, in.	Size of columns (square or rectangular) for which clamps are suitable Size is net of concrete, in.
30 x 30	2 x $\frac{5}{8}$ x 30	14	20 x 20 to 9 x 9
36 x 36	2 x $\frac{5}{8}$ x 36	17	25 x 25 to 10 x 10
48 x 48	2½ x $\frac{5}{8}$ x 48	22	36 x 36 to 14 x 14
60 x 60	3 x $\frac{5}{8}$ x 60	24	48 x 48 to 24 x 24
48 x 72	2½ x $\frac{5}{8}$ x 72	24	34 x 58 to 12 x 36
72 x 72	2½ x $\frac{5}{8}$ x 72	30	58 x 58 to 36 x 36

Above specifications are for column forms made of 2-in. boards.

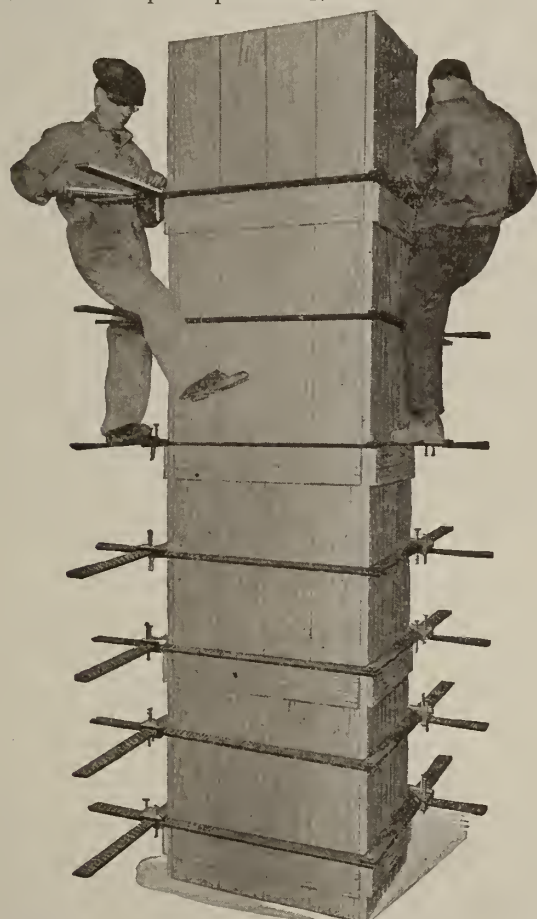
With 1-in. boards 30-in. size is suitable for columns 22 by 22 in. down to 11 by 11 in., etc.

*"Size of clamp" indicates length of clamp arm only. Does not mean size of column for which clamp is suitable.

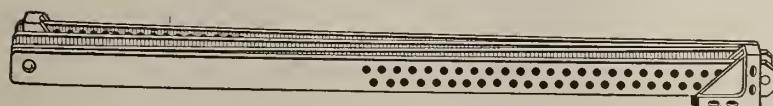
Sample Clamp.

The SYMONS CLAMP CO. has never employed a road salesman, but in answer to every inquiry, sends prepaid a sample clamp which speaks for itself in more convincing language than a salesman might command in telling about it.

If not acquainted with this popular clamp, send a postcard at once. Procure a sample and a list of over 1000 contractors in this country who will testify as to its worth.



SETTING UP COLUMN FORM WITH SYMONS CLAMPS



SYMONS COLUMN CLAMP, COMPLETE

THE CLEVELAND TRACTOR COMPANY

Manufacturers of the Cletrac Tank Type Tractor

20000 Euclid Avenue
CLEVELAND, OHIO

DISTRICT SALES AND SERVICE HEADQUARTERS

NEW YORK, N. Y., 1780-82 Broadway
ATLANTA, GA., 63 Edgewood Avenue
CLEVELAND, OHIO, Lamb and Euclid Avenues
CHICAGO, ILL., 1149 Peoples Gas Building
MINNEAPOLIS, MINN., 623 Plymouth Building

OKLAHOMA CITY, OKLA. 1217 Colcord Building
SPOKANE, WASH., 30 East Sprague Avenue
SAN FRANCISCO, CAL., 147 New Montgomery Street
LOS ANGELES, CAL., 604 Brockman Building
KANSAS CITY, MO., 1307 Waldheim Building

WINDSOR, CANADA, Hydro-Electric Building

Products.

The CLETRAC TANK-TYPE TRACTOR
(formerly the Cleveland Tractor).

Cletrac
TANK-TYPE TRACTOR
TRADE-MARK

Specifications.

Motor: 4-cylinder, 4-in. bore by 5½-in. stroke.
Protected overhead valves. Removable cylinder head.

Horsepower: 12 at draw-bar, 20 at belt pulley.

Length: 96 in.

Width: 50 in.

Height: 52 in.

Weight: 3300 lbs.

Turning circle: 12 ft.

Track: length on ground (each side) 50 in., width 8 in.

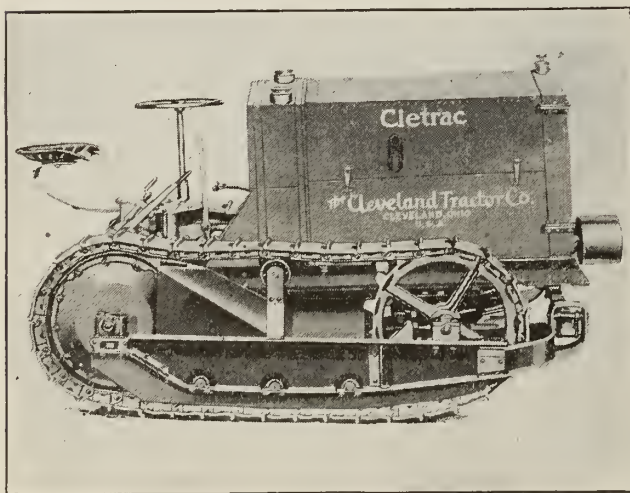
Traction surface: about 800 sq. in.

Center to center of tracks: 38 in.

Clearance: 12 in.

Belt pulley: diameter 8 in., face 6 in.

Suspension: 3-point.



CLETRAC TANK TYPE TRACTOR

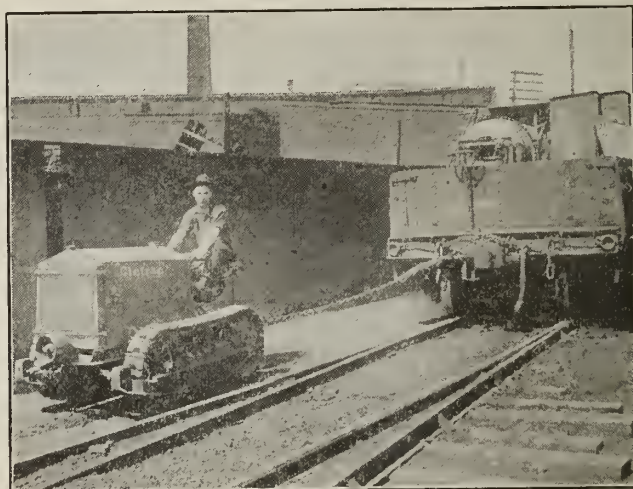
In Shops, Yards and Plants.

The Cletrac's value in the shop, yard or plant is the result of its great flexibility and wide working range. It is in a class by itself for rough hauling outside the plant, over loose fills, through mud, snow and slush—anywhere in fact that motive power is required. It will pull a load over footing that is impassable by any other means.

At the same time the Cletrac is just as adaptable to work within the plant. Its ease of control, short turning radius and compactness provide a ready and efficient substitute for electric tractors or small industrial railways giving equal or greater power at a reduced cost in first investment, operation and upkeep.

Hundreds of Cletracs are at work in foundries, machinshops, storage yards, warehouses and freight

terminals, hauling heavy machinery, castings, loaded transfer buggies, scrap carts, dump wagons and spotting freight cars. The representative firms using them have cut their haulage costs materially.



CLETRAC HAULING A LOADED CAR

On Contracting and Engineering Jobs.

The Cletrac constitutes a part of the contractor's equipment of first importance because of its ability to do the work of horses or mules better, cheaper and quicker. And when the footing is rough, sandy or muddy the Cletrac replaces trucks which are so easily stalled or mired under adverse conditions.

On the basis of a day's work in moving materials the Cletrac will replace 6 to 8 horses or mules. At the same time it costs nothing when not in use, saving the expense of care and feeding during the days when



CLETRAC HAULING WAGON LOADS OF DIRT

animals would be weatherbound and useless. The savings, therefore, are derived from a greater amount of work per day, more days of work—for the Cletrac is not stopped by mud, sand or snow—and a greatly reduced upkeep and labor expense.

Many contractors have also found the Cletrac invaluable as a means of keeping their "long-haul" motor truck equipment moving at the work end of the journey which is always rough, soft or muddy.

They are also using it with great success for snatch work in excavations or over steep grades.

Road Building and Maintenance.

On road work above all other applications the Cletrac justifies its use in fleets of two to six tractors. It is successfully replacing horses on breaker plows, drags, slip and wheel scrapers, scarifiers and graders and for hauling heavy material and machinery from one place to another along the job.

Because of its broad metal tracks, which reduce the weight per square inch and prevent slipping, the Cletrac can be used over unfinished parts of the roads that horses or trucks could not pull through.

It does as much work with one man in a day as is ordinarily done by three men and three teams. The economies are self-evident—particularly the saving in labor and feed which must be carried as a dead loss when the horses or mules are idle.

Ease of operation, economy and flexibility make the Cletrac equally useful for the maintenance of roads already built. Hundreds are now owned by municipalities, townships and counties for this work.



CLETRAC HAULING A ROAD SCRAPER

In the Lumber Industry.

At almost every turn in the lumber industry the Cletrac is saving time and cutting the cost of production.

Its good work begins in the timber where hundreds of Cletracs are replacing horses and mules in skidding logs to the road or stream. Six to eight animals are replaced on this job and at least 50% more footage can be hauled each day.

Then the Cletrac gets busy loading the trucks or trailers—an easy job because of its simple and positive control. And after that, it speeds up short hauls to the mill, or at the mill itself keeps the stock piles moving; spots freight cars, takes care of any hauling job around the yard and can even be set up to run a saw or dresser if the steam engine is down for repairs.

Because the Cletrac travels on its own broad, metal tracks, it can get through the wood in wet weather and in the winter when other pulling power can not be used.



CLETRAC HAULING LUMBER

In the Oil Fields.

The Cletrac's ability to go almost anywhere and take a good big load along with it is its greatest recommendation to oil men everywhere.

Roads are not essential when you have a Cletrac for it carries and lays down its own broad, metal tracks across country, over rough grounds, up mountain trails or through soft, wet stream beds.

The Cletrac supplies a complete haulage service capable of taking heavy machinery from the railway to the lease and from one job to another by the most direct route.

It is also an excellent auxiliary on any lease, supplying a flexible and economical source of power for pulling rods and tubing and for emergency work at the belt where an average of 20 h.p. is required.

Hundreds of Cletracs are in use throughout the Pennsylvania, Oklahoma, Texas and other oil fields.



CLETRAC USED IN THE OIL FIELDS

Transportation Advisory Service.

The Industrial Sales Department of THE CLEVELAND TRACTOR COMPANY has compiled and is constantly adding to a fund of facts and figures on haulage costs. These are taken from actual performance of the Cletrac under a wide range of conditions.

Shop men, yard managers, lumbermen, oil men and contractors are welcome to any information that can be supplied without cost or obligation. Address the Industrial Sales Department.

THE ELWELL-PARKER ELECTRIC CO.

Electric Industrial Trucks and Tractors

4400 St. Clair Avenue
CLEVELAND, OHIO

OFFICES IN PRINCIPAL CITIES

Products.

ELECTRIC STORAGE BATTERY INDUSTRIAL TRUCKS of the Tractor, Elevating Platform or "Self-loading," Carrier, End Dump, Revolving Crane, Rocking Crane, Straight and Drop Frame Types, for rail or floor.

Applications.

Used inside buildings; in yards or across streets; on inclines, elevators, bridges, or through tunnels at steel, tin plate, paper, cotton, textile and lumber mills; clay working, salt, sugar, chemical, automobile, fertilizer, leather, rubber, glass and power plants; foundries, machineshops; factories; hospitals; shipyards; warehouses, piers, railroad and marine passenger and freight terminals, for quick, economical inter-department transfer of materials. It matters little what the commodities are, electric trucks can be used to handle them at less expense—first cost, maintenance and adaptability to present manufacturing conditions considered.

Operation and Original Features.

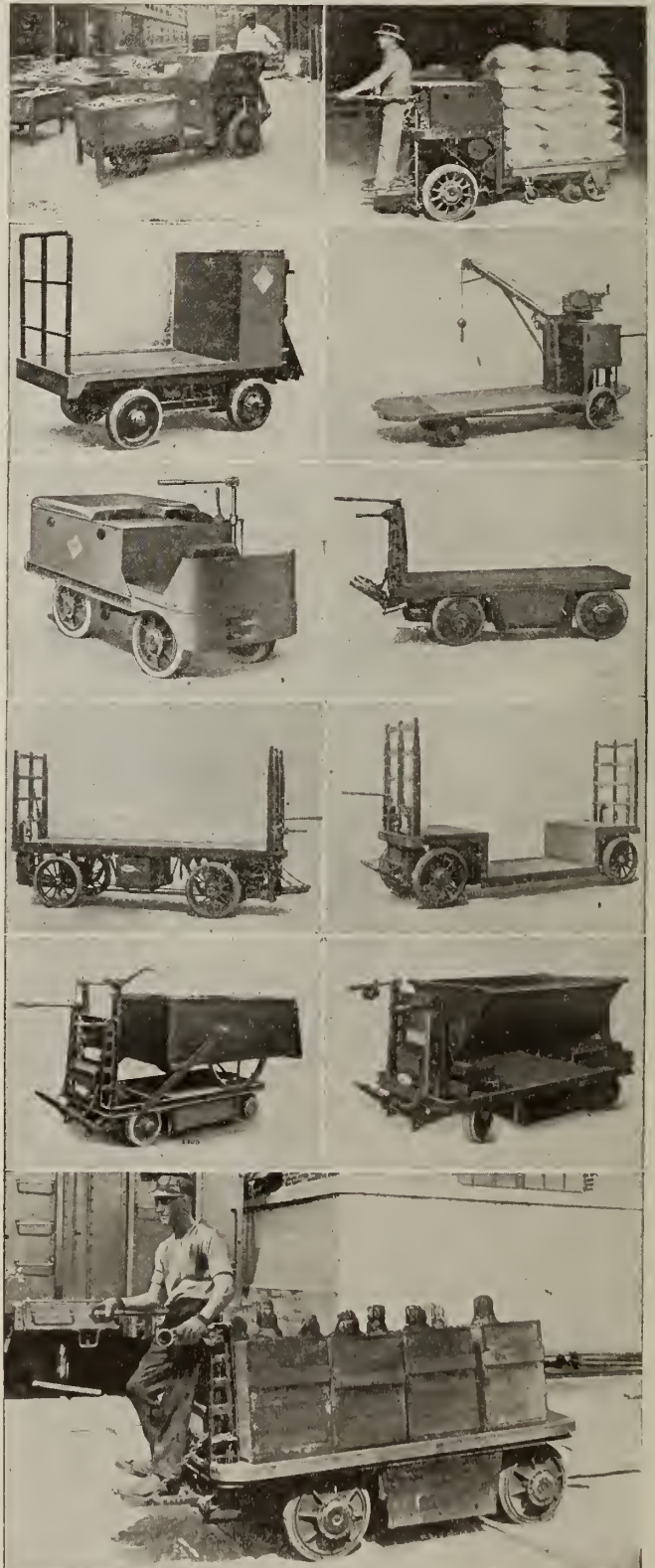
Elwell-Parker trucks and tractors steer on all 4 wheels, and are 2- or 4-wheel drive. Edison or lead battery furnishes power to totally enclosed drum type controller and motor. Motor drives through single reduction free coasting worm gear to large diameter solid rubber tired wheels. Battery assembled in a box, may be charged in the truck or removed and charged, or exchanged for one already charged. Battery capacity sufficient for 15 to 20 miles operation, or the average day's work in a factory. Charge from 40-volt DC line in 7 hours at 40 to 60 amperes.

Patent interlocked control is so arranged that truck or tractor can not be started except when operator is standing on pedals or sitting in seat. This control makes a fuse unnecessary. Motor will take entire battery charge. Power may be applied with brakes partially set—important when starting on inclines. When operator steps from truck same will stop within its length.

Speeds 400 to 700 ft. per minute. Carrying capacity of trucks 4000 lbs. Draw bar pull of tractors 6 to 30 tons. Self-loading trucks will pick up 4000 lbs. in 10 seconds. Cranes lift 2000 lbs. at 28 in. over side of truck. Dump trucks with 36 cu. ft. end dump, and 40 cu. ft. side dump bodies. Platform heights range from 11 to 33 in.; lengths from 4 to 11 ft.; widths 2½ to 3½ ft.

Inquiries.

Always state kind and amount of material to be moved per hour, length of haul, percentage and length of inclines, and size and capacity of elevators. Complete catalogue on request.



SOME TYPES OF ELWELL-PARKER ELECTRIC STORAGE BATTERY INDUSTRIAL TRUCKS

BELL LOCOMOTIVE WORKS, INC.

23 Water Street
NEW YORK, N. Y.

Products.

BELL OIL BURNING GEARED STEAM LOCOMOTIVES.
BELL GASOLINE LOCOMOTIVES.

Advantages.

Bell locomotives have the following points of superiority over other types:

Use cheapest fuel: kerosene, fuel oil, distillate or crude oil.

Lowest possible center of gravity with flexible frames permits of high speed over rough track.

Have 50% greater tractive effort than direct connected locomotives of equal weight.

One-man operated.

Accessible, simple and rugged construction.

Can be made with minimum length, width and height clearances.

All parts interchangeable; standardized design.

No smoke or sparks and fire risk eliminated.

More speed than any other locomotive of same class.

Licensed engineer not usually required.

Adaptability.

Bell locomotives are excellently suited for contractors' use; logging; industrial plants; sugar, fruit, hemp and other plantations; brickyards; clay pits; quarries; mining; tunnel and subway work; road building; bridge construction; aqueduct work; dock construction and various special uses.

Bell Oil Burning Steam Locomotives.

This geared type of Bell oil burning locomotive is built in 17 sizes approximating respectively 2 to 20 tons in weight and for any gauge desired.

DATA, STEAM LOCOMOTIVES

Sizes weight in working order, tons	Tractive effort, lbs.	Hauling capacity, maximum loads frictional resistance at 40 lbs. per ton		Sizes weight in working order, tons	Tractive effort, lbs.	Hauling capacity, maximum loads frictional resistance at 40 lbs. per ton	
		Level	5% grade			Level	5% grade
3	1200	25 tons	5 tons	12	6000	150 tons	32 tons
4	2000	50 "	11 "	14	7000	175 "	50 "
5	2500	62 "	14 "	15	7500	187 "	54 "
6	3000	75 "	17 "	16	8000	200 "	57 "
7	3500	87 "	19 "	17	8500	212 "	60 "
8	4000	100 "	22 "	18	9000	225 "	64 "
9	4500	112 "	25 "	20	10000	250 "	70 "
10	5000	125 "	28 "				

BELL UNIT ENGINE—Only 15 moving parts. Is geared direct to the axle and runs in oil; has roller bearings and dropped forged parts throughout. It is durable, compact, light, and powerful, and is the most highly developed steam engine made. The complete unit can be removed and replaced in two hours time.

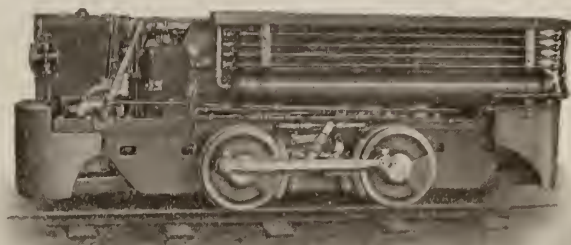
BELL HORIZONTAL BOILER—Made of the best grade firebox steel, with no stays, rivets or seams. It is compact, quick firing, and gives high pressure superheated steam. Tubes are of cold drawn seamless steel.

BURNER—The Bell patented type burner, adapted for kerosene, fuel oil, or heavy petroleum, is most efficient in its use of fuel.

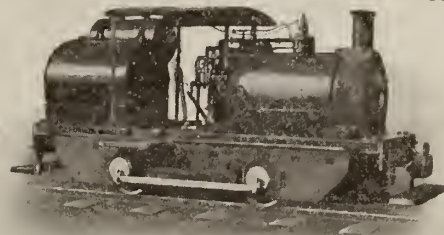
FRAMES—Bar steel and cast frames are designed to secure maximum flexibility, permitting operation on rough, uneven track and roadbed.

Bell Gasoline Locomotives.

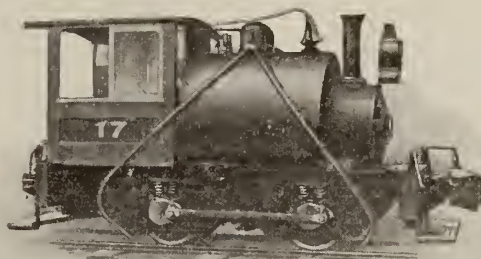
The internal combustion, friction driven locomotives are made in 2-, 3-, and 4-ton sizes. Heavy duty Buda motors, with Bosch magneto and thermo-syphon cooling system, are used. Only 36 in. high without cab. Excellently suited for lighter class of contracting, industrial and plantation work.



BELL MINE LOCOMOTIVE, CONDENSING TYPE



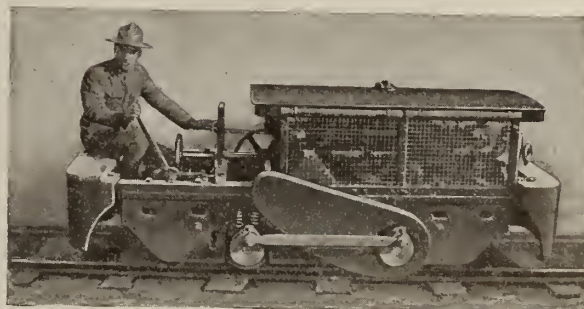
BELL STEAM LOCOMOTIVE
Sizes, 2 to 12 tons



BELL SADDLE TANK TYPE
Sizes 4 to 15 tons



BELL STEAM LOCOMOTIVE
Sizes, 15-16-17-18-20 tons



BELL GASOLINE FRICTION DRIVEN LOCOMOTIVE

VULCAN IRON WORKS

Designers and Builders of Locomotives

MAIN OFFICE AND WORKS

WILKES-BARRE, PA.

BRANCH OFFICES

CHICAGO, ILL., 913 McCormick Building

NEW YORK, N. Y., 50 Church Street

AGENCIES

BIRMINGHAM, ALA., KEISER GEISMER ENGINEERING Co.
 DENVER, COLO., H. N. STEINBARGER, 1539 16th Street
 LOS ANGELES, CAL., HARRON, RICKARD & McCONE, 225 S.
 San Pedro Street
 MONTREAL, CANADA, MUSSENS, LTD., 211 McGill Street
 HAVANA, CUBA, O. B.

NEW ORLEANS, LA., FRANK DAVIES, Hennen Building
 SAN FRANCISCO, CAL., HARRON, RICKARD & McCONE, 139
 Townsend Street
 SEATTLE, WASH., CLYDE EQUIPMENT COMPANY, 542 First
 Avenue, So.
 CINTAS, Apartado 1335

Products.

LOCOMOTIVES to suit the varying needs of Manufacturing Plants, Steel and Iron Mills, Coke Oven Plants, Outside or Inside Mine Haulage, Quarries, Brick Yards, Phosphates or Ore Mines, Contractors, Municipalities; Yard or Terminal Switching; Suburban, Plantation, Logging, Freight, Passenger, or General Main Line Service.

General.

Vulcan locomotives are in successful operation in practically all parts of the world, and are built not only in the standard types available for almost immediate delivery, but also in all the prevailing special designs to meet the needs of any particular service for reasonably quick shipment.

Vulcan locomotives are built to cover a wide range of service, for all practicable gauges of track; to burn all grades of coal, wood or crude oil fuel; cylinders from 5 by 10 in. to 22 by 26 in., and weights in service order vary from 5 tons to approximately 75 tons, exclusive of separate tenders.

CONSTRUCTION—All Vulcan locomotives are built to the duplicate or interchangeable system, so that repeat orders for new locomotives or repairs for engines previously built of similar size or type, can be quickly and correctly supplied.

BOILERS—All boilers are built to conform to the latest American practice, and are tested under water and steam, each engine being given a rigid running test before shipment whenever practicable.

Shipments.

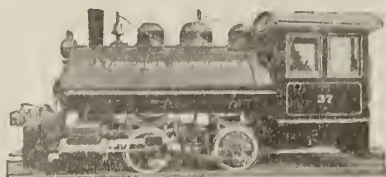
Especially care is given to shipment of locomotives whether for domestic or foreign service. With foreign shipments particular care is taken regarding packing, boxing, etc.

Detailed Information.

Complete information furnished to all prospective purchasers, including prices, specifications, sketches, photographs, and correspondence.

Class C-S 0-4-0 Saddle Tank Locomotive.

Adapted to light contracting, switching and industrial service, for short hauls, sharp curves, etc. All sizes from 5 by 10-in. to 17 by 24-in. cylinders, ranging in weights from 6 to 55 tons working order. Side or saddle water tanks, coal, oil or wood fuel. All practicable gauges.



20-TON CLASS C-S 0-4-0 SADDLE TANK LOCOMOTIVE

Class C-S 0-4-0 Saddle Tank Locomotive.

For heavy contracting, switching and industrial service, built to all practicable gauges of track and to burn coal, wood or oil fuel. Sizes, 6 by 10-in. to 18 by 24-in. cylinders. Weights, 7 to 60 tons working order. Constructive features modified to suit special conditions.



50-TON CLASS C-S 0-4-0 SADDLE TANK LOCOMOTIVE

Class C-S 0-4-0 "Steel Works" Type Locomotive.

For shifting about steel mills, open hearth furnaces, etc., where 24 hours per day service is necessary, under most exacting and limited clearance conditions. Short wheel bases for extremely sharp curves. Sizes from 6 by 10-in. to 19 by 24-in. cylinders, and in weights 8 to 60 tons.



50-TON CLASS C-S 0-4-0 "STEEL WORKS" TYPE LOCOMOTIVE

Class D-S 0-6-0 Plantation Locomotive.

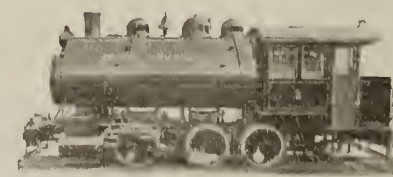
Adapted to light plantation, logging or tramway service, for light rails, steep grades, reasonably sharp curves. Sizes from 6 by 10-in. to 12 by 16-in. cylinders and in weights from 9 to 30 tons. Coal, wood or oil fuel. Steel cabs or canopies.



12-TON CLASS D-S 0-6-0 PLANTATION LOCOMOTIVE

Class D-S 0-6-0 Saddle Tank Locomotive.

Adapted to industrial or general switching service, for steep grades and for moderately long runs where minimum weight per axle is desired. Standard sizes run from 6 by 10-in. to 19 by 24-in. cylinders, and range in weights from 9 to 70 tons. Constructive features modified to suit special conditions.



64-TON CLASS D-S 0-6-0 SADDLE TANK LOCOMOTIVE

Class D-S 0-6-0 Side Tank Locomotive.

Adapted for heavy switching or industrial haulage, for reasonably sharp curves, steep grades, moderately long runs. Sizes run from 12 by 18-in. to 19 by 24-in. cylinders, and range in weights from 33 to 70 tons. Coal, wood or oil fuel. Constructive features modified to suit conditions.



61-TON CLASS D-S 0-6-0 SIDE TANK LOCOMOTIVE

Class I-S 2-4-2 Double Ender Side Tank Locomotive.

Embodies all requirements of speed, power, steady running, distribution of weight, for light rails, and is adapted for running in either direction. Suitable for logging, light terminal or industrial haulage. Sizes from 7 by 12-in. to 19 by 24-in. cylinders, and weights from 12 to 70 tons. Constructive features modified to suit conditions.



31-TON CLASS I-S 2-4-2 DOUBLE ENDER SIDE TANK LOCOMOTIVE

Class M-S 2-6-2 Double Ender Saddle Tank Locomotive.

For light terminal, logging or general haulage, for moderately long runs, fair speeds, reasonably sharp curves, and for running in either direction. Sizes from 8 by 12-in. to 20 by 24-in. cylinders, and in weights from 15 to 75 tons. Saddle or side water tanks. Coal, wood or oil fuel. Constructive features modified to suit conditions.



72-TON CLASS M-S 2-6-2 DOUBLE ENDER SADDLE TANK LOCOMOTIVE

Class C-T 0-4-0-8 Switching Locomotive.

Suitable for light contracting, industrial or switching work in railroad yards and terminals, having short wheel bases and all the weight available for adhesion. Sizes 10 by 16-in. to 19 by 24-in., and weights from 25 to 60 tons, exclusive of tender.



50-TON CLASS C-T 0-4-0-8 SWITCHING LOCOMOTIVE

Class D-T 0-6-0-8 Switching Locomotive.

For heavy shifting service, where maximum power and weight available for adhesion are desired. Suitable for steel works, railroad yards, terminal or heavy contracting work. Sizes range from 10 by 16-in. to 21 by 26-in. cylinders and weights run from 30 to 75 tons, exclusive of tender. Constructive features modified to suit special conditions.



70-TON CLASS D-T 0-6-0-8 SWITCHING LOCOMOTIVE

Class B-T 2-4-0-8 Plantation Locomotive.

Adapted to light general logging, plantation, service for moderately long runs, fairly level track and reasonable curves. Sizes from 8 by 14-in. to 16 by 24-in. cylinders, and ranging in weights exclusive of tender from 14 to 40 tons. Constructive features modified to suit special conditions.



19-TON CLASS B-T 2-4-0-8 PLANTATION LOCOMOTIVE

Class J-T 2-6-0-8 "Mogul" Type Locomotive.

Adapted to heavy freight, logging, plantation or main line service, requiring long runs on good tracks with ordinary grades and curves. Built in all sizes from 10 by 14-in. to 21 by 26-in. cylinders and varying in weights from 16 to 75 tons exclusive of tender.



69-TON CLASS J-T 2-6-0-8 "MOGUL" TYPE LOCOMOTIVE

Class M-T 2-6-2-8 "Prairie" Type Locomotive.

Suitable for heavy freight, logging or main line service, for long runs, fair speeds, undulating track conditions and fairly steep grades. Sizes from 10 by 16-in. to 21 by 26-in. cylinders, weights from 19 to 75 tons exclusive of tender. Constructive features modified to suit special conditions.



59-TON CLASS M-T 2-6-2-8 "PRAIRIE" TYPE LOCOMOTIVE

Class L-T 4-6-0-8 "Ten Wheel" Type Locomotive.

For heavy freight, logging, plantation, passenger and main line service on good tracks, with ordinary curves and grades. Preferable to American type (4-4-0-8) having power and weight under given track conditions. Sizes from 10 by 16-in. to 21 by 26-in. cylinders and in weights from 19 to 75 tons. Constructive features modified to suit conditions.



55-TON CLASS L-T 4-6-0-8 "TEN-WHEEL" TYPE LOCOMOTIVE

Class R-T 2-8-0-8 "Consolidation" Type Locomotive.

For light and heavy freight, logging, plantation and main line service. Combination of power, speed and adaptability for light track conditions for long runs and moderate curves. Sizes from 10 by 16-in. to 21 by 26-in. cylinders and weights from 20 to 80 tons. Constructive features modified to suit special conditions.



55-TON CLASS R-T 2-8-0-8 "CONSOLIDATION" TYPE LOCOMOTIVE

EASTON CAR & CONSTRUCTION COMPANY

32 Church Street
NEW YORK, N. Y.

WORKS: EASTON, PA.

BRANCH OFFICES

ATLANTA BOSTON CHICAGO DETROIT MILWAUKEE PHILADELPHIA PITTSBURGH

Products.

Complete NARROW GAUGE RAILWAY EQUIPMENT, designed and built for mines, plantations, factories, power plants, docks, quarries, etc., which includes:

Steel Cars of every description, Small Locomotives, Permanent and Portable Track, Switches, Crossings, Rails, Turntables, Track Scales, Cast Iron Track, Floor Plates, Wheels and Axles, etc.

Service.

The specialists of this company, with 30 years' experience in this line, will welcome an opportunity to solve transportation problems. Designs of special and standard cars are to be had for the asking. Genuine sincere service is the foundation on which this business has been built.

General Information.

These pages illustrate, as well as the space permits, the wide and complete variety of narrow gauge railway equipment designed and built by this company. Brief description of standard equipment is possible, but there is room for only a few of the typical variations from these standards, and some special types picked at random from among thousands. Full specifications, drawings and additional illustrations will gladly be sent to supplement the data given here.

There are but few different types of industrial railway cars, viz.: platform, V-body dump, rotary dump, end dump, box, gable bottom, hopper bottom, scoop, skip, etc. Each class may be further divided into *standard*, *variation from standard*, and *special*. The so-called *standards* are merely the types most used. *Variations from standard types*, which are made necessary by working conditions, are very common. It is only when the conditions are very unusual indeed that *special* designs are necessary.

A platform car, for example, without being anything but a slight *variation from standard* might be equipped with automatic or link pin couplings, spring draft rigging or rigid bumpers, spring pedestals or springless pedestals, roller bearings or brass bearings, steel platform or wooden platform, with or without brakes, with or without sides, with or without ends, etc.

Since these slight differences in construction are applicable to practically all other standard cars, it will be obvious that: (1) the purchase of a car which varies somewhat from *standard* does not necessarily involve the added first cost which might be expected; and (2) it is absolutely essential on inquiries and orders that this company be furnished with all the details and data obtainable in order that unnecessary correspondence and delay may be avoided.

Because so much of the equipment built by the EASTON CAR & CONSTRUCTION COMPANY is for such widely different conditions, it can readily be seen that the company is peculiarly well fitted to turn out any kind of *special* equipment to buyer's, or its own, drawings and specifications.



Standard Rocker Dump Cars.

Designed for handling all kinds of loose materials.

BODY—Carefully balanced, self-dumping and arranged to dump clear of the wheels.

AUTOMATIC LATCHES—So arranged as to be operated from the sides of the car. A special latch for holding the body in a partially dumped or fully dumped position is supplied on order.

UNDERFRAME—Made of channels, well braced and complete with bumper and link and pin coupling.

WHEELS—Extra heavy single plate type, made of best charcoal iron, thoroughly annealed, with chilled treads, and are hydraulically pressed on steel axles with finished journals.

Standard Easton dustproof roller bearing boxes with flexible yokes are supplied.

VARIATIONS FROM STANDARD—Brakes on 2 or 4 wheels, spring draft rigging with rectangular underframes, spring pedestals, brass bearing boxes and other features incorporated as ordered. See other illustrations on these pages and send for Bulletins No. 2 and No. 3.



FIG. 255. STANDARD ROCKER DUMP CAR

DATA, STANDARD ROCKER DUMP CARS

Code word	Cap., cu. ft.	Gauge, in.	Over all dimensions						Body dimensions			
			Lgth.,		Wth.,		Hgt.,		Lgth.,		Wth.,	
			ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
Ribbenland...	18	24	6	7	4	3	3	8	4	0	4	0
Ribbestuk...	27	24	7	3	4	5	3	9 1/2	4	9	4	2
Ribbonism...	40	24	8	0	5	4	4	6 3/4	5	5	5	0
Ribeavate...	27	30	7	4	4	5	3	11	4	9	4	2
Ribecco...	40	30	8	1	5	4	4	9	5	5	5	0
Ribollisco...	54	30	8	8	5	10	4	11	6	0	5	6
Ribucammo...	40	36	8	1	5	4	4	9	5	5	5	0
Riburilato...	54	36	8	8	5	10	5	0	6	0	5	6

Code word	Center to edge in dumped position		Wheel diam., in.	Axle diam. in.	Wheel base,		Plates		lbs. Wt.,
	ft.	in.			ft.	in.	Side, in.	End, in.	
Ribbenland . . .	1	10½	12	1¾	2	0	1½	1½	900
Ribbestuk . . .	1	11½	12	1¾	2	0	1½	1½	1000
Ribbonism . . .	2	3½	14	2	2	6	1½	1½	1325
Ribeavate . . .	2	2	12	1¾	2	4	1½	1½	1050
Ribecco . . .	2	6	14	2	2	6	1½	1½	1425
Ribollisco . . .	2	6½	14	2¼	2	6	1½	1½	1675
Ribucammo . . .	2	8	14	2	2	6	1½	1½	1520
Riburilato . . .	2	8½	14	2¼	2	6	1½	1½	1770

NOTE—Capacities level full; weights and dimensions approximate only and not binding on us. End braces on cars of 40 cu. ft. and over.

Standard Coal Charging Cars.

This type of car is designed for charging coal directly from car through fire doors.

BODY—Made of steel plate properly reinforced and to dimensions and height which have been carefully worked out in relation to scientific coal firing.

LATCHES—Automatic and guarded. Hinge of door is coaltight, and offers no obstruction to the fireman's shovel.

Continued on next page

UNDERFRAME—Made of heavy braced steel channels without couplings.

WHEELS—Made of best charcoal iron, thoroughly annealed, with chilled treads, pressed on steel axles of ample diameter with finished journals revolving in Easton standard dustproof roller bearing boxes.

VARIATIONS FROM STANDARD—Such as double doors, end doors, other gauges, flexible wheel base, etc., supplied if required. See other pages and send for Bulletin 16.

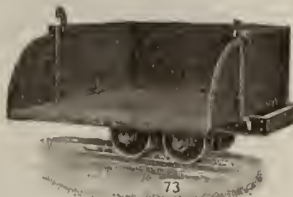


FIG. 73. STANDARD COAL CHARGING CAR

DATA. STANDARD COAL CHARGING CARS

Code word	Cap., tons	Gauge, in.		Lgth of body,		Wdth of body,		Dpth of body,		Hgt over all,		Plates, in.		Wheels, in.		Wt., lbs.
		ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	
Treckfuss...	1 1/2	24	4	6	3	4	1	6	3	0	3	8	1/2	14	3	750
Treckung...	1	24	5	0	3	10	2	0	3	8	1/2	16	1000			
Treckler...	1 1/2	24	6	0	4	0	2	6	4	5	16	1300				

Add 5 in. for width over all.

Standard Platform Cars.

This type is a widely used general utility car.

PLATFORM—Made of yellow pine, carried on steel channel underframe thoroughly braced but without coupling.

WHEELS—Extra heavy single plate type with chilled treads, pressed on steel axles with machined journals revolving in Easton dustproof roller bearing boxes.

VARIATIONS FROM STANDARD—Such as couplings, bumpers, sides, ends, partitions, spring draft rigging, spring pedestals, automatic couplers, etc. furnished as ordered. See other pages and Bulletins 1, 6 and 18.



FIG. 1005. STANDARD PLATFORM CAR

DATA. STANDARD PLATFORM CARS.

Code word	Type	Platform					Wheel diam., in.	Axle diam., in.
		Lgth		Wdth		Hgt., in.		
		ft.	in.	ft.	in.			
Stobrorum.....	"O"	4	9	3	0	15	12	1 3/4
Stachetto.....	"O"	5	0	3	4	15	12	1 3/4
Stockblind.....	"O"	6	0	4	0	15	12	1 3/4
Saber.....	"O"	6	0	4	0	18	14	2
Sable.....	"O"	8	0	4	6	19	14	2 1/4
Saccharine.....	"O"	12	0	6	0	22	16	2 3/4

Code word	Hgt. of coupler, in.	Hgt. of channel frame, in.	Wheel base, in.	Gauge, in.	Floor, in.	Cap., tons	Wt., lbs.
Stoborum...	11	5	20	20	13 3/8	2-3	500
Stachetto...	11	5 1/2	24	24	13 3/8	2-3	550
Stockblind...	11	5 1/2	24	24	13 3/8	2-3	640
Saber...	13	6	30	24	13 3/8	5	825
Sable...	14	6	42	36	13 3/8	5	1,200
Saccharine...	14 1/2	7	72	4 ft. 8 1/2 in.	1 3/4	6	2,000

Standard Scoop Cars.

A dump car, the body of which revolves on the underframe and dumps to both ends and to both sides. Usually pushed by hand. Due to its ease of operation and general utility, it is very widely used for sand, ashes, concrete, gravel, coal and other loose materials.

BODY—Made of steel plate strongly braced and reinforced, has an automatic latch and an easily operated turntable.

UNDERFRAME—Made of rolled steel channels securely tied together.

WHEELS—Made of charcoal iron with chilled treads

and are of the self-oiling type, revolving on square axles. Roller-in-the-hub wheels are furnished at a small extra charge.

VARIATIONS FROM STANDARD—In the way of partitions in the body, different shape or size of body, different gauge of track, etc., as ordered. See other pages and send for Bulletin 4.

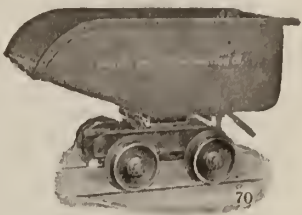


FIG. 70. STANDARD SCOOP CAR

DATA. STANDARD SCOOP CARS

Code word	Cap., cu. ft.	Gauge, in.	Over all lgth.,		Over all wdth.,		Hgt. of body,		Center to edge in side dump		Over all hgt. in dumped position,		Over all hgt.,	
			ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
			ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
Sporcheyza...	18	18	4	7	2	6	1	10	2	3 1/2	4	4 1/4	3	1 1/4
Sporisori...	18	24	4	7	2	6	1	10	2	8	4	6	3	2
Sporobole...	18	30	4	7	2	6	1	10	2	9	4	7	3	2
Spora...	18	36	4	7	2	6	1	10	2	9	4	7	3	2
Sporocarp...	27	18	5	4	2	8	2	0	2	10	4	9	3	6
Sporotarne...	27	24	5	4	2	8	2	0	3	4	4	11	3	6
Sportfully...	27	30	5	4	2	8	2	0	3	2	4	10	3	8
Sport...	27	36	5	4	2	8	2	0	3	4	4	10	3	8

Code word	Hgt. of dis. edge,		Center to dis. edge in end dump,		Axles, in.	Wheel, in.	Channel frame, in.	Wt., lbs.	Plate, in.		Wheel base,	
	ft.	in.	ft.	in.					ft.	in.	ft.	in.
	ft.	in.	ft.	in.					ft.	in.	ft.	in.
Sporcheyza...	2	2 1/4	2	8	1 1/2	10	5	540	1 1/2	1	4	
Sporisori...	2	2 1/4	2	8	1 1/2	10	5	550	1 1/2	1	4	
Sporobole...	2	3	2	7	1 1/2	10	6	580	1 1/2	1	4	
Spora...	2	3	2	7	1 1/2	10	6	690	1 1/2	1	4	
Sporocarp...	2	5	3	4	1 3/8	12	6	740	1 1/2	1	9	
Sporotarne...	2	5	3	4	1 3/8	12	6	750	1 1/2	1	9	
Sportfully...	2	8	3	3	1 3/8	12	8	780	1 1/2	1	9	
Sport...	2	8	3	3	1 3/8	12	8	790	1 1/2	1	9	

Standard Turntable.

The best turntable obtainable is the best known means for effecting change of direction in track work where there is no room for switches. This is an axion. The Fig. 94 turntable is the best this company knows how to build.

The table is centered and carried by the machined ball race with its hardened, ground and polished steel balls; and by it alone. This eliminates all the sources of friction and trouble found in all other types of turntables. Both top and bottom are made of heavy reinforced cast iron. The top carries, cast integral in it, a right angle depressed track crossing. The balancing ring and pads are machined. The ball race top and bottom is, of course, also carefully finished. The balls are made of tool steel, hardened, ground and polished. The top is supplied with an automatic latch or stop. Rail supports are supplied cast in the frame.



FIG. 94. STANDARD TURN-TABLE

Standard cast iron, ball bearing turntables with automatic locking device. Large stock on hand

Variations of Standard—In other crossings than those of 90°, double tracks, other gauges, etc., as ordered. See other pages and send for Bulletins 12 and 13.

DATA. STANDARD TURNTABLES

Code word	Diam. of top, in.	Track space, in.	Cap., tons	Standard gauge, in.	Weight, lbs.
Revolvedor	40	41 1/4	3	20	700
Revolving	44	45 1/4	4	24	800
Revolution	48	49 1/4	4	24	1,150
Revotaba	52	53 1/4	6	24	1,275
Revuelto	60	61 1/2	6	24	2,000
Revue	72	73 1/2	7	24	2,000
Revulsarum	84	86 1/2	8	24	3,400

Turntables 44 in. to 84 in. will also fit 21 1/2 in. outside track gauge. Other gauges than standard can be furnished at a slight additional cost.

Standard Portable Track.

Standard portable track is made any gauge, of any weight of rail, mounted on steel ties, complete in 15-ft. sections, 5 steel ties to the section, ready to lay.

Curves and one-way, two-way or three-way switches of any radii, crossings of any angle, ground throws, switchstands, etc., are furnished for complete track layouts.

Drawings to meet any conditions will gladly be furnished, and the track will be shipped complete in sections ready to lay, for rapid bolting up in the field.

VARIATIONS FROM STANDARD—In the way of permanent track, cast iron track, special switch work, etc., supplied, as ordered. See other pages and Bulletins 9, 10, 11 and 12.

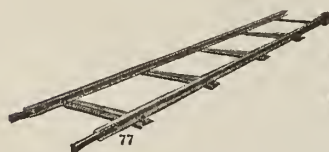


FIG. 77. INDUSTRIAL TRACK ON STEEL TIES
Furnished in 15-ft. or 5-meter sections



FIG. 80. PORTABLE SWITCH
Also right- and left-hand switches

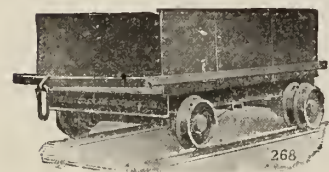


FIG. 268. SKIP CAR
Another type of skip built for any purpose and to meet any condition

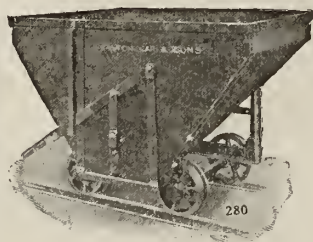


FIG. 280. SIDE DISCHARGE CAR
With inclined bottom and gate for controlling flow of contents

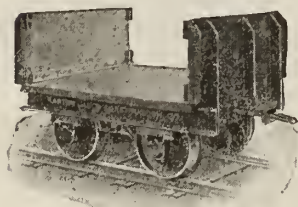


FIG. 264. PIG IRON CAR
Furnished either with or without sides or ends, with ends and sides removable, or with only one fixed side



FIG. 273. BILLET CAR
For ingots, billets, pig iron, etc.



FIG. 226. HOPPER BOTTOM CAR
Large double truck, with brake and automatic coupler for locomotive traction



FIG. 444. HOPPER BOTTOM CAR
Built with all four sides inclined to insure the contents discharging between the rails

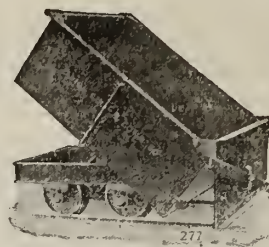


FIG. 277. END DUMP CAR
These all-steel cars are commonly used for mining service



FIG. 430. SPECIAL SIDE DISCHARGE CAR
With inclined bottom. Differs from other types in that a hinged side is substituted for the sliding gate

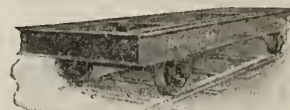


FIG. 1837. CORE OVEN CAR
4-wheel core oven car of I-beams and channels. For all types of core oven cars, the use of the Easton core oven roller bearing box is recommended



FIG. 414. DOUBLE SIDE DOOR COAL CHARGING CAR

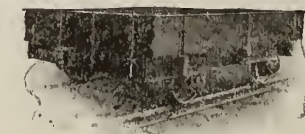


FIG. 1879. STANDARD PLATFORM CAR
Provided with removable sides and ends, and has automatic couplers and spring draft rigging



FIG. 276. CRADLE DUMP CAR
Built to dump side, end or rotary. A large stock of standard sizes is kept on hand

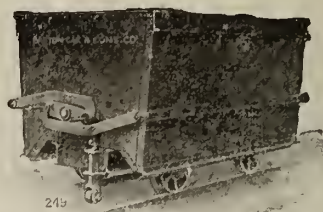


FIG. 249. GABLE BOTTOM CAR
All types built in standard and special designs with and without brakes, smaller sizes being 4-wheel construction; larger sizes double truck, or 8-wheel



FIG. 1886. END DISCHARGE CAR
A special design with inclined bottom, chute and sliding gate

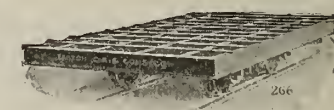


FIG. 266. CORE OVEN CAR
Another type of core oven car with steel channel frame, with grid platform of flat steel bars

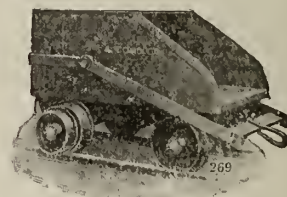


FIG. 269. SKIP CAR
All-steel of various designs, built to meet special requirements



FIG. 274. STANDARD PLATFORM CAR
Double truck with wood floor and brake

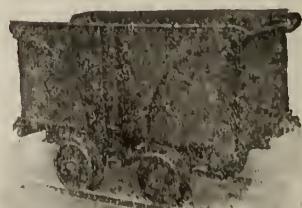


FIG. 450. DOUBLE END DOOR COAL CHARGING CAR



FIG. 451. CHARGING BOX CAR
Special all-steel cars built from private or special designs and specifications for steel and rolling mills

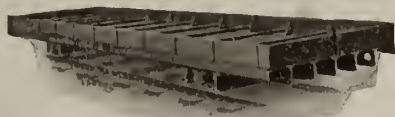


FIG. 1321. ANNEALING FURNACE CAR
Built in various widths and in practically any length



FIG. 1448. ANNEALING FURNACE CAR
Built in various widths and in practically any length

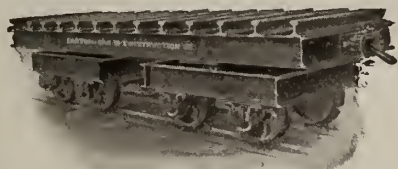


FIG. 1634. STEEL PLANT CAR
Special all-steel cars built for steel mills and iron foundries in any capacity and gauge. For ingots, bar iron, pipe, etc.

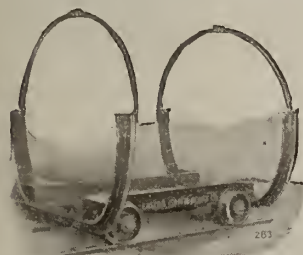


FIG. 283. CREOSOTING CAR
All types

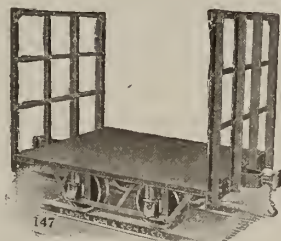


FIG. 147. SUGAR CANE CAR
All-steel car with end walls; used specially for carrying sugar cane



FIG. 1533. PLATFORM CAR
Double truck platform cars built to meet any specific requirements and in any desired size. Both with and without brakes

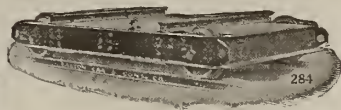


FIG. 284. TRANSFER CAR
Built in a number of designs. Many of them being underslung, so that the load platform is very close to the ground

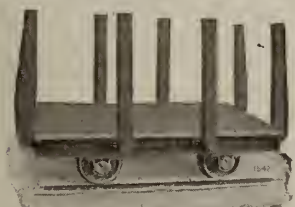


FIG. 1542. STANDARD PLATFORM CAR
Same as 1005, except equipped with stake pockets and stakes



FIG. 3530. ROCKER DUMP TRAILER
With extra wide tired wheels for uneven, soft ground; used in connection with tractors



FIG. 974. ROCKER DUMP CAR
Special for locomotive traction. Made in any capacity or design, for any track gauge and either with or without brakes and automatic couplers



FIG. 99. STANDARD PUSH CAR
With wood frame made extra strong but light for quick and easy removal from track



FIG. 403. MINE CAR FOR HEAVY WORK
This type is built in capacities ranging from 12 to 27 cu. ft.



FIG. 184. QUARRY CAR
With automatic end doors. One of many designs



FIG. 135. CROSSING
Any design, angle, gauge, or weight of rail

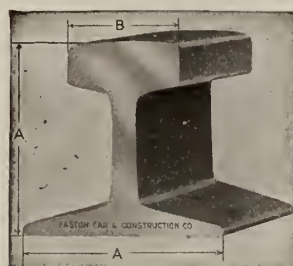


FIG. 9. RAIL
Rails of any weight. Large stock on hand



FIG. 76. TRACK CURVES
All standard sizes carried in stock

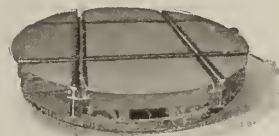


FIG. 2543-B. TURNTABLE
One type of 50-ton capacity turntable with 90° manganese steel standard gauge track crossing



FIG. 176. STANDARD GROUND THROW

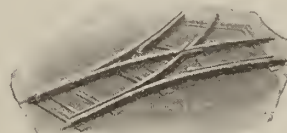


FIG. 81. EASTON TWO-WAY SWITCH



FIG. 82. EASTON THREE-WAY SWITCH

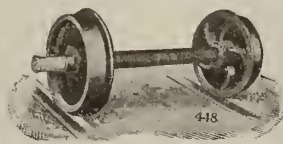


FIG. 448. WHEELS AND AXLE
Wheels and axles of any design and for all gauges

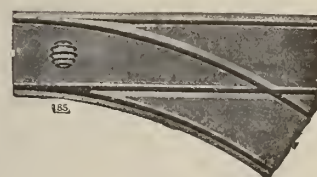


FIG. 185. CAST IRON PLATE SWITCH

C. W. HUNT COMPANY, INC.

Manufacturers of Industrial Railways and Coal Handling Machinery

SALES OFFICES

NEW YORK, N. Y.

WORKS AND EXECUTIVE OFFICES: WEST NEW BRIGHTON, N. Y.

Products.

INDUSTRIAL RAILWAY TRACKS, SWITCHES, CARS, SCALES, ELECTRIC MINE and INDUSTRIAL LOCOMOTIVES and STORAGE BATTERY TRUCKS; AUTOMATIC RAILWAYS; CABLE RAILWAYS; CONVEYORS; COAL CRACKERS; SKIP HOISTS; CUT-OFF VALVES or GATES; WEIGHING LARRIES.

Transmission and Hoisting Manila Rope and Rope Couplings, Coal Tubs.

Co-operative Service.

Since every coal handling or railway proposition has specific requirements and conditions to meet, our engineering staff is at the disposal of all parties interested in the above classes of work. It will gladly advise, recommend, or furnish estimates.

Facilities.

Standard parts most in demand are carried in stock. The company's resources, including plant, capital and engineering force, are prepared for prompt action on the largest special requirements. Prompt deliveries are further assured through exceptional shipping facilities—Baltimore & Ohio R. R. tracks on the property and wharf accommodating the lighters of every railroad centering in New York City.

Industrial Railway and Equipment.

TRACKS—Laid on any form of floor or roadbed and can be run across or between standard gage railway tracks without cutting the rail heads, run out on trestles or in tunnels. Made up in sections of 20-ft. length with ties spaced every $24\frac{1}{2}$ in. Rails are furnished either riveted to steel cross ties or having cast tie plates integral with rail or knocked down steel track. Track gage from outside of one rail head to other is $21\frac{1}{2}$ in. (Fig. 2).



FIG. 1. CAST PLATE STRAIGHT TRACK
Sectional view

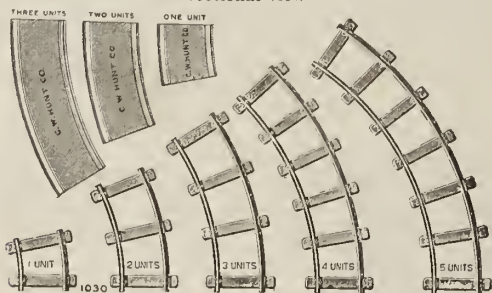


FIG. 2. ROLLED STEEL AND CAST PLATE CURVES



FIG. 3. LEFT-HAND SWITCH, WITH STAND



FIG. 4. TWO-WAY SWITCH



FIG. 5. RIGHT-HAND SWITCH

Combination of switches are left- or right-hand, 2-way or 3-way, furnished with or without stands. Also, the above can be furnished in cast plate (Fig. 1). Frogs, crossovers and turntables are also manufactured. Any workman of ordinary intelligence can put together a whole system ready for use.

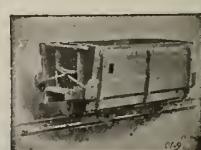
CARS—Bodies of various designs to meet a wide range of use, but all have essentially same truck construction. Axle bearings are either plain or roller bearing. Arrangement of running gear (Fig. 9) facilitates propulsion on short curves. Standard width for clearance of cars is 4 ft. Curve radius, 12 ft.



No. 011
Standard Eight-wheel Shop Car



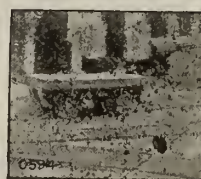
No. 0355
Standard Charging Car



No. 07129
Standard Four-wheel Self-dumping Push Car



No. 014
Standard Tip Car



No. 0594
Standard Shop Car



No. 0491
Standard Foundry Car

FIG. 6. INDUSTRIAL RAILWAY CARS

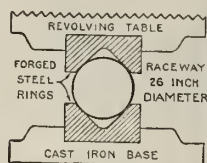


FIG. 7. TURNTABLE WITH SKETCH SHOWING CONSTRUCTION OF BALL BEARING SUPPORT



FIG. 8
ROLLER BEARING

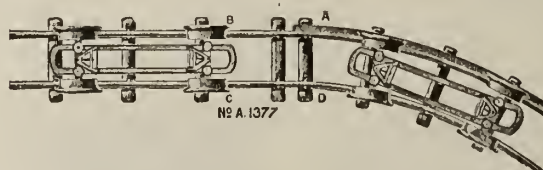


FIG. 9. POSITION OF TRUCK AXLES WHEN ROUNDING A CURVE



FIG. 10. THEORETICAL CONE AND CIRCULAR PATH BY AXLE AND WHEELS IN ROUNDING A CURVE

TRACK SCALES—Made in both iron and wooden frames, especially designed for use with industrial railway, track ends connecting directly with either cast plate track or made-up steel track of railway system.

Both types of scales are provided with a tare beam to balance weight of empty cars so that load beam will give net weight of load. Beams are furnished graduated to pounds or kilograms as desired.

Cast iron type has track rails cast integral with both platform and frame. Platform is 27 in. wide, and clearance distance from center of platform to beam box, when beam is parallel with car track, is 36 in. Where necessary, an extension to base can be fitted to frame, moving beam 4 ft. further or a lesser distance away. Beam box is cast iron, dustproof, and can be made to face in any direction to secure best light on beam. Weights are attached to beam to prevent their being misplaced or lost.

ELECTRIC LOCOMOTIVES FOR INDUSTRIAL AND MINE SERVICE—Narrow gage electric locomotives in connection with industrial railways further reduce cost of handling material. Designed to take full load around 12-ft. radius curves as easily as on straight track.

Various types of locomotives are made to pull loads up to 50 tons.

Standard machine as shown (Fig. 11) is built for any track gage from 18 to 36 in. Minimum curve radius 10 ft. Rated draw bar pull, 800 lbs., at 4 miles per hour; steel wheels slip at 1600 lbs. starting pull. The

operator is protected by sliding top on cab. Over all height from top of rail to top of cab 52 in. Battery capacity ample for full day's work. Battery box easily removable for extra set of cells for 24 hours' service.

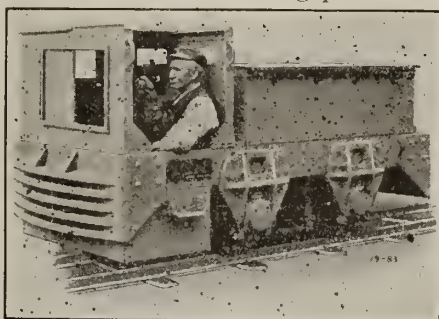


FIG. 11. STANDARD ELECTRIC LOCOMOTIVE

Locomotives can be equipped with storage battery for motive power, or current can be taken from overhead trolley or from third rail. Motors and gears are housed to protect them from injury and dust. Speed, variable, from 1 to 10 miles.

Also load carrying motor cars (Fig. 12), 1-ton to 10-ton capacities.



FIG. 12. MOTOR DRIVEN SELF-DUMPING CAR

STORAGE BATTERY TRUCKS—Electric storage battery industrial truck (Fig. 13) is designed for heavy duty in handling freight in and about railway and steamship terminals, manufacturing establishments, warehouses, etc. Its design combines with strength and ruggedness, the maximum of simplicity and



FIG. 13. STORAGE BATTERY TRUCK
Length of car over all..... 108½ in.
Length of platform..... 90 in.
Width of platform..... 48 in.
Height of platform..... 22½ in.
Capacity..... 4,000 lbs.

accessibility. Parts subjected to greatest wear or stress are of steel. It has high grade bronze bushings, seasoned oak platforms, hardened steel pinions, etc. Bearings are of the highest grade such as are in the best automobiles.

Electrical equipment consists of General Electric controllers, Diehl or General Electric motors and either Exide or Edison batteries, and is of ample capacity to perform severest service, day in and day out, without danger of injury. System of electrical control is such that 3 speeds are given in each direction without the use of resistances which are great wastes of energy.

Batteries are hung in a spring suspended basket which absorbs road shocks and reduces to a minimum the danger of broken battery jars. Platform is in 3 sections, hinged so as to give easy access to all parts of truck.

The 2 levers used for steering and speed control are placed in a convenient position for operator and are moved in a vertical plane, simplifying steering. Brakes are the external band type and are placed on the 2 driving wheels. They are positive in action and will hold fully loaded truck on any grade it will climb. The 20-in. wheels with large 3½-in. solid rubber tires insure easy running and permit installation of batteries under platform, and yet height of platform above ground is only 23 in. and road clearance 5½ in. Clear loading space of 48 by 90 in. will carry either a bulky load or a concentrated load up to 4000 lbs.

Also manufactured with longer wheel base and 10-ft. platform for exceptionally heavy and bulky loads. Other designs include tractors (Fig. 15), "motor-in-wheel" drop frame trucks, elevating platform, crane trucks and models equipped with special dump bodies for bulk material (Fig. 14); also a 3-wheel very low truck for use in extremely congested places—the turn-radius being very short.

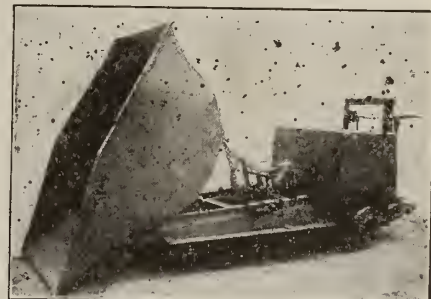


FIG. 14. DF-60 TRUCK WITH DUMPING BODY



FIG. 15. TRACTOR HAULING EMPTY TRAILERS

Hunt's Automatic Railway.

Designed primarily for transporting coal, sand, rock, cement and similar bulk materials from railway cars or vessels to storage bins where run does not exceed 600 ft. Operation is entirely automatic. Time consumed for round trip of 300 ft., dumping its load and returning, is about 50 seconds. Requires services of only one man—the crane man.

In operation, loaded car is started down an inclined track, and a few feet ahead of discharging point picks up a cross bar which is attached to a cable leading to a weight box. This raises weight box, and when load is discharged from car the reaction due to falling weight returns empty car to loading point.

Two sizes of cars are manufactured: 1-ton and 2-ton capacity. Made of wood, lined with sheet steel.

Cable Railways.

Adapted for handling coal and for carrying heavy material from point to point. Used extensively in conveying coal from barge to storage bins. Standard gage, 21½ in.; curve radius, 12 ft.

Skip Hoists.

Consists of load-carrying bucket, wire hoisting rope, head and leading sheaves, electric single drum hoisting engine with motor, traveling cam control and electrically operated brake, bucket guides, loading pit valve or loading chute, control panel and push button station for operating machine.

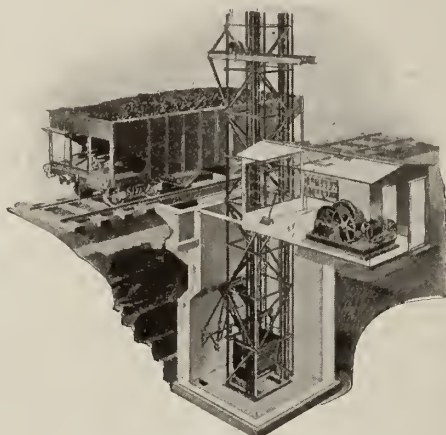


FIG. 16. STANDARD SKIP HOIST

Single bucket skip is counterweighted and guides constructed for properly guiding counterweight and bucket. Electric skips with drum type controller and steam hoist friction operated skips of high speed can be furnished if desired. Skip hoists can be operated equally well whether vertical or inclined.

Capacities from 25 to 300 tons per hour.

Overhead Weighing Larries.

Built to meet existing conditions with one way or bifurcated chutes to serve a single or double line of stoker hoppers. Accurate records of coal consumption registered on cards. Manually or electrically operated either from boiler room floor or cab. Capacities ½ ton and up.

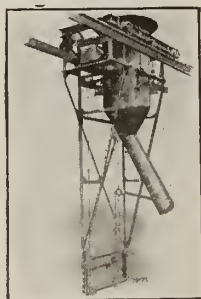


FIG. 17. OVER-HEAD WEIGHING LARRY

Conveyors.

The Hunt pivoted bucket conveyor carries bulk material, dry or liquid, noiselessly in any direction without shock, breakage or violence. Three types of conveyors are manufactured: "Standard," with independent buckets, being separately filled; "Continuous," with edges of buckets in contact; "Lip Type," with edges of buckets overlapping—material being spouted into conveyor in constant stream without spill or scatter.

Buckets are suspended on pivots so that gravity keeps them upright whether track be horizontal, vertical or inclined. Conveyor driven by pawls which run smoothly on driving pins on chains. Whole conveyor designed for thorough lubrication of all bearings.

Capacity secured not by speed but by enlarged bucket. Operation entirely automatic. All parts interchangeable. Conveyor will operate on 5 to 10 h.p.

Special automatic machinery is designed for filling each "Standard" type bucket with definite quantity of material. Several fillers can be arranged for measuring and mixing different materials.

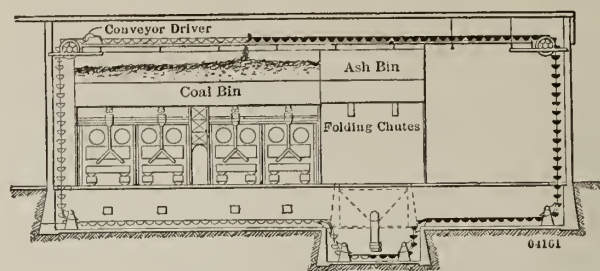


FIG. 18. SECTION THROUGH A POWER PLANT EQUIPPED WITH HUNT CONVEYOR

Coal Crackers.

Designed for breaking lump bituminous coal into pieces small enough to feed through automatic stokers. Rolls have hardened steel chisel points that split or crack instead of crushing the lumps. Steel points renewable. Bearings and mechanisms protected from dust. Cracker may be placed below hopper under railway car track, so that coal feeds directly from car into conveyor. Can also be suspended from overhead beams, or be supported from below. Steam or electrically operated.

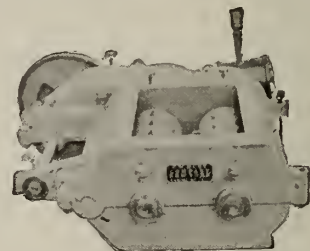


FIG. 19. COMPLETE COAL CRACKER

Cut-off Valves or Gates.

For controlling flow of coal, broken stone, sand, etc., from storage bins to mechanical stokers, mixers or cars. Installed at side or bottom of bins, or at end of spout. Hand operated by single lever, but power can be applied to larger sizes. Have no sliding parts, but jaws rotate on centers, cutting through material without jamming. Normal tendency of valve is to close automatically by gravity. Almost every requirement may be met with standard types or modifications.

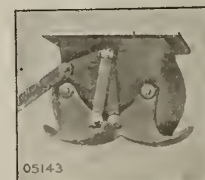


FIG. 20. CUT-OFF VALVES

Fig. 22 shows a low body duplex valve with outside flanges particularly suitable for ash hoppers. If the conditions are unfavorable for the operation of any other type of cut-off valve, these duplex valves will be successful. They are heavily built and are not quickly burned out.

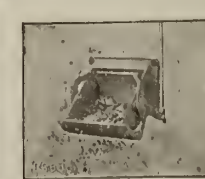
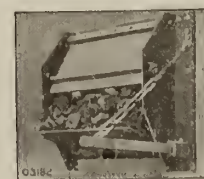


FIG. 21. VALVES AND CHUTES



FIG. 22. LOW BODY DUPLEX VALVE

THE PENNSYLVANIA TANK CAR COMPANY

(PENNSYLVANIA TANK LINE)

Manufacturers of Tank Cars

SHARON, PA.

DISTRICT SALES OFFICES

NEW YORK, N. Y., 50 Church Street
ST. LOUIS, MO., Third National Bank Building

HOUSTON, TEX., 1110 Carter Building
SAN FRANCISCO, CAL., 503 Market Street

Product.

"PENNSYLVANIA" TANK CARS.

Facilities.

The general offices and works are situated about three miles south of Sharon, Pa., on the Youngstown and Sharon Street Railway. Substantially built structural steel buildings, including power plant, fabricating shops, machineries, painting shops, and storage yards having direct connections with the New York Central, Erie and Pennsylvania Railroads, and the most modern and efficient machinery, enable the company to fabricate and turn out for quick delivery the light and heavy steel plate work which goes into "Pennsylvania" tank cars.

Territory.

"Pennsylvania" tank cars operate in all parts of North America and in many foreign countries, engaged in their big task of transporting raw materials to the manufacturers, and the finished products from the manufacturers to the consumers.

Description.

All materials used in manufacturing "Pennsylvania" tank cars are of the best quality and in accordance with all requirements of the Master Car Builders' Association. The tank is double riveted throughout, and all seams are well calked; it is tested with cold water at a pressure of 60 lbs. per sq. in., and is made absolutely tight in conformity to M. C. B. requirements. All details and appliances on "Pennsylvania" tank cars also conform to M. C. B. specifications and comply with the Federal Safety Appliance and Interstate Commerce Commission Laws.

Capacities and Dimensions.

The standard capacities of tank cars are 6500, 8050 and 10100 gals., though special cars with different capacities can be manufactured to order on receipt of specifications as to the particular product and use covered. The length over striking plates is 35 ft. 6 in. the width over running boards is 9 ft. 5 in. for the 10100-gal. car. Dimensions for the others of course vary slightly according to their capacities.

Adaptability.

"Pennsylvania" tank cars are today serving many industries—hauling various liquids, from acid to wine. Government figures show that about 70% of all tank cars in service are used to transport petroleum and its by-products, and 30% are used for products other than petroleum. To suit the peculiarities of any particular product (such as the prevention of corrosion when certain liquids come in contact with the steel in the tank) "Pennsylvania" tank cars can be insulated with wood or other material when desired.

Uses.

For the carrying of acids, animal oils, ammonia liquor, alcohol, benzol, cottonseed oil, candle grease, caustic potash, caustic soda, corn oil, calcium chloride, coal tar, creosote oil, crude oil, cider, castor oil, edible oils, fish oil, fuel oil, fatty oils, gasoline, glycerine, glucose, illuminating oils, lard, lubricating oils, lard oil, linseed oil, liquid driers, molasses, mineral waters, petroleum products, pitch, paints, road oil, rosin, red oil, silicate of soda, syrup, tallow, toluol, turpentine, tanning extracts, vinegar, wood alcohol, wine, etc.



ONE OF THE 5000 "PENNSYLVANIA" TANK CARS IN THE PENNSYLVANIA TANK LINE

These cars are leased to producers, refiners and marketers of petroleum products. They also carry products in the chemical, mineral and vegetable fields

SWEET'S STEEL COMPANY

Manufacturers of Steel Rails and Appurtenances
MILLS AND GENERAL OFFICES
WILLIAMSPORT, PA.

BRANCH OFFICES
PHILADELPHIA, PA., Land Title Building WILKES-BARRE, PA., Miners Bank Building NEW YORK, N. Y., 2 Rector Street

Products.

LIGHT STEEL TEE RAILS; STEEL TIES and APPURTENANCES.

Also, Light Steel Angles, Flats and Bands; Steel Concrete Reinforcement Bars; Special Agricultural Implement Shapes.

Light Steel Rails and Fastenings.

Standard A. S. C. E. section rails are rolled from high grade stock of *new first quality*, which is required to pass severe chemical and physical tests. These methods insure a thoroughly satisfactory section rail. Under Sweet's construction, a uniform product, made from steel suitable for hard usage, is secured without flaws or defects, due to segregation of various metal compositions.

LENGTHS—Regular standard lengths with splice bar punching, and rolled in accordance with A. S. C. E. specifications. Special lengths, such as 15, 20 or 24 ft., also supplied. Bond drilling when required.

SPLICE BARS—Complete with bolts and nuts for rails of 12, 16, 20, 25, 30, 35 and 40 lbs.

ANGLE BARS—Complete with bolts and nuts for rails of 30, 35, 40, 45, 50, 55 and 60 lbs.

Steel Ties and Fastenings.

Life of steel ties, laid in ballast, is about 20 years and is indefinitely prolonged by immersing ties (when heated to 500° Fahr.) in hot coal tar.

CORRUGATED FEATURE—A double corrugation running the entire length, combined with high carbon steel from which the ties are rolled, gives *much greater rigidity than any other similar section on the market*, with minimum possibility of buckling.

CLIPS AND TEE HEAD BOLTS—Constitute an idea which has stood the test during many years. Clips and tee head bolts are placed opposite each other—a distinct advantage.



LIGHT STEEL RAILS
A.S.C.E. sections, 8, 12, 16, 20, 25, 30, 35, 40, 45, 50 and 60 lbs.

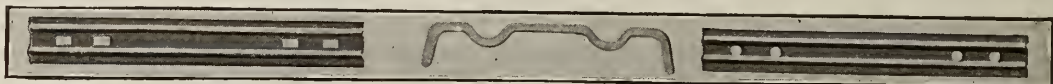
DATA, LIGHT STEEL RAILS AND FASTENINGS

Rail section No.	Weight of rails per yard, lbs.	Number pairs of splice bars	Number bolts and nuts	Number spikes	Gross tons of rails	Weight of splice bars, lbs.	Weight of bolts and nuts, lbs.	Weight of spikes, lbs.	Weight of rails and fastenings, gross tons
2-12	12	360	1440	10560	18.86	1240	310	1705	20.31
2-16	16	360	1440	10560	25.14	1570	310	1805	26.78
2-20	20	360	1440	10560	31.43	1750	328	3406	33.87
2-25	25	360	1440	10560	39.29	2052	350	3770	42.05
2-30	30	360	1440	10560	47.14	3762	625	3770	50.78
2-35	35	360	1440	10560	55.00	4356	625	4140	59.07
2-40	40	360	1440	10560	62.86	5796	1070	4512	67.92
2-45	45	360	1440	10560	70.71	6750	1070	6212	76.98

FOR ONE JOINT

Splice bar section No.	Weight of 1 pair of splice bars, lbs.	Weight of 4 bolts and nuts, lbs.	Total weight of joint, lbs.
2-12 A	3.44	.865	4.305
2-16 A	4.36	.865	5.225
2-20 A	4.86	.91	5.77
2-25 A	5.70	.97	6.67
2-30 A	10.45	1.74	12.19
2-35 A	12.10	1.74	13.84
2-40 A	16.10	2.90	19.00
2-45 A	18.75	2.90	21.65

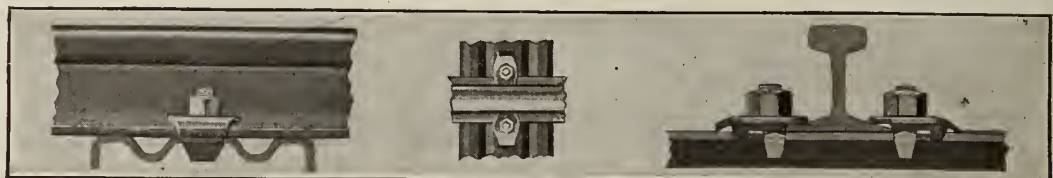
Table based on rail lengths, 90 % to be 30 ft., 10% to be shorts down to 20 ft. Ties 2 ft. center to center. 4 spikes per tie. No excess has been allowed.



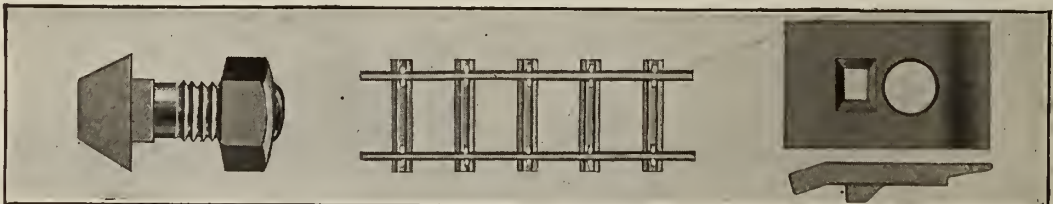
DOUBLE CORRUGATED STEEL CROSS TIES

No. 4 Section
Weight approximately 2½ lbs. per ft. for 8, 12, 16 and 20-lb. rails

No. 5 Section
Weight approximately 3½ lbs. per ft. for 25, 30, 35, 40 and 45-lb. rails.



CROSS SECTIONS SHOWING METHOD OF ATTACHING RAILS TO TIES



TEE HEAD BOLTS AND CLIPS FOR FASTENING RAILS TO TIES



TWO-WAY SWITCH

FROG

THREE-WAY SWITCH



TRACK CROSSING

TEMPORARY CROSSOVERS OR CLIMBERS

THE SAMUEL J. CRESWELL IRON WORKS

Twenty-third and Cherry Streets
PHILADELPHIA, PA.

Products.

CAST and WROUGHT IRON ENGINEERING SPECIALTIES and GENERAL FOUNDRY WORK, including Columns, Spiral Stairs, Wheel Guards, Manhole Doors and Frames, Roadway Drain Grates and Frames, Vault Plates and Frames, Ash Pit Doors and Frames, Trench Covers and Frames, Post Caps, etc.

Facilities.

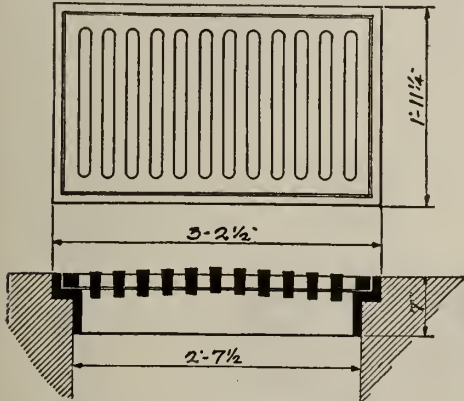
The SAMUEL J. CRESWELL IRON WORKS is one of the best equipped and largest plants in the vicinity of Philadelphia for the production of the various kinds of wrought and cast iron work mentioned above. Furthermore, this company is prepared to submit estimates, or designs and estimates, for any ornamental work for large or small buildings, etc., on short notice.

Stock Specialties.

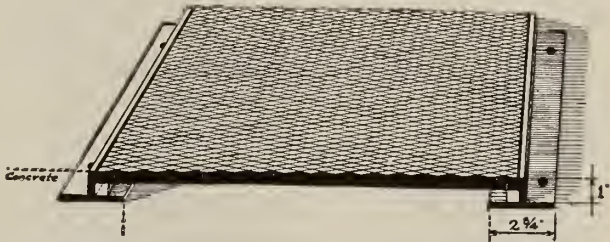
The accompanying illustrations show a few specialties regularly carried in stock. The prices quoted are f.o.b. Philadelphia.

Catalogue.

A catalogue illustrating the entire line of manufacture, and containing also discount rates, will be sent on request.



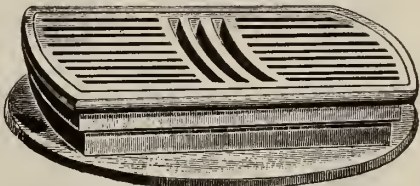
NO. 3 SEWER INLET
Price, \$22.00



COVER AND CURBING FOR DUCTS OR TRENCHES
Plates made to suit conditions. Curbing carried in stock.
Prices on application



NO. 11 ROADWAY DRAIN GRATE AND FRAME
11" x 22 1/2" grating..... \$6.00
8 3/4" x 17 1/4" grating..... 4.00

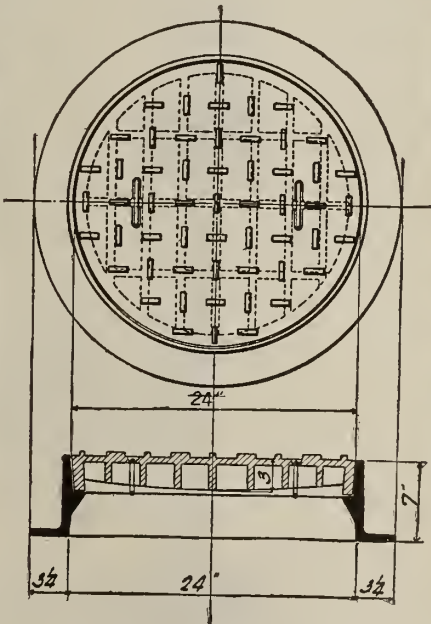


NO. 10 ROADWAY DRAIN GRATE AND FRAME
13 1/4" x 24 1/2" grating..... \$7.00
12" x 18" grating..... 6.00



NO. 1 MANHOLE DOOR AND FRAME					
Width	Height	Price	Width	Height	Price
36"	72"	\$70.00	24"	30"	\$11.75
36"	36"	30.00	24"	24"	11.00
33"	49"	30.00	20"	24"	10.00
24"	48"	20.00	18"	24"	8.50
24"	36"	12.50			

All manhole doors and frames have return flanges 4 ins. deep



NO. 19 MANHOLE COVER
Extra heavy for city use..... \$17.00
With concrete or asphalt filled cover..... 22.00



NO. 3 MANHOLE DOOR AND FRAME					
Width	Height	Price	Width	Height	Price
24"	24"	\$11.00	16"	20"	\$7.25
18"	33"	10.00	16"	10"	4.50
18"	24"	8.50	12"	16"	4.50
18"	18"	7.50	12"	12"	4.00
16"	24"	8.00	12"	10"	3.50
			12"	8"	2.50

BANNER IRON WORKS

Structural Steel and Cast Iron Work

4560 Shaw Avenue
ST. LOUIS, MO.

Products.

STRUCTURAL, ARCHITECTURAL and ORNAMENTAL STEEL and IRON WORK.

SPECIALTIES: ORNAMENTAL LAMP POSTS and BRACKETS; BELL and SPIGOT and FLANGED PIPE FITTINGS: for gas and water mains; MAN-HOLE FRAMES and COVERS; DRAIN GRATES; GUTTER and SEWER INLETS.

Gray Iron Castings, medium and large; Cast Iron Columns; Reinforcing Steel Bars; Angles, Beams, Channels and Tees.

Bench Mountings for Gas Plants consisting of Self-sealing Mouthpieces, Hydraulic Mains and Buckstays.

Furnace Castings, Grate Bars, Fire and Ash Doors; Door, Window and Wheel Guards; Iron or Steel Stairs; Roof Trusses.

Facilities.

This company's plant consists of a well equipped structural steel shop, ornamental iron and fitting shop, pattern shop, gray iron foundry and machinshop. Direct railroad shipping connections. A large stock of structural steel sections, plates, reinforcing bars and stock manufactured castings are always on hand.



TRADE-MARK

Ornamental Lamp Posts.

The designs shown in the new lamp post catalogue, giving dimensions, weights and list prices of cast iron lighting standards and brackets, are as attractive as any on the market. These designs vary from the comparatively simple to the ornate; from 1-light to 5-light standards suitable for the illumination of streets, boulevards and building entrances to the larger cluster standards for park en-

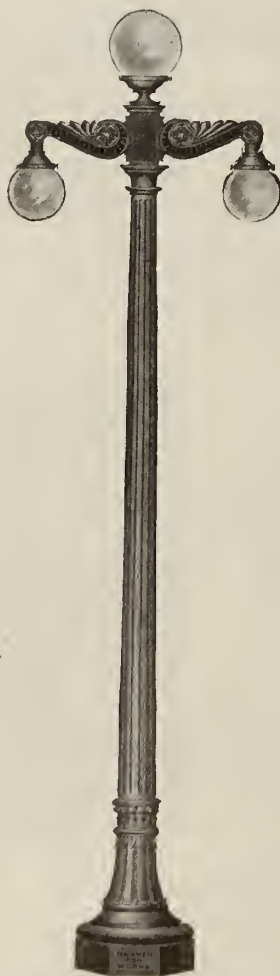
trances and boulevard intersections. Standards for stone or concrete copings on bridges and viaducts are also illustrated. The range in height will meet every requirement.

These standards and brackets are adaptable for either electric or gas lighting. The test of time has proved the superiority of cast iron for lamp post standards over all other materials.

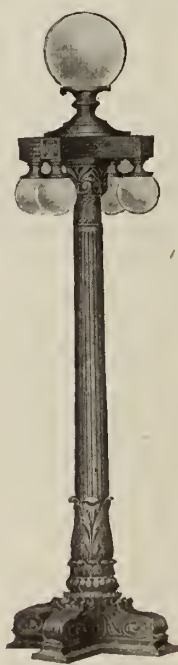
"Banner Standards" are made of the best grade of gray iron, well finished, and are given one coat of shop paint before shipping. The bases of the posts are arranged with inside flanges or lugs having holes to engage the anchor bolts. A handhole at the base of the



"St. Louis"
1-Light
No. 251



"University" 3-Light
No. 223



"Sterling" 5-Light
No. 655



"Columbia" 5-Light
No. 165



"Standard"
1-Light
No. 101

SOME OF BANNER IRON WORKS MOST POPULAR ORNAMENTAL LAMP POST DESIGNS

shaft is so placed as to make the nuts of the anchor bolts and the feed wires accessible.

The BANNER IRON WORKS endeavors to keep a quantity of each design on hand so that prompt shipments can be made from stock, and is prepared to submit special designs to conform to any particular requirements. A new special catalogue, illustrating the complete line of designs, is now ready for mailing.

Cast Iron Fittings for Gas and Water Pipe.

The BANNER IRON WORKS has a complete set of patterns for cast iron street main specials made to conform to the requirements of the American Gas Institute. They include bell and spigot, and flanged pipe fittings such as bends, tees, crosses, reducers, sleeves, line drips, etc., in all the usual sizes.

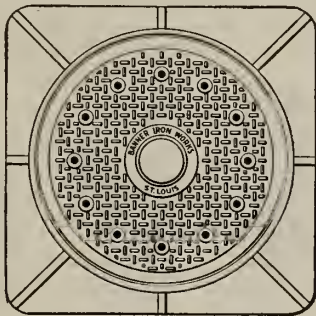
The company is equipped to face and drill flanged fittings to meet any standard or special specifications. Fittings usually required are carried in stock for immediate delivery. Its facilities enable the company to execute large or special orders for this class of material.



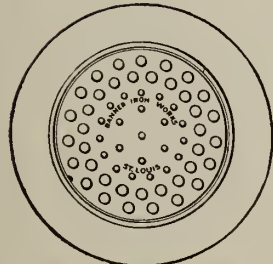
Bell and Spigot
PIPE FITTINGS

Cast Iron Manhole Frames and Covers, Drain Grates, Gutter and Sewer Inlets, etc.

A new special catalogue, illustrating the complete line of this class of castings, is now ready for mailing. The illustrations shown here are selected from the



No. 4760



No. 4730



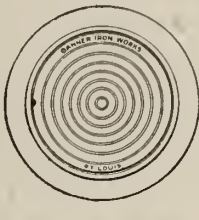
No. 4800

MANHOLE FRAMES AND COVERS

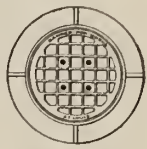
catalogue to give an idea of the range of patterns. They cover every requirement of the municipal, highway, drainage, plumbing and public utility contractor. All necessary dimensions and weights are given. A sufficient number of castings of each pattern to meet ordinary demands is carried in stock. Facilities enable the BANNER IRON WORKS to make prompt deliveries of quantity orders. It is prepared to furnish any special castings to meet unusual requirements. Send for quotations.



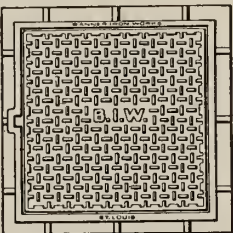
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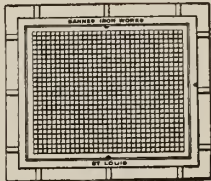
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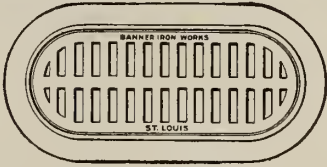
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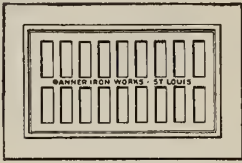
No. 4750



No. 4770



No. 4870



No. 4860



No. 4880

MANHOLE FRAMES AND COVERS AND GRATES
DIMENSIONS AND WEIGHTS

No.	Cover, in.	Outside of frame in.	Height of frame, in.	Weight complete, lbs.
4760	34½ diameter	42½ x 42½	10	940
4730	24 diameter	36 diameter	9	335
4800	26 diameter	36 diameter	8	515
4570	10 to 32½	14 to 36½	4	33 to 180
4790	21½ diameter	29½ diameter	5	200
4890	16 diameter	23 diameter	8	134
4750	28½ x 28½	36 x 36	9	725
4770	18 x 18	24 x 24	4	164
4770	24 x 24	30 x 30	4	270
4770	30 x 24	36 x 30	4	325
4770	30 x 30	36 x 36	4	385
4870	15 x 39	23 x 47	7	303
4860	14 x 26	22 x 34	6	220
4880	13 x 13	15 x 15	1½	30

Catalogues.

Send for the BANNER IRON WORKS' special catalogue showing many other stock patterns of manhole frames and covers, etc.; also for special lamp post catalogue.

ATEN SEWAGE DISPOSAL CO.

TELEPHONE CONNECTION

286 Fifth Avenue
NEW YORK, N. Y.

Products and Services.

ATEN SANITARY SEWAGE DISPOSAL SYSTEMS, adapted to single buildings or groups of buildings unable to connect with city sewers.

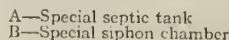
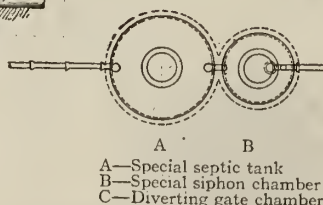
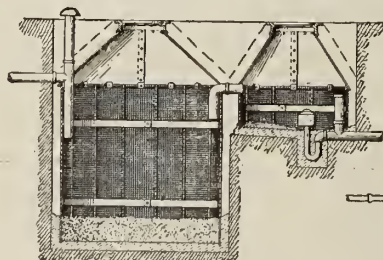
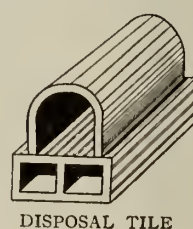
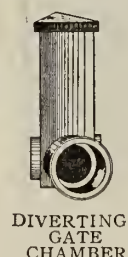
The following special parts are required: Combination Form and Reinforcement for Concrete Walls, allowing a reinforced concrete wall to be built without the use of wooden or other auxiliary forms; Cast Iron Manhole Collars and Covers; Metal Tops for Concrete Roof; Automatic Sewage Siphon; Cast Iron Diverting Gate Chamber; Double Porous Disposal Tile; special Y Distributing Branches; special Septic Tank connecting pipes and vents.

Special reports and designs are rendered on sewage disposal problems for buildings, municipalities, factories, etc. Recovery of valuable constituents from manufacturing trade wastes investigated from a chemical and engineering standpoint, and designs and reports submitted for plants where it is necessary to produce efficient results.

Cost estimates will be furnished for systems using Aten materials, and where sufficient data or topographic maps are submitted, details of location and a general layout of the system will be supplied at no cost to the inquirer. When materials are ordered construction specifications are supplied so that complete systems can be installed by inexperienced labor. Materials furnished by this company can also be used in plants designed by other engineers.

Designs.

For smaller systems handling domestic sewage, the design advocated by the ATEN SEWAGE DISPOSAL CO. follows that recommended by leading state boards of health,



ELEVATION SHOWING INSTALLATION OF ATEN SANITARY SEWAGE DISPOSAL SYSTEM AND A FEW ACCESSORIES

ARRANGEMENT OF TANKS AND TILE FIELDS



TRADE-MARK

providing septic tanks for settling and digesting solids, and disposing of the effluent by intermittent filtration through the soil by means of percolating tile lines. No chemicals are used. By installing an Aten system all the sanitary comforts of a modern city building are obtained, and free use can be made of toilets, sinks, bathtubs and similar fixtures.

Catalogue 15, giving description of systems, operation, and other useful information, sent free on request.

Guarantee and Catalogue.

Aten systems are guaranteed, and assurance of their efficient operation is based on ten years of successful experience with them.

Partial List of Aten Users.

Engineers Club, Roslyn, N. Y.
Thos. Hastings, Architect, Carrere & Hastings, Old Westbury, N. Y.
Saito Shozo, Tokyo Office, Builder, Osaki Sta., Tokyo, Japan
M. Van Geisen, Merchant, Soerbaya, Java
Wm. F. Schlemmer, Hammacher & Schlemmer, Tools, Great Neck, N. Y.
E. P. Charleton, Manager Woolworth Stores, Westport Harbor, Mass.
Fred Ruchti, Engineer, American Bridge Co., Gary, Ind.
Blind Brook Club, Port Chester, N. Y.
Nazareth Trade School, Farmingdale, N. Y.
Camp Merritt Inn, Camp Merritt, N. J.
Isolation Hospital, Perth Amboy, N. J.
Holyoke Canoe Club, Holyoke, Mass.
Wm. L. Lyall, Pres. Brighton Mills, Passaic, N. J.
C. S. Stolp, Contractor and Builder, Ellendale, N. Dak.

NEW YORK SEWAGE DISPOSAL CO.

Sewage Disposal, Drainage and Water Supply Plants

37-39 East 28th Street

NEW YORK, N. Y.

Products and Services.

The DESIGN and CONSTRUCTION of SEWAGE DISPOSAL, DRAINAGE and WATER SUPPLY PLANTS.

Scope of Work.

The NEW YORK SEWAGE DISPOSAL CO. will undertake the entire solution of sewage problems, from analyzing local conditions to building the plant, or will execute any part of the job.

This company is prepared to furnish plans, specifications, reports, special equipment with or without installation, or act in a purely advisory capacity.

Experience.

Sixteen years' experience enables this company to offer the most expert engineering service obtainable for the design and construction of sewage disposal and water supply plants for towns, institutions, country houses, hospitals, camps, etc.

The system employed eliminates all the dangers attending the use of the old-fashioned cesspool, requires very little attention, and is only slightly more expensive.

Description of System.

Following are the 6 salient points that best show the advantages of this company's system:

(1) A sewer connecting the soil pipe at the building with the disposal plant. This is properly designed and laid, care being taken that manholes be placed so that easy access to the sewer can be had in case of changes of alignment.

(2) The settling tank, a tight masonry structure provided with inlet and outlet devices, baffle and weir walls, and other arrangements to insure the sewage being received and held a proper length of time to permit the maximum degree of liquefaction.

The nature and volume of sewage to be treated determines the design of the settling tank. While a simple tank is adequate for a dwelling with from 6 to 30 people, hotels, factories or other large institutions require more special design and construction.

(3) The siphon chamber, another tight masonry structure built in connection with the settling tank. It receives the liquid overflow, and by means of an automatic siphon designed for the purpose, discharges this effluent at periods. The function of the siphon chamber is to produce periodic discharges in order to fill uniformly the tile disposal field beyond, at the same time permitting a period of rest during which the oxidation of the effluent will progress at a uniform rate.

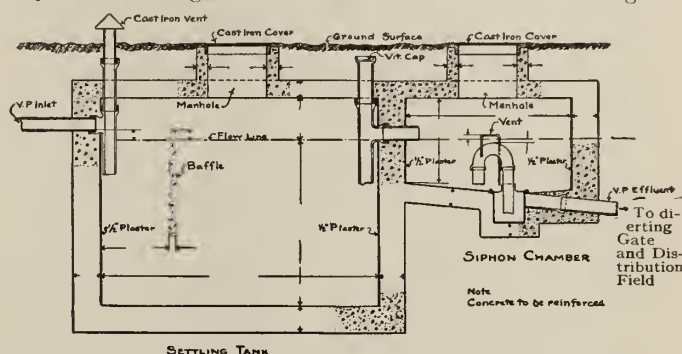
This company has for its exclusive use a siphon which works in a perfect manner, eliminating all the troubles which usually develop with water flushing siphon.

(4) Some form of secondary treatment such as sprinkling beds, contact filters, or sterilization.

The size of the installation, the scope of work it is

to accomplish, and the local soil conditions, are all factors which determine the design of this system for secondary treatment, as well as the type of special devices used.

(5) A special diverting gate, which deflects the siphon discharges into either filter area. Turning a



A TYPICAL SEWAGE DISPOSAL PLANT, SHOWING SECTION OF SIPHON CHAMBER

valve in this gate chamber once a week will accomplish the result, and will permit a period of rest and recovery for the filter last in use.

These gates have openings at the bottom provided with bronze plates which prevent them from rusting and sticking.

(6) A terra cotta fitting made exclusively for this company from its own design. This fitting is set along the distribution lines so that the sewage will flow evenly and uniformly through each line of tile, making a complete distribution over a considerable area, and thus developing the maximum condition of purification.

Procedure.

This company's engineers will visit the property and make a careful study of all local conditions after which a layout will be prepared with stakes and batter boards, indicating the exact location of the plant, cuts necessary, etc. Upon delivery of the special material, a trained foreman arrives and proceeds with the construction of the plant; 3 or 4 skilled workmen are usually sent with the foreman. At all times the work is subject to the inspection and criticism of the architect and the owner. During progress of the job an engineer from the main office visits it to see that all work is being carried out as planned.

Upon completion, the grounds are restored as nearly as possible to their original condition, and the architect and owner each furnished with a map showing the exact location of the plant.

Guarantee and References.

Plants built directly under the supervision of this company's engineers and foremen are guaranteed for design, material and workmanship. A booklet containing the names of over 1000 users will be sent on request.

THE KINNEY MANUFACTURING CO.

Manufacturers of Road Oiling Equipment

3529-3541 Washington Street
BOSTON, MASS.

BRANCH OFFICES

NEW YORK, N. Y. PHILADELPHIA, PA. CHICAGO, ILL. KANSAS CITY, MO. SAN FRANCISCO, CAL.

Products.

ROAD OILING EQUIPMENT: AUTO HEATERS, DISTRIBUTORS and SPRAYERS.

For Friction Clutch Pulleys and Cut-off Couplings, see page 834; for Pumps and Strainers, see pages 742-43.

The Kinney Auto Heater and Distributor.

A machine for heating and spraying by direct pressure all varieties of bituminous materials, hot or cold, for road construction, maintenance or dust laying.

The Kinney auto distributor (Fig. 61) consists of a horizontal steel tank of stated capacity, furnished with the Kinney heating and circulating system and equipped with the Kinney pressure pump, spraying nozzles, valves and controlling levers complete. The outfit is mounted upon a specially designed motor truck chassis. The equipment is furnished in three sizes, 600-, 800- and 1,000-gal. tank capacity. The machine is so constructed that the entire equipment may be removed from the chassis and the truck used for other purposes (Fig. 67).

The heat is derived from kerosene oil burners arranged to convey heated gases through heating tubes placed horizontally through the tank interior similar to the construction of a water tube boiler. Pressure for spraying is supplied by the Kinney pump. The pressure is under direct control of the operator.

The spraying nozzles are adapted to produce a uniform spray in any desired volume (Fig. 61). Both width and volume of spray are under direct control of operator. The spray pipes are provided with spraying hoods to prevent dripping of oil on cross walks. Full and complete description in Bulletin "A" furnished on request.

The Kinney Handy Heater and Sprayer.

This machine (Fig. 144) is specially designed for road or highway repairing and maintenance. It is made



FIG. 67. TANK AND SPRAYING EQUIPMENT REMOVED FROM CHASSIS

Spraying equipment is mounted on separate subframe attached by bolts to frame of chassis. Bolts may be removed and entire oiling outfit lifted off, without detaching parts or disconnecting any piping of tank equipment

in 2 sizes, 300- and 500-gal. tank capacity. The tank is of steel, constructed with welded seams to prevent the possibility of leakage, and is mounted upon a steel truck furnished with steel wheels fitted with broad tires. The machine is equipped with the Kinney pump driven by a gasoline engine. The pump is enclosed in a heating chamber, which prevents the hardening of cooled material and affords the necessary pressure for spraying through flexible metal hose and spraying nozzle. The facilities for heating may be wood, coke, coal or kerosene oil burners. The apparatus is self-loading from heating kettles or tank cars. The Kinney circulating system insures uniform temperature and prevents the coking or burning of material. The machine will heat and spray under pressure all kinds of bituminous material, including the heaviest asphalt or tar products of any desired degree of temperature, and in any required volume of application.

Write for Bulletin "B" giving full particulars and prices.



FIG. 61. THE KINNEY AUTO HEATER AND DISTRIBUTOR IN OPERATION



FIG. 144. THE KINNEY HANDY HEATER AND SPRAYER

MacARTHUR CONCRETE PILE & FOUNDATION CO.

Foundation Engineers and Contractors

120 Broadway
NEW YORK, N. Y.

• BRANCH OFFICES

CHICAGO, ILL.

BOSTON, MASS.
TOLEDO, OHIO

PITTSBURGH, PA.

MONTREAL, CAN.
NEW ORLEANS, LA.

PHILADELPHIA, PA.

Products and Services.

MACARTHUR PEDESTAL CONCRETE PILES.

This company contracts to install MacArthur Pedestal Concrete Pile Foundations for buildings and other structures in any part of North America, and also install Pre-moulded Reinforced Concrete Piles and Steel Pipe Concrete Filled Piles where conditions make these types desirable. In fact it is equipped to handle the complete foundations ready for column bases and brick walls.

Co-operative Engineering Services.

This company is prepared to send engineers to any part of the country to investigate conditions and for consultation, at its own expense. On receipt of data on soil conditions and blue prints of any proposed structures, together with loads to be carried, plans for MacArthur Pedestal Pile Foundations suitable for the requirements, with estimates of cost, will be submitted promptly.

MacArthur Pedestal Concrete Piles.

The great carrying capacity of this pile is made possible because of the bulb or spread base, which derives direct bearing power by resting on the firm and compressed subsoil. In addition, no smooth permanent form is left in the ground and greatest possible friction resistance is received on the rough concrete shaft of the pile.

Advantages and Economy.

This company has volumes of proofs that this pile will carry from 50% to 100% greater loads than any other type of pile of the same length and under the same soil conditions. The company can show by actual experience that under many soil conditions, a given load can be carried by fewer and shorter MacArthur Pedestal Piles than would be required with other types.



METHOD OF INSTALLING MACARTHUR PEDESTAL PILES



TYPICAL MACARTHUR PEDESTAL PILE

How MacArthur Pedestal Piles are Made.

Pile-forming apparatus, consisting of a cylindrical core and casing, is driven into the ground under compression, using pile driving methods, until required penetration is obtained. The core is then withdrawn and a charge of concrete dumped to bottom of casing. Core is then placed on this concrete and casing raised to permit formation of pedestal. The core being used as a rammer, being driven down by a steam hammer, compresses the surrounding soil until a large base or pedestal is formed. This pedestal completed, the casing is filled with concrete, and, weight of core and hammer resting on the newly formed pile, the casing is pulled steadily and evenly out of the ground, leaving monolithic column 16 in. in diameter, surmounting the broad spread base of pedestal.

The method is safe, certain, simple and fast. See illustration of the formation.

Representative MacArthur Clients.

United States Government; Standard Oil Co.; Willys-Overland Co.; General Electric Co.; Corn Products Refining Co.; The White Co.; Watson Engineering Co.; Habirshaw Electric Cable Co.; Canadian Government; Boston & Maine R. R.; Southern Pacific R. R.; Pittsburgh Plate Glass Co.; Westinghouse Electric & Manufacturing Co.; Firestone Tire & Rubber Co.

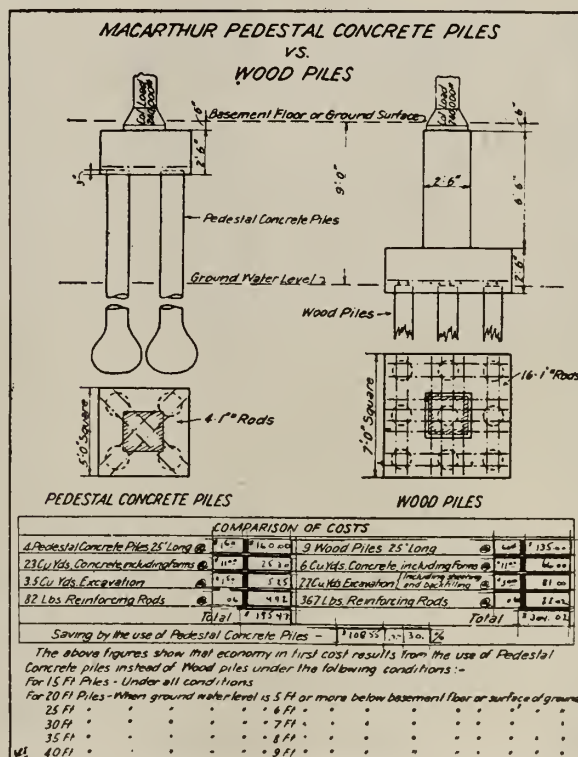


TABLE OF COMPARISON OF COST BETWEEN MACARTHUR CONCRETE PILES AND WOOD PILES

RAYMOND CONCRETE PILE COMPANY

Concrete Piles and Special Concrete Work

140 Cedar Street
NEW YORK, N. Y.

111 West Monroe Street
CHICAGO, ILL.

BRANCH OFFICES IN ALL PRINCIPAL CITIES
RAYMOND CONCRETE PILE CO. OF CANADA, LTD., MONTREAL, CANADA

Products.

RAYMOND CAST-IN-PLACE CONCRETE PILES.
RAYMOND PRE-MOULDED CONCRETE PILES.
RAYMOND COMPOSITE (WOOD-CONCRETE) PILES.
PLAIN BEARING and SHEET PILES of CONCRETE.
CONCRETE WORK of a Special Nature.

Slogan.

"A form for every pile; a pile for every purpose."

Raymond Method.

A collapsible steel core, 8 in. in diameter at the point and increasing in diameter at the rate of .4 in. per lin. ft. of length, is incased in a spirally reinforced steel metal shell. The core thus incased is driven to a proper penetration and then is collapsed and withdrawn from

the shell; the shell remaining in the ground and maintaining the resistance encountered during the driving. The shell is then inspected and filled with concrete. This makes a complete Raymond concrete pile.

Concrete Pile Loads.

Usually Raymond concrete piles are driven to carry a working load of 30 tons each. Where it is impossible to secure proper resistance, it is necessary to reduce this to 25 or even 20 tons.

In other cases, loads of 35 and 40 tons are safely carried.

In view of the wide variation in soil conditions, a conference is suggested with the nearest Raymond office, that the site may be investigated and recommendations made.

Spacing.

Raymond concrete piles, of a length not exceeding 30 ft., may be spaced as close as 2 ft. 6 in. on centers and driven as close as 18 in. from center of pile to building wall. When extremely long piles are used, it is necessary to increase this spacing to 3 ft.

Certainty.

The Raymond method of pouring concrete into a spirally reinforced steel shell, and leaving this form in place, follows the accepted method of all good concrete construction. This steel form makes *certain* that underground conditions will not adversely affect the structure of the pile.

Speed Records.

This company always endeavors to make good a promise.

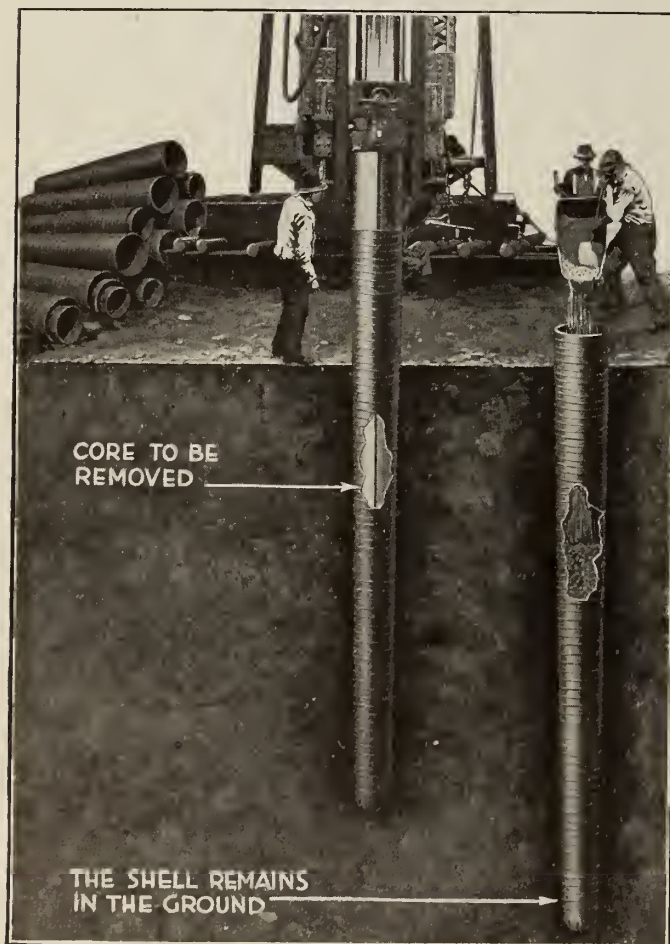
On April 26th, 1917, it promised to place 3600 piles for the United States Government at the Brooklyn Navy Yard by June 10th, or in 46 calendar days; 3800 piles were actually placed by May 26th—30 calendar days after the contract was signed.

On April 19th, 1917, a contract was signed with the Chevrolet Motor Co.; the first pile was driven April 27th, and 1535 piles were completed in 32 driving days.

On August 11th, 1917, this company promised the Austin Company to place 140 piles for a Government contract within 9 days. The contract was completed six hours ahead of schedule.

On April 27, 1915, this company signed a contract with the Crucible Steel Company of Harrison, N. J., for 5533 piles, driving the first pile on the sixth day thereafter and completing the job in 135 working days at the rate of 40 piles per day.

Many other speed records can be shown.



ESSENTIAL STEPS IN THE MAKING OF A RAYMOND CONCRETE PILE

Cost of Raymond Piles.

As Raymond concrete piles are made in place and not sold by the foot, f.o.b. cars, it is impossible to quote prices without knowing the conditions under which the work is to be done, the probable number of piles required, and penetration expected. The spacing of the piles, soil conditions, accessibility to the site, cost of concrete materials and labor are governing factors.

Saving of Raymond Piles.

The Raymond method practically eliminates excavation, sheeting, shoring and pumping, together with the attendant costs in time and labor.

Specifications.

If "Raymond Concrete Piles" are called for, it is of course sufficient; on the other hand, if for any reason it is not advisable to name them specifically, the following will cover:

"The concrete piles shall be of a type specially approved by the architect and shall be placed in the following manner:

"A collapsible steel core, 8 in. in diameter at the small end, increasing .4 in. per lin. ft. of length, shall be incased in a spirally reinforced metal shell and driven to proper penetration. The core shall then be collapsed and withdrawn from the shell, which remains permanently in the ground. Each shell shall be carefully inspected and being found perfect shall thereupon be filled with concrete placed in accordance with good engineering practice."

Concrete in the piles will be composed of 1 part approved portland cement, 3 parts of clean, sharp sand and 5 parts of crushed stone or gravel which will pass a 1½-in. ring.

Special Concrete Work.

This company also designs, manufactures and places pre moulded reinforced concrete bearing piles; concrete sheet piles, both plain and interlocking, and concrete work of a special nature such as difficult foundations, docks, piers, bulkheads, sea walls, retaining walls, ore bins, trestles, and such structures as require a special knowledge of concrete construction.

This company has on its staff, at the service of architects and contractors, experts in the designing and installation of concrete piling for all purposes.

The engineering department will gladly submit recommendations, designs and estimates.

Representative Architects.

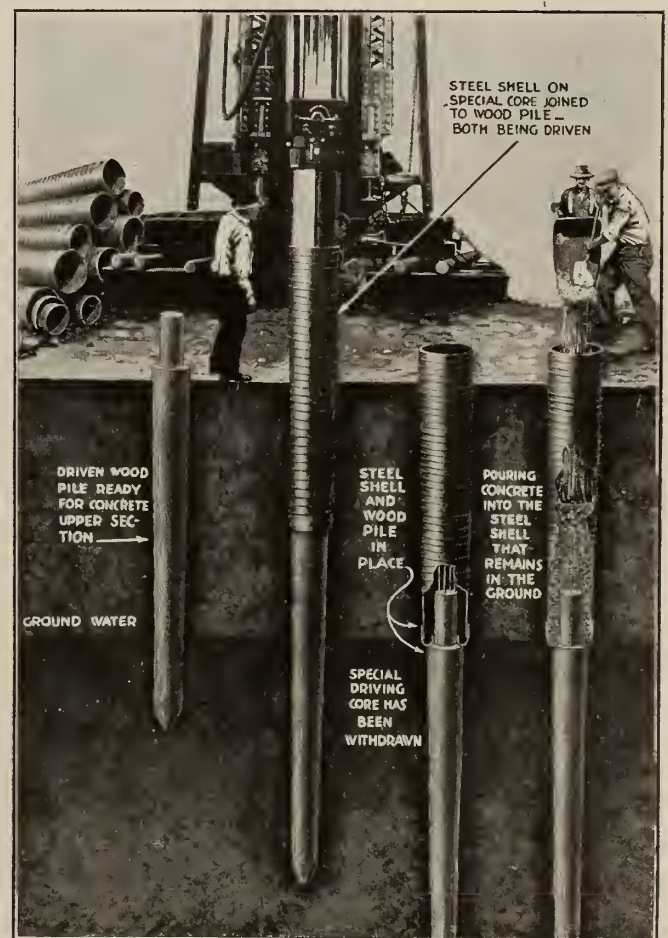
The following architects have used and are using Raymond concrete piles:

Ernest Flagg, New York, N. Y.
Wm. Higginson, New York, N. Y.
James Gamble Rogers, New York, N. Y.
Cass Gilbert, New York, N. Y.
Ernest Greene, New York, N. Y.
Herbert Kelsey & Paul Cret, Philadelphia, Pa.
Ballinger & Perrot, Philadelphia, Pa.
Simon & Bassett, Philadelphia, Pa.
Alden & Harlow, Pittsburgh, Pa.
Henry Boettcher, Armstrong Cork Company, Pittsburgh, Pa.
Sturgis & Barton, Chicago, Ill.
Jenny, Mundie & Jensen, Chicago, Ill.
Geo. C. Nimmons, Chicago, Ill.
Jarvis Hunt, Chicago, Ill.
Mauran, Russell & Crowell, St. Louis, Mo.
Barnett, Haynes & Barnett, St. Louis, Mo.
Eames & Young, St. Louis, Mo.
Albert Kahn, Detroit, Mich.
J. Knox Taylor, Supervising Architect, Washington, D. C.
Richards, McCarthy & Bulford, Columbus, Ohio

Samuel Hannaford Sons, Cincinnati, Ohio
Theodore W. Pietsch, Baltimore, Md.
John Latenser, Omaha, Nebr.
Morgan & Dillon, Atlanta, Ga.
D. X. Murphy & Bro., Louisville, Ky.
Charles Montgomery Anderson, Baltimore, Md.
Wm. H. Amory, Jr., Baltimore, Md.
B. H. Prack, Pittsburgh, Pa.
Escnwein & Johnson, Buffalo, N. Y.
Franz C. Warner, Cleveland, Ohio
Bliss & Lavalley, Springfield, Mass.
Robert C. Fayfield, Buffalo, N. Y.
Osborn Engineering Co., Cleveland, Ohio
John W. Cooper Co., Buffalo, N. Y.

Representative Clients.

Bethlehem Steel Company, South Bethlehem, Pa.
United States Steel Corporation, New York, N. Y.
United States Government, Washington, D. C.
Standard Oil Company, New York, N. Y.
American Can Company, New York, N. Y.
General Electric Company, Schenectady, N. Y.
Pennsylvania Railroad Co., Philadelphia, Pa.
Chicago, Rock Island & Pacific Railroad Co., Chicago, Ill.
Ford Automobile Company, Detroit, Mich.
Youngstown Sheet & Tube Co., Youngstown, Ohio
Atlantic Refining Company, Philadelphia, Pa.
Procter & Gamble Company, Ivorydale, Ohio
Tidewater Oil Company, Long Island City, N. Y.
Turner Construction Company, New York, N. Y.
Goodyear Tire & Rubber Company, Akron, Ohio
American Chic Company, Long Island City, N. Y.
Patton Paint Company, Newark, N. J.
Otis Steel Company, Cleveland, Ohio
Nashua Manufacturing Company (Jackson Mills), Nashua, N. H.
Republic Iron & Steel Company, Youngstown, Ohio



RAYMOND COMPOSITE PILE

LACKAWANNA STEEL COMPANY

Steel Sheet Piling

GENERAL SALES OFFICE AND WORKS
LACKAWANNA, ERIE CO., N. Y.

ATLANTA BOSTON BUFFALO CHICAGO CINCINNATI CLEVELAND DETROIT NEW YORK PHILADELPHIA ST. LOUIS
SAN FRANCISCO

LICENSEES FOR THE MANUFACTURE OF LACKAWANNA STEEL SHEET PILING

For Great Britain and British Colonies in the Eastern Hemisphere:

CARGO-FLEET-IRON Co., LTD., MIDDLESBROUGH, ENGLAND

For France, Italy, Spain, French Colonies and Protectorates, Italian Colonies and Spanish Colonies in the Eastern Hemisphere:

CIE DES FORGES & ACIERIES DE LA MARINE D'HOMÉCOURT, PARIS, FRANCE

Sole Exporter for Other Countries: CONSOLIDATED STEEL CORPORATION, 165 Broadway, NEW YORK, N. Y.

Products.

LACKAWANNA STEEL SHEET PILING:
Arched-web, Straight-web, Bent-web, Center-flange, Plate and Protected Types.

Structural Steel, Merchant Bars, Plates,
Concrete Reinforcing Bars, Standard and Light Rails.

Co-operation and Service.

Our engineers, and important data collected from over 1200 successful installations for all imaginable purposes, are always at the service of engineers and contractors. The advice of the engineering staff will prove valuable and is gladly given free of charge.

Description.

The Lackawanna steel sheet piling has an integral section; is a rolled bar requiring no fabrication or other assemblage to form the interlock; has no rivets, bolts or parts to loosen or shear off in handling, driving or pulling.

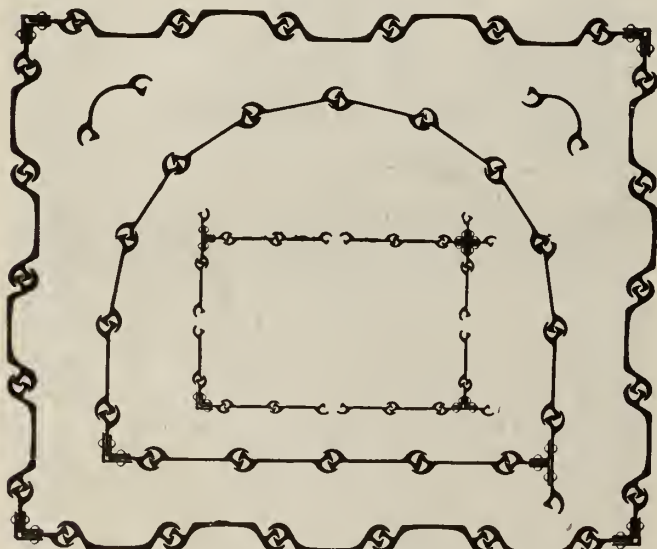


FIG. S-1. LACKAWANNA STEEL SHEET PILING
Showing typical combinations of circular and straight walls and junctions

The interlock consists of similar hooks and guards on both edges of the pile, so shaped that the interlocked joint is flexible through an equal arc of motion on each side of the center plane of the piling section. Hooks engage to resist longitudinal displacement; while the guards overlap and engage outer surface of hooks on



TRADE-MARK

adjacent sections, thus preventing lateral displacement. Between the interlocked members of each joint there are three lines of contact—a double, firm, and close interlock, with a minimum of friction in driving or withdrawing, and a free entry for displaced material to assist in sealing the joint.

Sections are shaped to attain flexibility at joints, for passing around obstructions, forming irregular enclosures, square or circular caissons, etc. Small sections permit change of direction of 16° (other sections, 20°) to either side of piling line. A right angle may be made with six 7-in. and with five of any other interlocked piling sections. Corners and junction members for walls meeting or crossing each other are fabricated by fitting edges of half sections to complete sections as required, and holding same in place by structural steel angles and rivets.

NOTE—The mathematical properties of any of the Lackawanna steel sheet piling sections will be promptly furnished on request.

Circular Structures.

The minimum diameters of circular structures made with *standard* sections of Lackawanna steel sheet piling are shown by the following table:

MINIMUM DIAMETERS

An Even Number of Piles is Required to Permit Interlocking of the Final or Closure Joint

Standard sections	Number of piles required	Deflection angle between piles	Diameter center to center of piling wall	Working diameter inside of piling wall
7" x 1/4"	20	18°	3' 8 1/8"	3' 6"
8 1/2" x 3/8"	20	18°	4' 6 1/8"	4' 3 1/2"
12 3/4" x 3/8"	18	20°	6' 1 1/8"	5' 9"
12 3/4" x 1/2"	18	20°	6' 1 1/8"	5' 9"
14" x 3/8"	18	20°	6' 8 3/8"	6' 4"
15" x 1/2"	18	20°	7' 1 1/8"	6' 9 3/4"

Circular structures having a wide variety of still smaller diameters may be constructed from sections of the straight-web type, of which the web has been *especially bent*.

Bent-web type for circular construction can be furnished to form diameters, as per the following table:

Width of pile	Thickness of web	Diameters of Circular Construction						
		6 piles	8 piles	10 piles	12 piles	14 piles	16 piles	18 piles
12 3/4"	3/8" or 1/2"	2' 3 3/8"	2' 8 1/8"	3' 4 1/8"	4' 1 1/8"	4' 8 1/8"	5' 4 1/8"	6' 1 1/8"
8 1/2"	3/8"	1' 4 3/8"	1' 9 1/8"	2' 3 1/8"	2' 8 1/8"	3' 1 1/8"	3' 7 1/8"	4' 1 1/8"
7"	3/8"	1' 1 3/8"	1' 5 1/8"	1' 10 1/8"	2' 2 3/8"	2' 7 1/8"	2' 11 1/8"	3' 4 1/8"

Strength.

The great tensional strength of the Lackawanna joint is due to the 3 line contact, distribution of the metal in interlocking joint members and their relation to longitudinal axis of piling section.

Competitive tension tests conducted in an entirely disinterested manner and under government supervision were made on five different makes of piling, using on each methods best adapted to bring out the best results. These tests are described in Bulletin No. 108, which will be mailed on request.

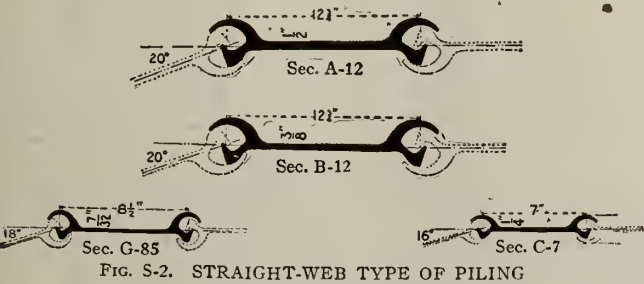
Length of Piling.

Usual length of piling is from 50 to 30 ft. or shorter. Longer lengths can be rolled if required, but it is usually desirable, for convenience in handling or shipping, to use a built-up pile, composed of two or more lengths spliced together. In such cases horizontal joints between adjacent piles should be staggered and abutting lengths fastened with splice plates and bolts to form the joint. The use of 65-ft. lengths in a single bar is not uncommon.

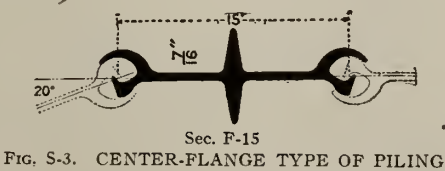
Types and Sizes.

The following sections offer at least one type and size to meet economically any sheet pile construction problem:

STRAIGHT-WEB TYPE—Suitable for general work, and especially constructions requiring high tensional and compressive resistance of the pile section, as in self-contained cofferdams made of rectangular or circular filled pockets. The smallest size is much superior to wooden sheeting in sewer and trench work.

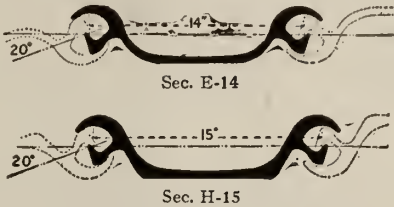


CENTER-FLANGE TYPE—For constructions requiring high tensional and compressive strength in connection with a fairly high transverse strength. The center-flange acts as a stiffener, increases the section modulus and furnishes means for attaching transverse ties, braces, etc., needed in special work, and for the mechanical bond of the concrete facing in protected piling.



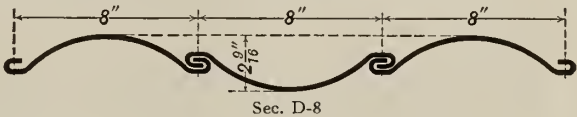
ARCHED-WEB TYPE—Preferable where transverse strength of the pile is of primary importance, as in

braced or tied constructions. Where the pile is used as a simple, continuous or cantilever beam, the high modulus of the single section per inch of width of pile gives a high moment of resistance to sustain the maximum bending moment produced by the load. A wall of this piling is very thin in proportion to its transverse strength, having no greater thickness over all at the centers of the arches than the over all thickness of the interlocked joints.



No. of section	Size and type of section	Weight per lineal unit of bar		Weight per unit area of wall	
		Per lineal foot in pounds	Per lineal meter in kilograms	Persquare foot in pounds	Persquare meter in kilograms
C-7	7" x 1/4" Straight-web	12.54	18.60	21.5	104.97
G-85	8 1/2" x 3/4" Straight-web	14.698	21.873	20.75	101.314
B-12	12 3/4" x 3/4" Straight-web	37.187	55.36	35	170.90
A-12	12 3/4" x 1/2" Straight-web	42.5	63.25	40	195.32
F-15	15" x 1 1/2" Center-flange	60.	89.29	48.	234.34
E-14	14" x 3/4" Arched-web	40.83	60.76	35	170.90
H-15	15" x 1 1/8" Arched-web	58.12	86.49	46.5	227.02
D-8	8" x 1 1/8" Plate	7.66	11.40	11.5	56.15

PLATE TYPE OF PILING—This piling is cold rolled from steel plate into a type of section designed for use principally where great economy demands a very low weight and cost per square foot of wall—lower than obtainable with the heavier sections of steel sheet piling.



Theory of Watertightness.

Every alternate pile has direct contact of both locks with wales. Intermediate piles acted upon by unbalanced pressures are forced into contact on two lines in each interlock.

Grip for Pulling Lackawanna Steel Sheet Piling.

Consistent with our policy of helping customers after as well as before a sale, we are prepared to loan a pulling grip like that shown. One of these grips will be allotted for a length of time consistent with the work to be done, the customer to pay charges to and from our plant, and cost of repairs.



GRIP FOR PULLING LACKAWANNA STEEL SHEET PILING

SMITH & BRENNAN PILE CO.

Concrete Piles

GENERAL OFFICE AND PLANT

Main and Angelica Streets

ST. LOUIS, MO.

Products and Services.

REINFORCED, CORRUGATED CONCRETE PILES.
PILE DRIVING.

Description.

The Smith & Brennan corrugated reinforced concrete pile differs from other types in that it is reinforced by six $\frac{5}{8}$ -in. corrugated bars running the full length of the column. No. 9 annealed wire, wound spirally at 3-in. intervals further adds to the rigidity and carrying capacity of the pile. It is circular in section, 18 in. in diameter at the broad end, running parallel down to the last 15 ft. which taper to 8 in. in diameter.

Advantages of the Tapered Pile.

The theory that increased surface area affords increased resistance, and consequently increased load bearing capacity is disproved by records of numerous tests, which show that where the soil is of a uniform, stable character to a practical depth, the tapered pile develops and maintains a greater frictional bearing than the straight pile.

Where the soil is of an unstable nature overlying solid rock or hard pan, the pile depends for its bearing capacity upon contact with this solid matter. But since the soils more frequently encountered are of a more or less stable character, the needed frictional resistance is secured by the increasing density and compactness of the ground, resulting from displacement of the soil by the pile.

The protruding, reinforced ridges on the Smith & Brennan pile further increase its advantages over the smooth pile, and prevent the pile from twisting while driving.

Specifications.

SIZES—18 in. over all at top, last 15 ft. to taper to 8-in. circular section. In figuring the length of proposed pile with the Smith & Brennan pile as a basis, figure 10% shorter pile than any other.

DESIGN—Circular in section with corrugated extensions running full length of the pile. Last 15 ft. to taper.

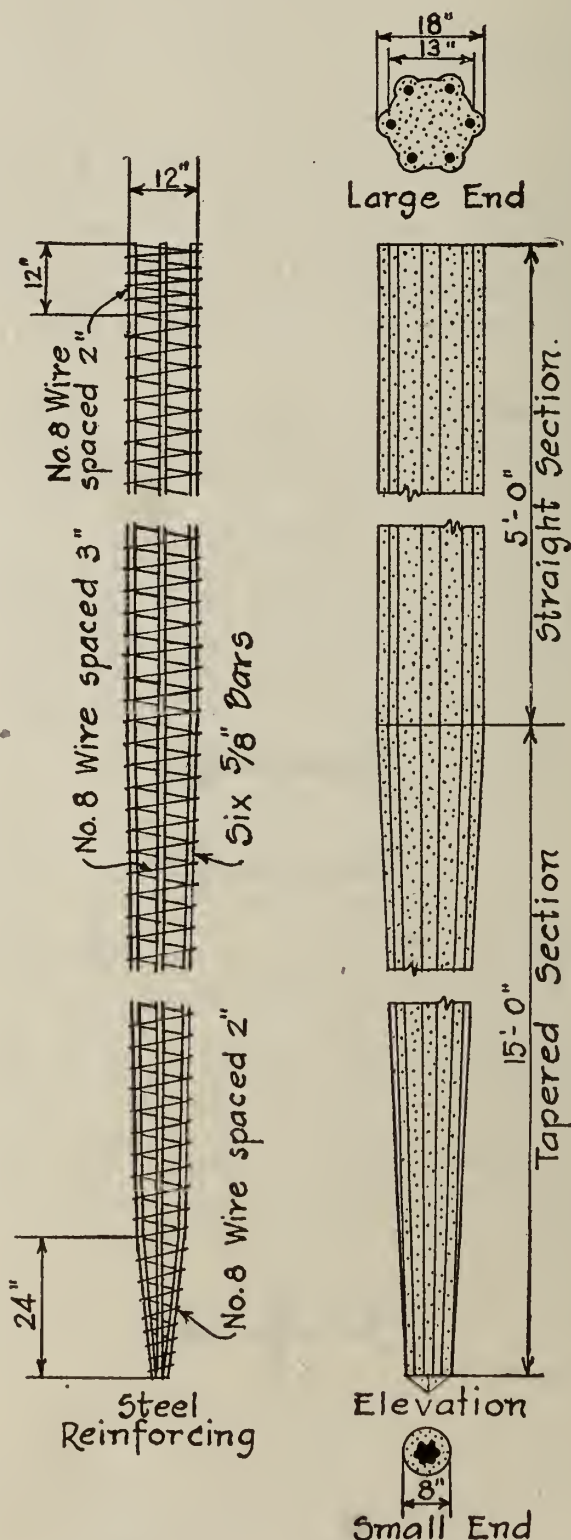
REINFORCEMENT—Six $\frac{5}{8}$ -in. corrugated bars running full length of the pile. Number 9 annealed spiral wire spaced 3 in.

CONCRETE—Consists of 1 part portland cement, 2 parts clean, sharp sand, $3\frac{1}{4}$ parts clean gravel or crushed limestone, $\frac{1}{4}$ in. to 1 in. in size.

SEASONING—Where possible, it is advisable to have the pile cure at least 30 days.

Co-operative Service.

Smith & Brennan engineers will co-operate with architects and contractors in the solution of difficult concrete piling problems of any nature. Upon the receipt of data as to soil condition on site of proposed structure, and loads to be carried, tentative plans together with applicable suggestions will be submitted.



SMITH AND BRENNAN CONCRETE PILE

THE ATLAS PORTLAND CEMENT COMPANY

30 Broad Street
NEW YORK, N. Y.

Corn Exchange Bank Building
CHICAGO, ILL.

BRANCH OFFICES

PHILADELPHIA, PA.
DES MOINES, IOWA

BOSTON, MASS.
SAVANNAH, GA.

ST. LOUIS, MO.

DAYTON, OHIO
MINNEAPOLIS, MINN.

WORKS

NORTHAMPTON, PA

HANNIBAL, MO.

HUDSON, N. Y.

Products.

ATLAS PORTLAND CEMENT and ATLAS-WHITE PORTLAND CEMENT.

Output.

18,000,000 barrels per year.

Packages.

Atlas Cement is shipped in barrels and in duck or paper bags, and Atlas-White Cement is shipped in barrels and in paper bags inside duck bags. The barrels weigh 400 lbs. gross, or 376 lbs. net. When shipped in bags the gross weight is 95 lbs. per bag; net weight, 94 lbs. per bag; 4 bags to the barrel.

Shipping and Marketing.

Atlas mills and branch offices cover the country and are conveniently situated for quick shipment. Atlas and Atlas-White are stocked by dealers even in remote points.

Atlas Quality.

Atlas Portland Cement meets all tests prescribed by the Standard Specifications for Tests of Portland



TRADE-MARKS

Cement, adopted by the American Society of Civil Engineers and approved by the American Society for Testing Materials, and concurred in by the American Institute of Architects, the American Engineering and Maintenance of Way Association, and the American Concrete Institute; also the specifications of the United States Government.

Atlas-White Quality.

Atlas-White is a true Portland cement of the same uniformity and high quality as Atlas Portland Cement.

It possesses the strength and physical characteristics of Portland cement and passes all standard specifications for this material; and, in addition, is *white* and *non-staining*.

Manufacturing Features.

Atlas Portland Cement and Atlas-White are manufactured from the finest raw materials, under constant expert supervision in every department of the works. Of the very highest quality, they are guaranteed to pass all customary specifications.



NATIONAL CASH REGISTER CO., DAYTON, OHIO
EXPANDED METAL FIREPROOFING Co., Contractors

Uses of Atlas.

Atlas Portland Cement is used in every department of civil engineering construction, such as canals, locks, dams, piers, railroad structures of every description, bridges, highways, industrial plant roadways, etc. Also for the construction of reinforced concrete industrial buildings, power plants, textile mills, grain elevators, cold storage plants, garages, etc.

Quantities of Materials in Concrete.

In estimating the quantities of cement, sand, and broken stone or pebbles in a given volume of concrete, or in estimating the volume of mortar or concrete which can be made from one barrel of cement, the accompanying tables will be found useful. The values given in the tables are computed from results of actual experiments and have been checked with concrete laid in large masses.

VOLUME OF CONCRETE MADE FROM ONE BARREL OF PORTLAND CEMENT *

Based on a barrel of 3.8 cu. ft.

Proportions by parts			Proportions by volume			Volume of mortar in terms of percentage of volume of stone	Average volume of rammed concrete made from one barrel of cement		
							Percentages of voids in broken stone or gravel		
Cement	Sand	Stone	Cement	Sand	Stone	per cent	50%†	45%‡	40%§
			bbl.	cu. ft.	cu. ft.		cu. ft.	cu. ft.	cu. ft.
1	1	2	1	3.8	7.6	75	9.5	9.9	10.3
1	1	3	1	3.8	11.4	51	11.5	12.2	12.8
1	1½	3	1	5.7	11.4	64	12.9	13.5	14.1
1	1½	3½	1	5.7	13.3	55	13.9	14.6	15.4
1	2	3	1	7.6	11.4	75	14.3	14.9	15.5
1	2	4	1	7.6	15.2	57	16.3	17.2	18.0
1	2½	4½	1	9.5	17.1	60	18.7	19.6	20.6
1	2½	5	1	9.5	19.0	54	19.8	20.8	21.8
1	3	5	1	11.4	19.0	61	21.1	22.1	23.2
1	3	6	1	11.4	22.8	52	23.2	24.4	25.6

Note.—Variations in the fineness of the sand and the compacting of the concrete may affect the volumes by 10% in either direction.
* Quoted from Copyrighted Treatise.

† Use 50% column for broken stone screened to uniform size.

‡ Use 45% column for average conditions and for broken stone with dust screened out.

§ Use 40% column for gravel or mixed stone and gravel.

QUANTITIES OF MATERIALS FOR ONE CUBIC YARD OF RAMMED CONCRETE*

Based on a barrel of 3.8 cu. ft.

Proportions by parts			Proportions by volume			Volume of mortar in terms of percentage of volume of stone	Percentages of voids in broken stone or gravel								
							50%†			45%‡			40%§		
Cement	Sand	Stone	Packed cement	Loose sand	Loose stone	per cent	Cement	Sand	Stone	Cement	Sand	Stone	Cement	Sand	Stone
			bbl.	cu. ft.	cu. ft.		bbl.	cu. yd.	cu. yd.	bbl.	cu. yd.	cu. yd.	bbl.	cu. yd.	cu. yd.
1	1	2	1	3.8	7.6	75	2.85	0.40	0.80	2.73	0.38	0.77	2.62	0.37	0.74
1	1	3	1	3.8	11.4	51	2.34	0.33	0.99	2.22	0.31	0.94	2.12	0.30	0.90
1	1½	3	1	5.7	11.4	64	2.09	0.44	0.88	2.00	0.42	0.84	1.91	0.40	0.81
1	1½	3½	1	5.7	13.3	55	1.94	0.41	0.96	1.84	0.39	0.91	1.76	0.37	0.87
1	2	3	1	7.6	11.4	75	1.89	0.53	0.80	1.81	0.51	0.76	1.74	0.49	0.74
1	2	4	1	7.6	15.2	57	1.65	0.46	0.93	1.57	0.44	0.88	1.50	0.42	0.84
1	2	4½	1	9.5	15.2	66	1.52	0.54	0.86	1.46	0.51	0.82	1.40	0.49	0.79
1	2½	4	1	9.5	17.1	60	1.44	0.51	0.91	1.37	0.48	0.87	1.31	0.46	0.83
1	2½	4½	1	9.5	19.0	54	1.37	0.48	0.96	1.30	0.46	0.92	1.24	0.44	0.87
1	2½	5	1	11.4	19.0	61	1.28	0.54	0.90	1.22	0.52	0.86	1.17	0.49	0.82
1	3	5	1	11.4	22.8	52	1.16	0.49	0.98	1.11	0.47	0.94	1.05	0.44	0.89

Note.—Variations in the fineness of the sand and the compacting of the concrete may affect the quantities by 10% in either direction.

* Quoted from Copyrighted Treatise.

† Use 50% columns for broken stone screened to uniform size.

‡ Use 45% columns for average conditions and for broken stone with dust screened out.

§ Use 40% columns for gravel or mixed stone and gravel.



Before
Dirt Roadway for Intra-plant Transportation



After
Same Roadway Built of Concrete
HARRISON BROS. & CO., INC., PHILADELPHIA, PA.
HENRY E. BATON, Contractor



Before
In Process of Remodeling



After
Same Building Remodeled and With Concrete Driveway
WM. WRIGLEY, JR., COMPANY, BROOKLYN, N. Y.
BARNEY-AHLERS CONSTRUCTION Co., Contractors and Engineers

Uses of Atlas-White.

Atlas-White is used for interior and exterior decorative work; exterior stucco; in mortar for setting marble, tile, brick and stone; facing concrete block; decorative concrete, stone and statuary; terrazzo floors; artistic color effects in conjunction with various colored pigments, exposed color aggregates, etc.; wainscoting for bathroom and kitchen walls, etc.

Atlas Service to Engineers.

Our technical department will co-operate with engineers who are interested in reinforced concrete industrial buildings, furnishing statistics and informa-

tion for the development of designs and economical layouts.

Atlas Publications.

For the benefit of those who desire to make durable improvements and as a guide to those who contemplate new construction, we have published the following books, constituting the "Atlas Cement Library":

- "Concrete in Railroad Construction."
- "Reinforced Concrete in Factory Construction."
- "Industrial Plant Roadways."
- "Industrial Houses of Concrete and Stucco."
- "Guide to Good Stucco."
- "Commercial Garages."



RICHMOND & CHESAPEAKE BAY RAILWAY CONCRETE VIADUCT, RICHMOND, VA.
TRUSCON STEEL CO., Engineers
JOHN T. WILSON & Co., Contractors



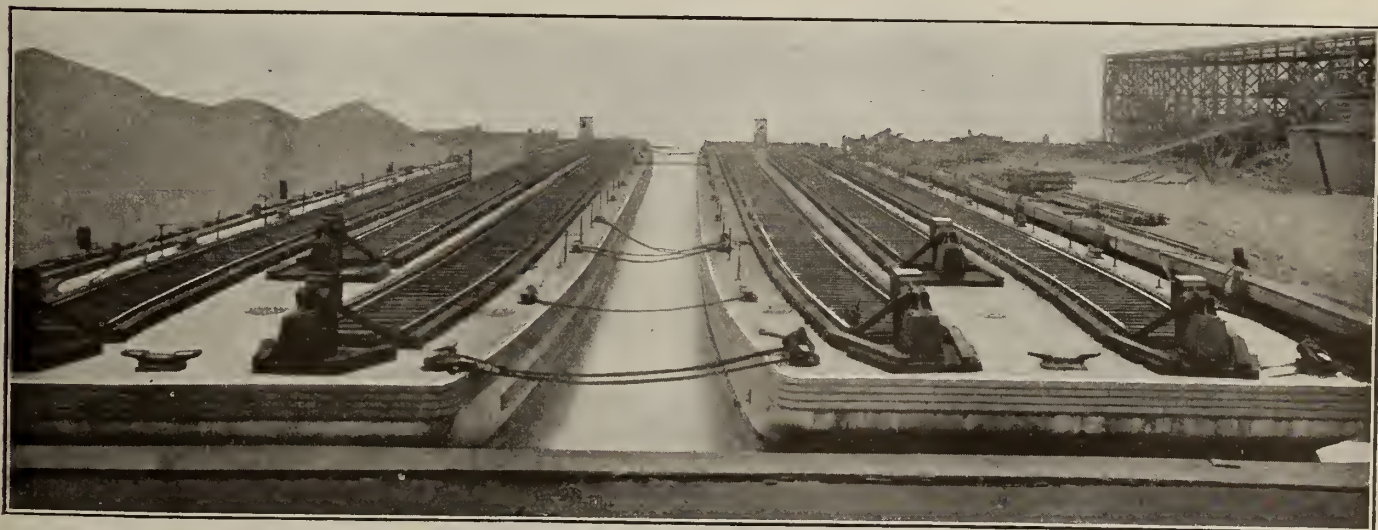
INDUSTRIAL HOUSES CONSTRUCTED BY GENERAL CHEMICAL COMPANY, OVERLOOK COLONY, WILMINGTON, DEL.



CONCRETE DAM OF THE LOCKWOOD COMPANY, WATERVILLE, ME.
THE SANDERS ENGINEERING COMPANY, Portland, Me., Contractors and Engineers



ANOTHER VIEW OF THE OVERLOOK COLONY HOUSES
H. E. COFFIN, New York, Architect



CONCRETE CAR FLOATS BUILT BY THE LIBERTY SHIP BUILDING AND TRANSPORTATION COMPANY, CLEVELAND, OHIO

THE LEHIGH PORTLAND CEMENT CO.

ALLENTOWN, PA.

CHICAGO, ILL.

SPOKANE, WASH.

BRANCH OFFICES

NEW YORK, N. Y.
JACKSONVILLE, FLA.PHILADELPHIA, PA.
OMAHA, NEBR.
MINNEAPOLIS, MINN.BOSTON, MASS.
MASON CITY, IOWANEW CASTLE, PA. PITTSBURGH, PA.
KANSAS CITY, MO. RICHMOND, VA.
BUFFALO, N. Y.

MILLS

FOGELSVILLE, PA. WEST COPLAY, PA.
IOLA, KANS. MITCHELL, IND.FORDWICK, VA.
METALINE FALLS, WASH.NEW CASTLE, PA. MASON CITY, IOWA
ORMROD, PA. OGLESBY, ILL.

Product.

LEHIGH CEMENT — Guaranteed to conform in every respect to the Standard Specifications for Portland Cement as adopted by the American Society for Testing Materials when tested by methods recommended by the American Society of Civil Engineers.



TRADE-MARK

Marketing and Shipping Facilities.

Lehigh mills are located at strategic points from the Atlantic to the Pacific. In principal marketing centers, branch offices have been established for the convenience of our customers.

Lehigh Cement is marketed in cloth or paper bags, or in bulk for domestic trade, and in barrels for export trade. The bags contain 94 lbs. net (4 bags to the barrel), and the export barrel contains 376 lbs. net. These barrels are made in our own cooperage plant and are tongued and grooved to withstand the rough handling necessary in export trade.

Use.

In practically every type of modern construction the use of cement is required. In great engineering works, concrete is an essential material.

The careful selection of the ingredients for concrete is an important factor in the success of the finished

work. The selection of Lehigh Cement is a warranty for the most important material used in concrete.

Perhaps the best guarantee on future promise is past performance. The great New York Connecting Railroad; the Municipal Building, New York; the Girard Point Elevators, the League Island Dry Docks, Philadelphia; the Boston Braves' Ball Park; the Chicago and Northwestern Railway Terminal; the Quay and Sea Walls, Charleston, S. C.; the Galveston Causeway—these are a few of the structures where Lehigh was used.

The most noteworthy conflagrations, quakes and storms have proved the strength and permanence of concrete. Another feature of concrete that recommends its consideration to engineers is its adaptability to every form and class of engineering.

For Engineers' Convenience.

To any engineer writing us on the stationery of his firm and mentioning SWEET'S ENGINEERING CATALOGUE, we will send our celluloid computing scale, giving the amounts of cement, sand and stone required per cubic yard of rammed concrete of different proportions.

Further discussion of items of particular interest to any engineer may be entered into by communication with any of our offices.



'THE NEW YORK CONNECTING RAILROAD'

One of the greatest engineering works of today, made possible through the use of concrete

AMERICAN ENAMELED BRICK & TILE CO.

INCORPORATED 1893

Manufacturers of Enameled and Fire Brick

TELEPHONES:

8787-8788 MURRAY HILL

52 Vanderbilt Avenue
NEW YORK, N. Y.

CABLE ADDRESS:

"AMEREBRICK"

Products.

ENAMELED BRICK, White, Mottled and Standard Colors, in Standard Sizes and Ornamental Shapes.

Fire Brick, Standard 9-in. and 9-in. Series Shapes (as adopted by the Members of the Refractories Manufacturers Association), and Special Shapes.

Fire Clay, packed in bags or in bulk.

Territory.

The business operations of this firm cover North and South America, Europe, Asia and Australia.

Personal Representatives.

For the convenience of our customers in the United States and Canada, we have, in order to keep in closer touch with them, located representatives in all the principal cities to attend personally to inquiries, orders and deliveries.

Dispatch of Shipments.

Factory and office are in constant telephone connection with each other, and we have a local telephone exchange connecting every department of the factory for quick and systematic dispatch of business.

Facilities.

We are the largest manufacturers of this commodity in North and South America.

SHIPPING—Our works, located but an hour's travel from the New York office, are situated so as to enable shipping over two of the largest railroads, viz., the Pennsylvania and the Central of New Jersey, and their connecting lines.

We are also situated on tide water, so that shipments can be made by vessel for the coastwise and export trade.

Capacity.

Our present capacity is 12,000,000 brick per annum, which will be increased as occasioned by the demand.

Stock.

The average stock on hand at our factory is more than 2,000,000 brick, giving a large assortment for immediate delivery.

Illustrations of Stock Designs of Enameled Brick.

Much delay is saved by use of stock designs of moulded brick.

We try to keep a stock of these on hand, in standard colors.

These designs are chosen to reduce manufacturing difficulties and delays to a minimum; to enable composite mouldings to be made up; and to enable prompt filling of orders.

Colors—Bright, Medium or Matt Finish.

In addition to our regular white and standard

colors, such as our sage green, red brown, etc., we have made a specialty of mottles in the following colors:

Gray, brown, black, blue and blue brown, which give a very fine appearance for both interior and exterior work, having a finish more on the type of marble than enameled brick.

If you have in mind, at any time, a particular color, shade or finish of enameled brick for interior or exterior purposes, advise us of your ideas and requirements and we will be pleased to submit samples.

Uniformity of Shade of Enameled Brick.

We guarantee uniformity of shade in all first quality deliveries to the limit of practicability. Colors and effects giving most uniform results are, in order of degree of uniformity, white, mottled gray, mottled brown, mottled black, sage green and red brown. Other colors follow in irregular positions.

We will try on orders of moderate size, or on larger orders, if ample time be given, to match in shade the moulded and stretcher stock, but can not always guarantee to uniformly shade shipments of specials, particularly on rush shipments.

Special Features and Advantages of Our Enameled Brick.

In making our product we follow the English and Scotch systems, working by the soft mud process. This is without question the only process which insures durability and the closest relation of bond obtainable between body and glaze.

Our brick are burnt in but one fire, thus making the chemical change in the body and the glaze simultaneous. We use hard and durable glazes; not soft lead glazes frequently seen on inferior grades of enameled brick and tile.

There has not been a single case during our twenty-six years of business where any peeling or discoloring has been seen or reported.

This is better than any guarantee which we might be asked to give, as it covers a distributed output of over 110,000,000 brick, located all over the United States, Canada, South America and elsewhere, subject to all varieties of climatic conditions.

Cleaning.

Enameled brick are best cleaned with some alkaline solution, such as caustic soda or sodium carbonate. This cleans the enamel and does not affect the cement or lime mortar.

Acids.

Sulphuric, nitric or hydrochloric acids, even in concentrated form, will not affect our glazes; but if used as a wash, even when diluted, they will attack the cement or lime mortar.

The only commercial acids which will attack and destroy our enamel are hydrofluoric and hydrofluosilicic.

DENISON FIREPROOFING CO.

Manufacturers of Load-bearing Tile under License from
American Tile Engineering Co.

MASON CITY, IOWA

OTHER LICENSEES

GOODWIN TILE AND BRICK CO., Des Moines, Iowa

AUGUSTA VITRIFIED SHALE BRICK CO., Augusta, Ga.

Products.

DENISON LOAD-BEARING TILE—Hollow Building Tile, Partition Tile, Floor Tile, Fireproofing Tile, Furring Tile.

License and Patents.

The manufacture of Denison Load-bearing Tile is licensed under the "Wilson System of Bearing Wall Construction" patents, owned by the American Tile Engineering Co., as follows:

United States Patents No. 1171913, February 15, 1916; and No. 1234990, July 31, 1917.

Canadian Patents No. 151165, October 14, 1913; and No. 178744, August 14, 1917.

Other patents pending and allowed.

Advantages of Load-bearing Tile.

(1) All vertical bearing webs are in perfect alignment to carry all load pressures. This gives a wall with the greatest load bearing capacity. (2) This tile produces two or more hollow walls with air spaces between them. It is so designed that it makes the most perfect insulating structural material on the market. (Test: apply blowtorch flame to middle of one face; and after 4 hours, take temperatures in air cells.) (3) Two separate mortar beds, at the top and bottom, lying in the same horizontal plane. (4) Dead air insulates the space between these two horizontal mortar beds in the same manner as the body of the tile is insulated, thus preventing the formation of frost or moisture lines on the inside of the wall. (5) Closed trough in the top of the tile insures against the conduction of moisture through the wall. (6) Works out to the same heights and thick-

nesses as common brick, thus is adaptable to any height of cornice, window ledge, etc., or to any thickness of wall. (7) Because of the discontinuous (or insulated) mortar joint, plaster may be applied direct to the wall without the use of furring. (8) The tile is completely symmetrical, thereby facilitating the laying of it. (9) It is a complete unit, which will stand on its own base in a stable condition when stood on either face or end, thus facilitating piling and handling. (10) Dimension tile of fractional lengths furnished to facilitate the laying of any length wall. (11) Corner tile of this series permit turning inside or outside corners without destroying the insulating efficiency of the wall at this point. (12) Jamb and half jamb tile are furnished for either standard or boxframe openings, which form a weather-proof union with these frames and which maintain the insulating efficiency of the wall.

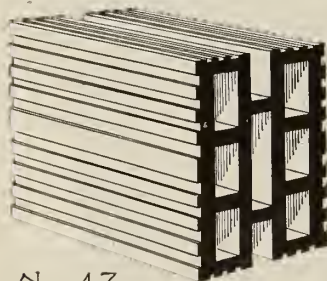
Specifications.

Specify the use of this tile by including in specifications this reference:

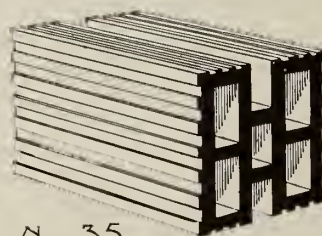
"To be laid according to the standard specifications for Wilson System Bearing Wall Construction." Copies of which may be obtained upon request to any sales agent or licensed manufacturer.

Engineering Service.

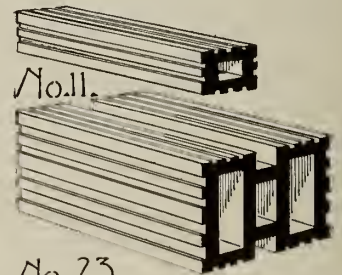
Engineering service to engineers and architects, and estimates to contractors, will be furnished without charge, all in accord with conditions stated on such estimates. A portfolio, containing a complete set of detail and working drawings, furnished on request.



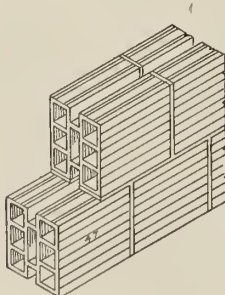
No. 47.
No. 47— $8\frac{1}{8}" \times 10\frac{1}{4}" \times 12"$
4 brick and 3 mortar joints high



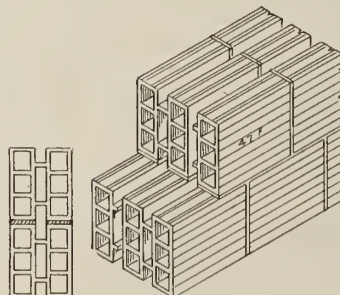
No. 35.
No. 35— $8\frac{1}{8}" \times 7\frac{5}{8}" \times 12"$
3 brick and 2 mortar joints high
DENISON LOAD-BEARING TILE



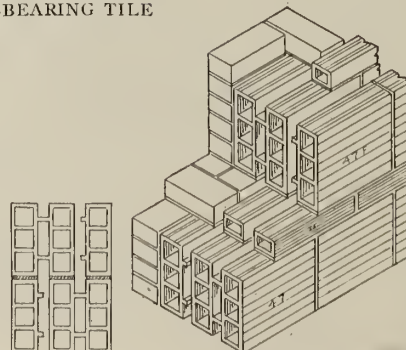
No. 23.
No. 23— $8\frac{1}{8}" \times 5" \times 12"$
2 brick and 1 mortar joint high



$8\frac{1}{8}"$ Tile Wall



13" Tile Wall



17" Brick Veneer Tile Wall

ISOMETRIC DETAILS OF DENISON LOAD-BEARING TILE WALL CONSTRUCTION
 $\frac{1}{4}$ -in. scale

THE HOCKING VALLEY FIRE CLAY CO.

Manufacturers of Salt Glazed Brick

NELSONVILLE, OHIO

SALES AGENCIES IN ALL PRINCIPAL CITIES OF UNITED STATES AND CANADA

Products.

ATHENA SALT GLAZED BRICK.
SANITARY FLOOR BRICK.
EVERWEAR PAVING TILE.

Athena Salt Glazed Brick.

SIZE—8 by 2¼ by 3⅞ in.

SHADE NUMBERS, ETC.—Made in beautiful shades of mahogany (105), brown (106), golden (107), buff (108), thoroughly vitrified and salt glazed on both faces and ends, and rich in both color and glaze. All standard shapes carried in stock and special shapes made on order.

INTERIOR USES—For facing entire interior walls or wainscot work wherever sanitary conditions are desired. Principal places: schools, hospitals, gymnasiums, swimming pools, stables, garages; office, factory and warehouse buildings; prisons, power plants, city market houses, acid rooms and vats, fire engine houses, packing plants; subways, passenger and freight depots.

Few Important Jobs (Interior)—

World's Largest Electric Generating Station, United Electric Light & Power Co., 201st Street, New York City (see illustration, opposite column)

Lincoln Park Lion House, Chicago, Ill.

Roseland & Mayfair Pumping Stations, Chicago, Ill.

Twin Market Houses, Pittsburgh, Pa.

Fire Engine Houses, Chicago, New York and Boston

General Chemical Co. Plants (many parts of United States)

Swift & Armour Packing Plants (various places)

Pennsylvania Railroad Stations and Tunnels

Ohio Penitentiary, Columbus, Ohio

Both High and Grade Schools in all principal cities of United States and Canada

EXTERIOR USES—For facing all exterior walls where a beautiful sanitary and permanent wall is desired, as it is not affected by acids or the elements.

Few Important Jobs (Exterior)—

6-story Moose Building in Loop District, Chicago, Ill.

Apartment Buildings in all principal cities

3-story Business Block, Dr. J. E. Pickett, Minersville, Pa.

3-story Business Block, Marvin DeMaine, Pomeroy, Ohio

These brick have been furnished for exterior facing in almost every conceivable class of building

Sanitary Floor Brick.

Size, 8¼ by 4 by 1⅜ in. This product is usually embedded in cement and adapted to practically the same class of floors as those named for our Everwear paving tile, but where the desire is for lighter weight material. Especially desirable in packing house floors, and is being used extensively for such purposes. Only one side is glazed and either side can be turned up as desired.

Few Special Jobs—

Cincinnati Abattoir Co., Cincinnati, Ohio

Detroit Edison Co., Detroit, Mich.

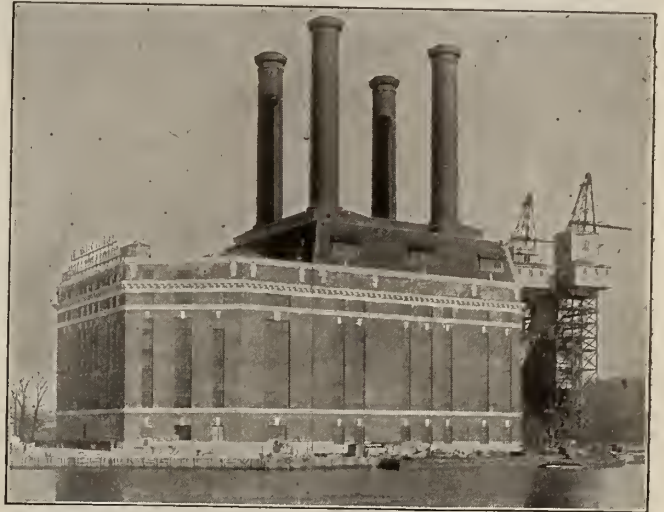
Wm. Davies, Ltd. (Packing Plant), Toronto, Ont.

Swift & Co., Chicago, Ill.

Armour & Co., Chicago, Ill.

Everwear Paving Tile.

Size 10 by 5 by 2¼ in. Extensively used for paving floors of engine and boiler rooms, power and industrial



201ST STREET GENERATING STATION, UNITED ELECTRIC LIGHT & POWER CO., NEW YORK, N. Y.
W. E. McCoy, Engineer F. F. Nesbit & Co., Contractors
650,000 brick used, shades 103 and 102 (interior)

plants; basements of public buildings, schools, warehouses and battery rooms; paving around electric and steam railway passenger and freight depots. Thoroughly vitrified and only one side glazed, and unsurpassed for beauty and wearing qualities. 50% saving over cement floors on original cost, and with many times life of a cement floor.

These tile have been upon the floors of boiler and engine rooms of the New York Life Insurance Building, New York, for 20 years and show scarcely any wear.

Few of Many Concerns Using Same—

Chicago Edison Electric Co., Chicago, Ill.

Cleveland Electric Railway Co., Cleveland, Ohio

Cincinnati Gas & Electric Co., Cincinnati, Ohio

Ford Motor Co., Detroit, Mich.

Aluminum Castings Co., Detroit, Mich.

Hocking Valley Railway Co., Columbus, Ohio

General Qualities of Salt Glazed Material.

All shades of the standard brick and two classes of floor brick are burned to about 2200° Fahr.; thoroughly vitrified and salt glazed; absolutely acidproof; non-absorbent of moisture; will not craze, crack or peel; withstands all the elements of the air besides heavy crushing strain, and always looks fresh and clean.

Samples.

Communicate with this company and the nearest sales agency will be directed to submit samples and prices at once.

Facilities.

With a daily capacity of 50,000 brick, or approximately 15,000,000 annually, and a large and well selected stock for quick shipment, all business is given prompt attention.

INDIANA LIMESTONE

BEDFORD, IND.

BLOOMINGTON, IND.

INDIANA LIMESTONE QUARRYMEN'S ASSOCIATION, OFFICES, BEDFORD, IND.

MEMBERS AS FOLLOWS:

BEDFORD STONE & CONSTRUCTION CO., Bedford, Ind.
BLOOMINGTON-BEDFORD STONE CO., Bloomington, Ind.
CHICAGO & BLOOMINGTON STONE CO., Bloomington, Ind.
CONSOLIDATED STONE CO., Bedford, Ind.
CRESCENT STONE CO., Bloomington, Ind.
GEORGE DOYLE CORPORATION, Bedford, Ind.
EMPIRE STONE CO., Bloomington, Ind.
FURST-KERBER CUT STONE CO., Chicago, Ill.

J. HOADLEY & SONS CO., Bloomington, Ind.
HUNTER BROS. STONE CO., Bloomington, Ind.
IMPERIAL STONE CO., Bedford, Ind.
INDIANA QUARRIES CO., Chicago, Ill.
W. McMILLAN & SON, Chicago, Ill.
NATIONAL STONE CO., Bloomington, Ind.
PERRY STONE CO., Ellettsville, Ind.
SHEA & DONNELLY CO., Bedford, Ind.

STAR STONE CO., Chicago, Ill.

Product.

BUFF, GRAY ("Blue") and VARIEGATED ("Mixed") INDIANA LIMESTONE (sometimes called "Bedford Stone").



upon industrial structures, is so general that it needs no comment.

Full description and complete architectural specifications will be furnished on application.

Structure and Chemistry.

Indiana Limestone is composed of shells and fragments of shells of microscopic and somewhat larger sizes, cemented together with a film of pure calcium carbonate. It is therefore a homogeneous, massive formation without cleavage planes. It is practically pure carbonate of lime.

Its average chemical analysis follows:

Carbonate of lime.....	97.26%
Silica.....	1.69%
Oxide of iron.....	.49%
Magnesia.....	.37%
Water and loss.....	.19%

Durability.

Indiana Limestone is extremely durable. The oldest known structures built of it show the original tool marks and perfect arrises everywhere. Its great chemical purity, especially the negligible proportion of magnesia, makes it practically inert and therefore but little, if at all, affected by the corrosive gases of city atmosphere. Its wide use for railway stations is "enough said" on this point. It is practically untouched by weather erosion. Inspection of the outcroppings at the quarries, where natural, sharp arrises have been exposed for centuries, proves this.

Strength Plus Softness.

Indiana Limestone is, comparatively, a soft stone. It is nevertheless of a strength for all practical purposes in the same class with granite, which is many times harder and more difficult to work. After quarrying and exposure Indiana Limestone becomes very hard. Its crushing strength in 2-in. cubes is about 15,000 lbs. per sq. in.—many times the strength needed for the heaviest structures.

Engineering Uses.

Indiana Oölitic Limestone has many advantages for the construction of piers, abutments, retaining walls, jetties, etc. It is especially adapted, besides, to sills and lintels in industrial buildings, being strong, inexpensive, easy to get, and quick and economical of labor in handling and setting. The fact that it needs no steel reinforcement in sills and lintels is a still further economy. Its use for decorative trim, so frequently used nowadays

Service Bureau.

We are prepared to discuss fully with any interested engineer the possibilities of Indiana Oölitic Limestone in any operation.

Impartial and practical advice and help of any sort, relating to the uses of Indiana Limestone (including advice as to where it should not be used), samples, photographs of buildings, setting, handling, etc., gladly furnished, gratis, by our Service Bureau at Bedford, Ind.



INTAKE TOWER, MISSISSIPPI RIVER WATER DEPARTMENT, CITY OF ST. LOUIS, MO.

ROTH & STUDY, Architects, St. Louis, Mo.
Constructed of Indiana Limestone



LAKE ISLAND BRIDGE NO. 1, MINNEAPOLIS, MINN.

C. B. CHAPMAN, Architect, Minneapolis, Minn., and SECURITY BRIDGE Co., Contractors, Minneapolis, Minn., both structures of Indiana Limestone



LAKE ISLAND BRIDGE NO. 2, MINNEAPOLIS, MINN.

HYDRO-ELECTRIC PLANT OF THE IOWA RAILWAY & LIGHT COMPANY, CEDAR RAPIDS, IOWA
Indiana Limestone above base course

GRAND RAPIDS SHOW CASE CO., GRAND RAPIDS, MICH.

WERNETTE-BRADFIELD-MEAD Co., Architects

Indiana Limestone sills, caps, copings and ornaments.
Erected in record time, a result to which the ease and speed of handling the Indiana Limestone elements contributed materially

PUMPING STATION (STAPLES), SOUTH BEND, IND.

FREYERMUTH & MAURER, Architects, South Bend, Ind.

BURNS & McDONNELL, Engineers, Kansas City, Mo.

Indiana Limestone trim



PUBLISHING BUILDING OF THE DETROIT NEWS, DETROIT, MICH.

ALBERT KAHN, Architect, Detroit, Mich.

A complete manufacturing plant. Faced entirely with Indiana Limestone

MICHIGAN STREET BRIDGE, SOUTH BEND, IND., BUILT OF REINFORCED CONCRETE FACED WITH INDIANA LIMESTONE
CHARLES W. COLE, Architect and Engineer, South Bend, Ind.

KUSHEQUA BRICK COMPANY

Manufacturers of Face Brick and Paving Materials

KUSHEQUA, PA.

WHOLESALE DISTRIBUTORS

NEW YORK, N. Y., C. T. WILLARD Co., Inc.
 BOSTON, MASS., WALDO BROTHERS
 CHICAGO, ILL., THOMAS MOULDING BRICK Co.
 PITTSBURGH, PA., GLONINGER & Co.
 ERIE, PA., A. M. COBBE BRICK & TILE Co.

SYRACUSE, N. Y., CUMMINS BRICK & TILE Co.
 DETROIT, MICH., COLONIAL BRICK Co.
 RICHMOND, VA., J. S. ARCHER
 ATLANTA, GA., B. MIFFLIN HOOD BRICK Co.
 And other dealers

TWO PLANTS

Products.

VITRIFIED SHALE FACE BRICK, FLOORING and PAVING MATERIALS; CHEMICAL STONEWARE.

Kushequa Face Brick.

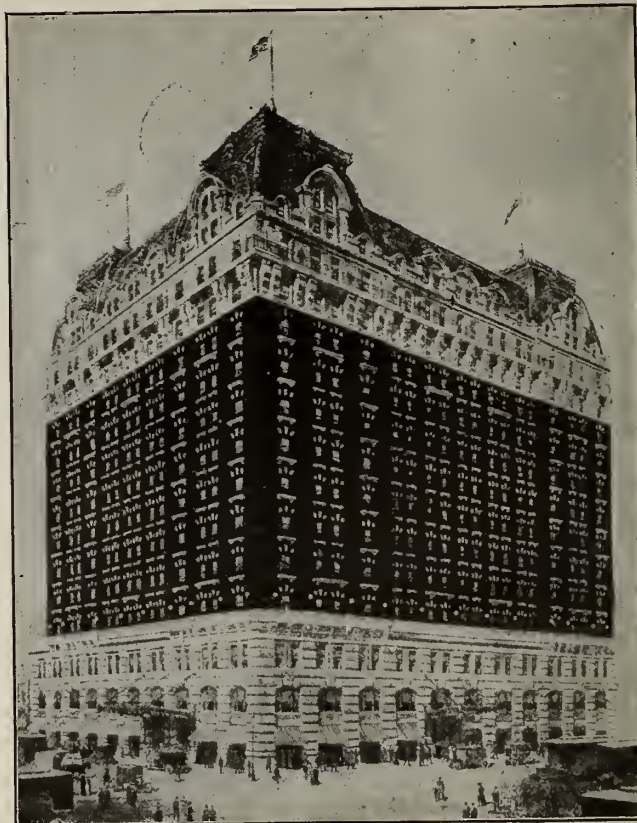
The characteristics of Kushequa face bricks are their deep color (specially dark red), great strength and high vitrification. Kushequa face bricks are made in the following types: Kq Paver, Wire-cut, Ox-blood Devonshire, Velours, Saruk, Smyrna and Blackheaders.

KQ PAVER— $2\frac{1}{4}$ by $8\frac{1}{4}$ by $3\frac{7}{8}$ in.; weight $6\frac{1}{8}$ lbs. This brick is repressed, with bevel edges and resembles a small paving block. 2 shades, dark and light. It gives the effect of massive strength and is particularly pleasing in large buildings. In second quality it makes a handsome front at low cost.

WIRE-CUT— $2\frac{1}{4}$ by 8 by $3\frac{3}{4}$ in.; weight 6 lbs. A standard red brick with smooth face and wire-cut sides, in 4 shades. Shade 1, exceptionally dark and strong; Shade 2, a dark red brick of moderate cost; Shade 3, a clear red brick for sidewalks and fronts not requiring dark red; and Shade 4, a light red brick, sufficiently vitrified to withstand wet and frost. Shades 3 and 4 in mixture form our cheapest face bricks.

OX-BLOOD DEVONSHIRE— $2\frac{1}{4}$ by 8 by $3\frac{3}{4}$ in.; weight, $5\frac{3}{4}$ lbs. Very rough texture and a clear, uniform red color. Shade 1, the darkest clear red on the market; Shade 2, a fine deep red; Shade 3, a bright red. The second quality in mixed shades is amply good for any large front and is recommended where price is an object.

SARUK— $2\frac{1}{4}$ by 8 by $3\frac{7}{8}$ in.; weight $5\frac{3}{4}$ lbs. The rough texture and variegated color give this brick an Oriental rug effect. The hues harmoniously blend from deep red through old rose to greenish gray, and



Y HOTEL SHERMAN, CHICAGO, ILL.
 HOLABIRD & ROCHE, Architects
 Faced with 500,000 Kq Pavers

from bronze to tan. To get the best effect, it should be laid with dark mortar joints, not exceeding $\frac{1}{2}$ in., raked. Saruks are choice enough for a parlor mantel, yet cheap enough for a fine hotel front. Second quality Saruks look well in large buildings, especially where "tapestry" effects are desired.

MOSS GARNET—Same as Saruk except less regular texture, and predominance of browns and other dark hues. Touch of gray scum on heads, occasionally on faces, suggests lichen moss.

TEXTURE VENEER BRICKETTES— $2\frac{1}{4}$ by 8 by 2 in., weight $3\frac{1}{4}$ lbs. Texture and rich colors of Moss Garnet. Corner ells show heads to match. Spiked to studding frame or common brick buildings produces beauty and durability of face brick at little over half its cost.

Paving Materials.

This company commenced business in 1904 with the manufacture of paving blocks out of a strongly ferruginous mountain shale highly vitrified by natural gas. The beauty of color and finish of the product created such a demand for building purposes that from 1915, except during the war, the output of the factory has been taken chiefly for face bricks.



LOUIS SEELBACH RESIDENCE, LOUISVILLE, KY.
 McDONALD & DODD, Architects, Louisville, Ky.
 Faced with 80,000 Wire-cut Shade 2



WESTMINSTER PRESBYTERIAN CHURCH, ROCHESTER, N. Y.
Faced with 100,000 Saruk and Ox-blood mixed

The high vitrification of these products makes them acidproof and electric insulating. The paving products comprise:

KUSHEQUA REPPRESSED PAVING BLOCK— $3\frac{1}{2}$ by $8\frac{3}{4}$ by 4 in.; weight, 10 lbs. Tough, durable, impervious and handsome in finish. Guaranteed to lay 40 per sq. yd. street measure.

BRICKETTE— $2\frac{1}{4}$ by 8 by 2 in.; weight, 3 lbs. A dark red, thoroughly vitrified brick, useful for floors where hard wear is desired but unnecessary depth is objectionable. It is beautiful for porch floors and hallways. The Mall or concourse at Staten Island end of New York's Municipal Ferry is paved with Kushequa Brickettes. It is a favorite for packing house floors.

FLOOR BRICK—4 by 8 by $1\frac{3}{4}$ in.; weight, $4\frac{2}{3}$ lbs. Specially made for packing house floors to resist grease, hot water and heavy trucking. One side and two edges smooth; wire-cut back and ends. Durability and lightness are combined.

The second quality is highly vitrified, but shows a fine crack or fire check. Laid with reverse side up, it makes exceptionally good sidewalks. Arrises are straight and true without kiln marks.

Chemical Stoneware.

The acid resisting qualities of our paving materials, such as packing house floor brick, have developed a trade in chemical stoneware which, during the war, absorbed three-fourths of our capacity. This company makes the following:

CHEMICAL RINGS, DIAPHRAGM PATTERN—Cylinders of red vitrified tileware quartered lengthwise by septum or diaphragms, length and diameter equal. Sizes 3 and 6 in. Spiral pattern is made exclusively for B. Mifflin Hood Brick Company of Atlanta, Ga.

CHEMICAL BRICK—For acid condensary towers. Arches and special blocks and shapes made to order. A notice of 45 to 60 days is required.

CHECKERWORK FOR ACID TOWERS—Checkerwork for acid towers is made of our second quality floor brick and Kq. Pavers. See above.

Shipping Facilities.

Daily output 25,000 face brick or paving brick from Plant No. 1 and 20,000 from Plant No. 2.

Independent railroad (Mt. Jewett, Kinzua & Riterville R. R.), connecting direct with Buffalo, Rochester & Pittsburgh Ry., Erie R. R., Pennsylvania R. R., Baltimore & Ohio R. R. and Pittsburgh, Shawmut & Northern R. R., gives short line mileage, speedy car movement, best car supply and minimum embargo trouble.



Y. M. C. A. BUILDING, LOUISVILLE, KY.
McDONALD & DODD, Architects, Louisville, Ky.
Faced with Saruk and Ox-blood Devonshire mixed

References.

The following is a partial list of buildings in which Kushequa products were used, giving the location, architect, kind and quantity:

- FACE BRICK**
- Thorp School, Lockwood and Berteau Streets, Chicago, Ill., A. F. Hussander; Brown Saruk, 60,000.
 - San. Dist. Pump Sta., Mohawk and Menominee Streets, Chicago, Ill., F. J. Barrett; Ox-blood Devonshire, 40,000.
 - Collins Apartments, 54th and Cornell Streets, Chicago, Ill., H. L. Newhouse; Kq Paver dark, 60,000.
 - Hotel Sherman, Clark and Randolph Streets, Chicago, Ill., Holabird & Roche; Kq Paver dark, 500,000.
 - Stock Yards Inn, Chicago, Ill., R. L. Lindstrom; Ox-blood Devonshire Shade 1, 450,000.
 - Callahan Apartments, 1622-24 Garfield Boulevard, Chicago, Ill., Worthmann & Steinbach; Kq Paver light, 35,000.
 - Y. W. C. A., Brooklyn, N. Y., Frank Freeman; Saruk and Ox-blood (Gardens), 180,000.
 - Erie R. R. Station, Ridgewood, N. J., Graham King; Saruk, 40,000.
 - Electric Power Plant, South Framingham, Mass.; Kq Paver (2nds), 90,000.
 - 8th District Police Station, 10th and Buttonwood Streets, Philadelphia, Pa., W. B. Powell; Wire-cut Shade 3, 47,000; Blackheaders, 48,000.
 - Church of Our Lady of Rosary, Yonkers, N. Y., John V. Van Pelt; Saruks.
 - Boys' High School, Louisville, Ky., J. E. Henry; Ox-blood and Saruk mixed, 225,000.
 - Westminster Presbyterian Church, Rochester, N. Y.; Saruk and Ox-blood Devonshire mixed, 100,000.
 - Colonial Theater, Dayton, Ohio; Ox-blood Devonshire Shade 1, 27,000.
 - United Evangelical Church, Oil City, Pa., J. C. Brenot; Saruk, 90,000.
 - Mayo Bros. Clinic Hospital, Rochester, Minn.; Kq Paver, 125,000.
 - Mayer Bros.' Block, Erie, Pa., Richard Irvin; Velours, 250,000.

- PAVING MATERIALS**
- D. B. Martin Co., Packing House, Claremont, Baltimore, Md.; Brickette, 57,000.
 - J. J. Felin Packing House, Philadelphia, Pa., C. B. Comstock; Floor Brick, 140,000.
 - Solvay Process Co., Syracuse, N. Y., Battery Room Floor Tile.
 - Electric Storage Battery Co., North Philadelphia, Pa.; Wil-lard Floor Tile.
 - W. M. Rice Institute, Courts and Cloisters, Houston, Tex., Cram, Goodhue & Ferguson; Kq Paver, 25,000.
 - Cape Fear Packing Co., Wilmington, N. C., Floor Brick.

- CHEMICAL STONEWARE**
- Pioneer Iron Co., Marquette, Mich., Arches and Shapes.
 - Richmond Guano Co., Richmond, Va., Checkerwork.

- CHEMICAL DIAPHRAGM RINGS**
- Pyrates Co., Wilmington, Del.
 - Atlantic Refining Co., Point Breeze, Philadelphia, Pa.
 - Aetna Explosives Co., Mt. Union, Pa.
 - Calco Chemical Co., Bound Brook, N. J.
 - Canadian Explosives, Ltd., Nobel, Ont.

KUSHEQUA KERAMIC COMPANY

ELISHA K. KANE, LESSEE

Manufacturer of Ox-blood Floor and Roof Tiles
KUSHEQUA, PA.

Products.

KUSHEQUA FLOOR and ROOF TILES.

Ox-blood Tiles.

Ox-blood tiles show superiority in clear, deep red color, high vitrification, even texture and neat finish. No artificial glaze or coloring, the color and substance being uniform throughout.

The material is a stratified mountain shale of uniform composition. It is ground very fine and highly vitrified by natural gas.

Size and Grading.

Ox-blood tiles are made in 3 principal sizes: 1 by 6 by 9 in. (Promenade), $1\frac{1}{8}$ by 9 by 9 in. (Quarry), and 1 by 6 by 6 in. (Quarry).

The Promenade size is graded into 3 qualities: flooring quality (very choice), roofing quality (suitable for floors, excellent for roofs) and seconds (serviceable for roofs or cheap floors). The Quarry sizes, into flooring quality (choice) and seconds (slightly defective).

Color.

Each grade and size is sorted into 3 shades of clear red color: A (dark red), B (deep red) and C (bright red). Oriental tiles, with dark red centers fading toward gray edges, are also made in 6 by 6 in. and 6 by 9 in.

For antique effects, second quality orientals are particularly desirable.

Specials.

A full line of sanitary cove base, quoins, angles, wainscot caps, plinths, coping and other shapes are carried in stock. Also, key quoins, 3 in. and $1\frac{1}{2}$ in., in red or black, and diagonals and fractional tile for course starters. Other special shapes are made to order on reasonable notice. See opposite page.

Uses.

Vitrified tiles are used wherever there is need for a surface which is proof against fire, frost, water, acid, grease and dirt. If, in addition to these requirements, beauty of color and resistance to wear are required, Kushequa ox-blood tiles are best.

Flooring quality is recommended for parlors, halls, dining rooms, restaurants, hospital operating rooms and laboratories. Roofing quality for roof gardens, roofs, porches, promenades, kitchens, laundries, packing houses, engine rooms, bridges, etc. Seconds for cheap roofs, covering for concrete, dye vat linings, acid towers, fertilizer plants.

Facilities.

Monthly output 300,000 tile (150,000 during war) and large stock enables prompt shipment.

Transportation facilities unexcelled, factory connected with Erie R. R., Buffalo, Rochester & Pittsburgh R. R., Pennsylvania R. R. and Baltimore & Ohio R. R.

Direct Sale.

Although represented in principal cities by capable



Copyright 1916 by Equitable Office Building Corporation

EQUITABLE BUILDING, NEW YORK, N. Y.

GRAHAM-BURNHAM, Architects

Roofed with Kushequa Promenade Tile

wholesale dealers, customers who so desire may buy direct at open published prices. In these, however, there is a reasonable discrimination in favor of tile setters and dealers.

References.

Stock Yards Inn, Chicago, Ill., R. L. Lindstrom, Architect
Engineering Laboratory, University of Michigan, Ann Arbor, Mich., Smith, Hinchman & Grylls, Architects
Niagara Falls Bridges, Niagara Falls, N. Y.
Canadian Pacific Hotels, Edmonton and Laggan, Alta.
Tennessee Coal and Iron & Railroad Co., Fairfield, Ala.
Metropolitan Museum of Art, New York, N. Y., McKim, Mead & White, Architects
Swift & Co., Packing House, Montreal, Que.
Giles Residence, Orlando, Fla., L. Percival Hutton, Architect
Geological Building, Interior Department, Washington, D. C.
Bureau of Engraving and Printing, Washington, D. C.
J. K. Billings, Residence, Locust Valley, L. I., Guy Lowell, Architect
Rockefeller Institute, East 64th Street, New York, N. Y., Shepley, Rutan & Coolidge, Architects
High School, Waterbury, Conn., Griggs & Hunt, Architects
St. Augustine's Church, Convent and School, San Juan, P. R.
Broadmoor Hotel, Colorado Springs, Colo.
Pennsylvania Hotel, 33d Street and 7th Avenue, New York, N. Y., McKim, Mead & White, Architects



Ox-Blood Promenade Tile

Straight Sizes

Nos. 9 and 92, 9 x 9 in.
 Nos. 1, 10, 11, 12, 13 and 14, 6 x 9 in.
 Nos. 6, 60, 61 and 62, 6 x 6 in.
 Nos. 3 and 22, 3 x 3 in.
 Nos. 2 and 20, 1½ x 1½ in.

Fractional Sizes

No. 99 Diagonal, 9 x 9 in.
 No. 26 Diagonal, 6 x 6 in.
 No. 95 Starter, 9 x 4½ in.
 No. 24 Starter, 6 x 4½ in.
 No. 23 Starter, 6 x 3 in.



External Cove Angle, Left Hand

No. 43, height, 4½ in.
 No. 53, height, 6 in.
 No. 42, height, 4½ in., Right Hand.
 No. 52, height, 6 in., Right Hand.



Cove Base, 4½ in., Square Top

No. 40, height, 4½ in.; length, 9 in.
 No. 46, height, 4½ in.; length, 6 in.
 No. 50, height, 6 in.; length, 9 in.
 No. 56, height, 6 in.; length, 6 in.
 No. 30, height, 3 in.; length, 9 in.
 No. 36, height, 3 in.; length, 6 in.



Internal Cove Angle

No. 41, height, 4½ in.
 No. 51, height, 6 in.



Square Plinth

No. 57, height, 6 in.
 No. 47, height, 4½ in.
 No. 67, Rounded



Cove Base, 6 in.

Round Top
 No. 63, length, 9 in.
 No. 66, length, 6 in.



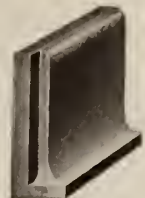
Internal Quoin

No. 64, height, 6 in.
 No. 34, height, 3 in.
 Square top



External Quoin

No. 65, height, 6 in.
 No. 35, height, 3 in.
 Square top



No. 54, Right Stop
 No. 55, Left Stop
 No. 68, Right Stop
 No. 69, Left Stop



Bullnose

No. 80, 6 x 9 in.
 No. 81, 6 x 6 in.



Internal Radius

No. 76, 6 in.
 No. 77, 9 in.



External Radius

No. 78, 6 in.
 No. 79, 9 in.



Wainscot Cap

No. 70, 4 in. high,
 9 in. long
 No. 71, 4 in. high,
 6 in. long



Bullnose Stop

No. 82, 6 x 6 in.



No. 100. Porch Coping



No. 101. Coping Corner



No. 72 Cap
 Internal Quoin



No. 73 Cap
 External Quoin



No. 102 Step Tread Tile

KUSHEQUA PROMENADE TILE, SANITARY BASES AND WAINSCOTS

NUMERICAL LIST OF ABOVE TO FACILITATE ORDERING BY NUMBER

- | | |
|---|---|
| 1 Promenade Tile, 6 by 9 by 1 in., Flooring Quality | 57 Cove Base, 6 in. high, square top, Plinth |
| 2 Key Quarry, 1½ by 1½ by 1 in., Flooring Quality | 60 Quarry, 6 by 6 in., Oriental, Flooring Quality |
| 3 Key Quarry, 3 by 3 by 1 in., Flooring Quality | 61 Quarry, 6 by 6 in., Seconds |
| 4 Key Quarry, 4 by 4 by 1 in., Flooring Quality | 62 Quarry, 6 by 6 in., Oriental, Seconds |
| 6 Quarry, 6 by 6 by 1 in., Flooring Quality | 63 Cove Base, 6 in. high, round top |
| 9 Quarry, 9 by 9 by 1½ in., Flooring Quality | 64 Cove Base, 6 in. high, round top, Internal Quoin |
| 0 Promenade Tile, Oriental, Flooring Quality | 65 Cove Base, 6 in. high, round top, External Quoin |
| 1 Promenade Tile, Roofing Quality | 66 Cove Base, 6 in. high, round top, 6 in. long |
| 12 Promenade Tile, Second Quality | 67 Cove Base, 6 in. high, Plinth, all edges rounded |
| 13 Promenade Tile, Third Quality | 68 Cove Base, 6 in. high, round top, Right Stop |
| 14 Promenade Tile, Oriental, Seconds | 69 Cove Base, 6 in. high, round top, Left Stop |
| 20 Key Quarry, 1½ by 1½ by 1 in., Blackish | 70 Wainscot Cap, 4 in. high, 9 in. long |
| 22 Key Quarry, 3 by 3 in., Blackish | 71 Wainscot Cap, 4 in. high, 6 in. long |
| 23 Course Starter, 6 by 3 in. | 72 Wainscot Cap, 4 in. high, Internal Quoin |
| 24 Course Starter, 6 by 4½ in. | 73 Wainscot Cap, 4 in. high, External Quoin |
| 25 Course Starter, 3 by 9 in. | 74 Wainscot Cap, 4 in. high, Internal Miter |
| 26 Diagonal, 6 by 6 in. | 75 Wainscot Cap, 4 in. high, External Miter |
| 30 Cove, 3 in. high, square top, 9 in. long | 76 Wainscot, Internal Radius 6 in. |
| 34 Cove, 3 in. high, square top, Internal Quoin | 77 Wainscot, Internal Radius 9 in. |
| 35 Cove, 3 in. high, square top, External Quoin | 78 Wainscot, External Radius 6 in. |
| 36 Cove, 3 in. high, square top, 6 in. long | 79 Wainscot, External Radius 9 in. |
| 40 Cove Base, 4½ in. high, square top, 9 in. long | 80 Bullnose, 6 by 9 in. |
| 41 Cove Base, 4½ in. high, square top, Internal Angle | 81 Bullnose, 6 by 6 in. |
| 42 Cove Base, 4½ in. high, square top, External Angle, Right Hand | 82 Bullnose Stop, 6 by 6 in. |
| 43 Cove Base, 4½ in. high, square top, External Angle, Left Hand | 83 Bullnose, Internal Quoin, 6 in. high |
| 46 Cove Base, 4½ in. high, square top, 6 in. long | 84 Bullnose, External Quoin, 6 in. high |
| 47 Cove Base, 4½ in. high, square top, Plinth | 90 Quarry, 1½ by 9 by 9 in., Oriental |
| 50 Cove Base, 6 in. high, square top, 9 in. long | 92 Quarry, 1½ by 9 by 9 in., Second Quality |
| 51 Cove Base, 6 in. high, square top, Internal Angle | 95 Course Starter, 9 by 4½ in. |
| 52 Cove Base, 6 in. high, square top, External Angle, Right Hand | 99 Diagonal, 9 by 9 in. by 1½ in. |
| 54 Cove Base, 6 in. high, square top, Right Stop | 100 Porch Coping, 6 in. by 9 in. by 2 in. |
| 55 Cove Base, 6 in. high, square top, Left Stop | 101 Porch Coping Corner, 9 in. by 9 in. by 2 in. |
| 56 Cove Base, 6 in. high, square top, 6 in. long | 102 Step Tread Tile, 6 in. wide, 9 in. long |
| | 120 Quarry Tile, 12 in. by 12 in. by 1½ in., Flooring Quality |
| | 121 Quarry Tile, 12 in. by 12 in. by 1½ in., Second Quality |

NATIONAL FIRE PROOFING COMPANY

ORGANIZED 1889

Manufacturers of Hollow Tile

MAIN OFFICE
Fulton Building
PITTSBURGH, PA.

BRANCH OFFICES IN PRINCIPAL CITIES
Twenty-three factories in the United States and one at Hamilton, Ont.

Products and Services.

Manufacturers of DENSE and POROUS HOLLOW TILE for Fireproof Floors, Roofs, Ceilings, Partitions, Wall Furring, Column and Girder Coverings, and for Exterior Walls of all kinds, including barns, silos, and other farm buildings; NATCO LOCK JOINT SEWER TILE and NATCO FACE TILE in various types.

Trade-mark.

Look for the trade-mark "Natco" indelibly stamped on every piece of our product; it is protection against substitution.

Natco Advantages.

Natco hollow tile construction is superior in its moistureproofing, soundproofing, heat preserving (and conversely heat resisting), sanitary qualities, and from the standpoint of economy both initial and final.

Natco Floor Construction.

Floor arches of hollow tile can be set in winter, as the construction dries out in a few days. They are more nearly soundproof than solid construction. Following are illustrations and descriptions of some of the forms in common use. Only typical sections are given. Write for bulletin No. 171, "Natco Standard Fireproofing."

Natco Flat Arches.

The flat arch is the accepted type of standard fire-

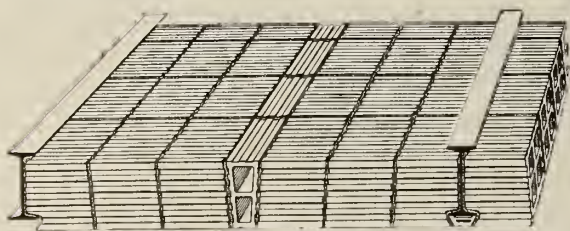


FIG. 1. PERSPECTIVE OF STANDARD NATCO FLAT ARCH

proof floor construction, meeting every requirement as to strength, fire protection, architectural appearance and minimum weight.

The Natco hollow tile flat arch construction, as illustrated above, has been developed as the company's standard for this type.

APPROXIMATE WEIGHTS AND SAFE SPANS NATCO FLAT ARCHES
(For designing purposes only)

Depth of arch, in.	Weight, lbs. per sq. ft.	Spans allowable between I-beams arch set flat, ft. in.
6	26	4 0
7	30	4 6
8	32	5 0
9	36	6 0
10	38	6 6
12	44	8 0
14	50	9 0
15	54	9 6
16	55	10 0

The strength of any arch depends as largely upon workmanship as upon materials, therefore the maximum spans given can be used only where experienced workmen are employed and the work is guaranteed by a responsible contractor.

"Combination" System of Long Span Floor Slab.

Used without girders for clear spans up to 25 ft. Rows of tile 12 in. wide between reinforced concrete joists 4 to 6 in. wide monolithic with a concrete top

coat 2 in. thick mixed 1 part cement, 2 parts sand, and 4 parts gravel. Eliminates beam forms and requires one-third to one-half less flat centering, effecting great economy in erection.

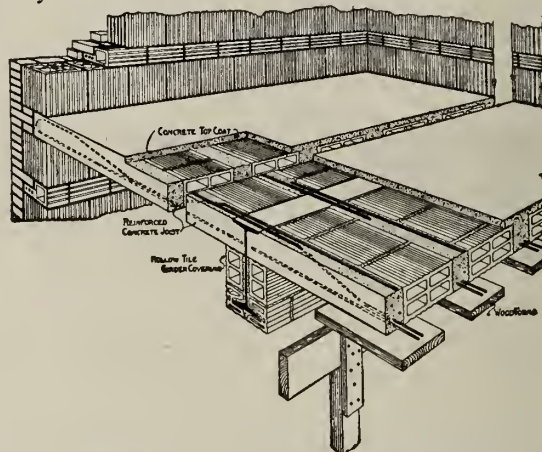


FIG. 2. PERSPECTIVE VIEW OF TYPICAL COMBINATION FLOOR
Note economical wood centering used; 2"x8" or 2"x10" under each joist is sufficient

"Natcoflor" System of Fireproof Construction.

An exceptionally light slab of wonderful strength designed to reduce the dead load of fireproof floor construction carried on girders, columns, and footings. A minimum of flat centering required and an all-tile ceiling surface dovetail-scored for plastering a feature.

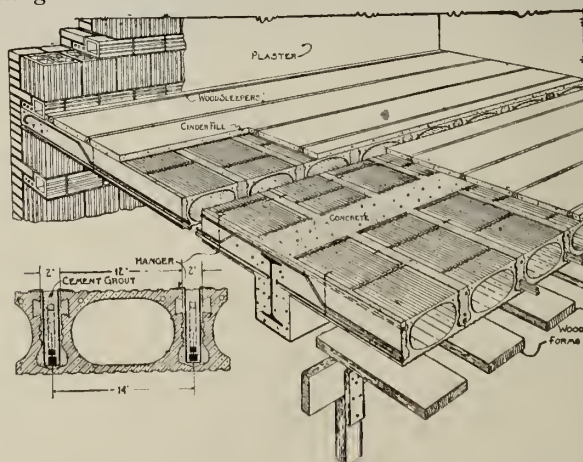


FIG. 3. PERSPECTIVE VIEW OF TYPICAL "NATCOFLOR"
Note simple method of reinforcing; also economical wood centering, 2"x8" under each joist is sufficient

Natco "Two-way" Floor System (Patented).

A later development of the "Combination" floor designed to carry loads to four sides in place of two, thus enabling designer to cut down thickness of slab and reduce depth of supporting girders. Most economical for bays, the ratio of whose sides does not exceed 1:1½; for long narrow spans "one-way" system is cheaper.

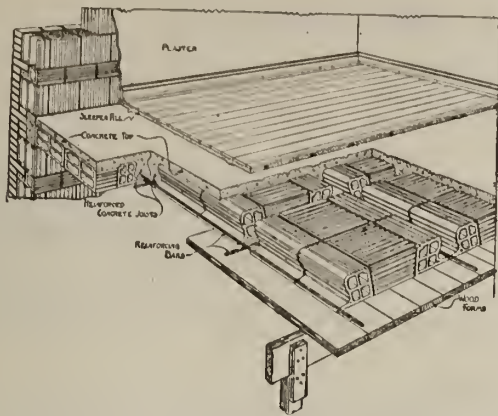


FIG. 4. PERSPECTIVE VIEW OF NATCO "TWO-WAY" FLOOR SYSTEM

Natco Segmental Arch.

Combining great strength with lightness and cheapness. Suitable for warehouses, lofts, factories, sidewalks or wherever a flat ceiling is not required. A flat suspended ceiling may be installed wherever deemed essential, such as used in the New York public schools, and in private houses, stores, etc. The 6-in. tile weighing approximately 27 lbs. per sq. ft. is the standard.



FIG. 5. TYPICAL SPAN OF NATCO SEGMENTAL ARCH

Natco Girder Covering.

Hollow tile beam and girder covering is made in various forms to fit the flanges of all standard steel beams and girders. It is self-supporting except where the width to be covered is more than 12 in.; then the soffit is supported by metal clips.

Note—See Fig. 2 for typical girder covering.

Natco Column Covering.

Steel and cast iron columns should be covered with at least 2 in. of semiporous hollow tile. Natco column covering can be furnished, both circular and square, for almost any type of column and from 2 to 4 in. in thickness. Covering for square columns can be made with rounded corners if necessary.

Natco Hollow Tile Partitions.

Fireproof, soundproof, easily erected, and the standard for stability, especially where called upon to support plumbing fixtures, heavy picture frames, shelving, etc. Stock sizes 2 to 12 in. thick, laying up 1 sq. ft. of wall surface. A reasonable percentage of short lengths also furnished on request.

Natco Face Tile.

For curtain or bearing walls of factories, warehouses, storage buildings, etc., Natco double shell tile in an 8-in. thickness, Natco smooth building tile and Natco XXX Tex tile in 3-, 4-, 6-, 8- and 10-in. thicknesses, with a reasonable percentage of corners, jambs, closures, sills, lintels and half-tile. When laid in a good cement mortar any one of these types produces an exterior surface of attractive finish without the addition of either stucco plaster or paint.

A post card request will bring a copy of the new bulletin No. 174, "Natco Wall Construction."

Natco XXX Hollow Tile.

For wall bearing and curtain wall construction—hard burned tile exposed or to be covered with cement stucco finish.

Natco XXX as compared with regular Natco merely represents added strength. Complete structural efficiency is realized in Natco XXX design in that every square inch of webs and shell is under direct compression when set in walls. Write for Bulletin No. 174, "Natco Wall Construction."

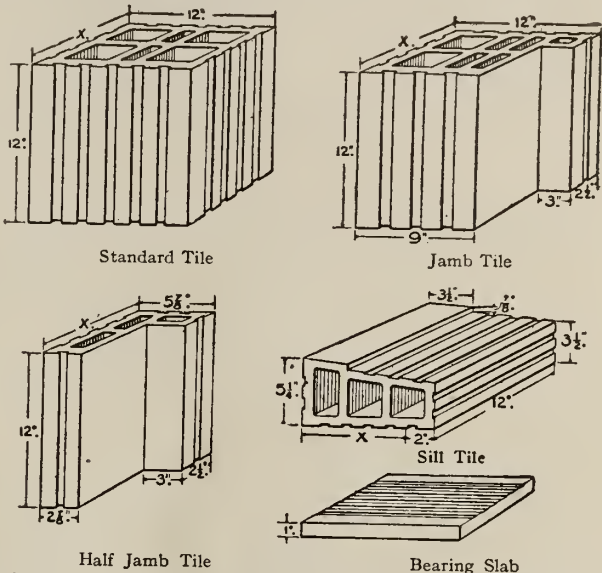


FIG. 6. TYPICAL SHAPES OF NATCO XXX HOLLOW TILE

Natco Lock Joint Sewer Tile.

Triple lock, hermetically sealed. Manufactured from a specially selected, carefully prepared, hard burned clay thoroughly salt glazed.

The recesses of the inner tile are designed to receive projections on each outer tile, which produces a continuous irregular mortar joint for entire length of sewer. The tile also lap 6 to 9 in. horizontally and 3 to 4 in. radially, thus eliminating "through mortar joints." Descriptive catalogue mailed anywhere.



FIG. 7. Cross Section

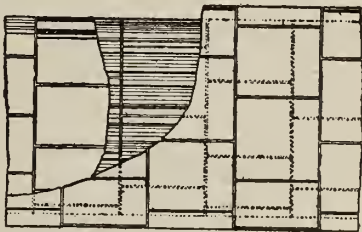


FIG. 8. Longitudinal View
NATCO LOCK JOINT SEWER TILE CONSTRUCTION

APPROXIMATE WEIGHTS, DIMENSIONS, ETC.

Diam. sewer, in.	Number double tile in circumference of sewer	Thickness of sewer, in.	Thickness inside wearing surface, in.	Area of wearing surface inside tile, sq. in.	Approx. weight per foot of sewer, lbs.
30	7	6	3/4	235	410
33	8	6	3/4	226	450
36	8	6 1/8	3/4	247	480
39	9	6 1/8	3/4	238	540
42	10	6 1/8	3/4	230	560
45	10	6 1/8	3/4	247	585
48	11	6 1/8	3/4	240	610
54	12	6 1/8	3/4	247	650
60	13	8	1	254	970
66	14	8	1	259	1000
72	15	8	1	264	1140
78	16	8	1	268	1170
84	18	9	1	257	1290
90	18	9	1	275	1400
96	20	9	1	264	1530
102	21	9	1	267	1630
108	22	10	1	270	1790

THE HUMPHREY BRICK & TILE CO.

Hollow Terra Cotta Blocks
BROOKVILLE, PA.

Products.

SCORED and SMOOTH HOLLOW TERRA COTTA BLOCKS, 8 by 12 by 12 in. (exclusively during 1920).

Partition Blocks, Hollow Brick and Back-up Blocks will also be manufactured when factory conditions permit.

Facilities.

This plant is located in a section where special advantages for the manufacture of terra cotta blocks, etc., are obtained, such as an abundance of material and water, railroad and shipping facilities and cheap fuel. All motive power in the plant is supplied by gas engines, natural gas being used exclusively for power and fuel, this company operating its own gas wells.

The plant is constructed entirely of terra cotta blocks and is under ownership management, assuring owners' personal attention to all orders.

Due to peculiar trade conditions, this company will devote its entire plant during 1920 to the exclusive manufacture of the 6-chambered 8 by 12 by 12 in. terra cotta wall block both scored and smooth.

Fully 75% of all hollow tile requirements can be met by this block as either an 8-in. or a 12-in. wall can be built with this one size.

This plan of concentrating on one design will naturally result in an increased output and the advantages of purchasing this material from a plant making one run are apparent.

Range of Utility.

The inherent fireproof and dampproof qualities of Humphrey hollow terra cotta blocks extend the scope of their use over a large, growing field. They are eminently adapted for the economical construction of walls, floors, and ceilings for residences, public service, industrial, farm and other buildings, due to the fact that their design facilitates rapid handling and their enduring qualities assure rigid, permanent masonry construction.

Advantages of Hollow Terra Cotta Blocks.

The following advantages are insured by hollow terra cotta construction:

- (1) Absolutely indestructible by fire—due to the process of intense burning resulting in a dense, extremely hard substantial product.
- (2) Low percentage of absorption gives dryness, warmth and insulation to walls exposed to the weather where resistance to moisture, cold and heat are of paramount importance.
- (3) Positive saving in construction as compared with brick or stone.
- (4) Continuous, permanent saving in heating costs.
- (5) The hollow construction minimizes the weight on walls.
- (6) Positive insurance against mice and vermin in walls or other hollow tile construction.
- (7) The use of metal lath is obviated—nothing to rust or corrode.
- (8) The use of wood lath is done away with—nothing to rot or burn.
- (9) No furring strips to give trouble.
- (10) Saves space occupied by furring and lath.
- (11) Being symmetrically accurate in design they facilitate laying.

(12) Each block is a separate unit and will stand on face or end assuring easy, rapid handling and stacking.

(13) Perfect alignment of webs and walls of the block assure maximum load bearing capacity.

(14) Can be made to conform to any architectural treatment, either interior covered or exterior uncovered construction.

Strength Test.

Tests conducted by the United States Government Arsenal at Watertown, Mass., showed Humphrey 6-cell wall blocks to have an ultimate crushing strength of over 111 tons per sq. ft. of 8-in. wall. As this is many times the weight that could be put on any ordinary wall, ample strength of material is assured.

Scored Special 6-Chamber Wall Block.

The increase in the growing application of hollow terra cotta blocks to wall and other construction made many improvements in their design and manufacture necessary.

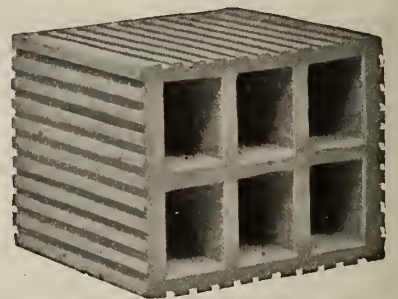
One of the vital improvements that made the hollow terra cotta block the universal favorite was the scoring of the surface with longitudinal ribs which serve as a bond for stucco, concrete or similar material applied thereto. This feature made possible the use of hard burned block, superior in strength to the soft burned block and more impervious to water which is the reason why hollow terra cotta construction is the dryest of any known masonry construction.

Humphrey scored 6-chamber blocks are recommended for exterior walls, floor arches, back-ups, pillars, or work where a specially strong block is required.

Humphrey Smooth Faced Block.

With these smooth face blocks a wall of either 8-in. or 12-in. thickness for either outside or inside use can be constructed. They are supplied in dark, fire flashed color but if uniform color is desired they can be painted inside or outside as paint will last twice as long as on wood. Their use, in nearly all cases, will cut the cost of even common brickwork in two, besides making a warmer, drier building.

They possess the same qualities of hardness, density and strength as the scored block and they are of precisely the same advantage where special conditions warrant their use.



SPECIAL 6-CHAMBER WALL BLOCK
8 x 12 x 12 in., 36 lbs.



HUMPHREY SMOOTH FACED BLOCK
8 x 12 x 12 in., 38 lbs.

CALIFORNIA REDWOOD ASSOCIATION

Exposition Building
SAN FRANCISCO, CAL.

MEMBER ASSOCIATIONS AND REPRESENTATIVES

ALBION LUMBER COMPANY
BAYSIDE LUMBER COMPANY
DOLBEER & CARSON LUMBER COMPANY
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HOLMES EUREKA LUMBER COMPANY
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Redwood Sales Company, Exposition Building, San Francisco, Cal.

GOODYEAR REDWOOD COMPANY
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C. A. Goodyear Lumber Co., McCormick Building, Chicago, Ill., Union Lumber Company, Grand Central Terminal, New York, N. Y.

THE PACIFIC LUMBER COMPANY

The Pacific Lumber Co., Lumber Exchange Building, Chicago, Ill. and 103 Park Avenue, New York, N. Y.

REPRESENTING ALL COMPANIES: A. C. DUTTON LUMBER CORPORATION, SPRINGFIELD, MASS.

CANADIAN DISTRIBUTERS: BRONSON, GREENE & COMPANY, OTTAWA

Products.

REDWOOD LUMBER in all grades and sizes.

Character and Qualities of Redwood.

Redwood grows only in California. The trees vary from 150 to 300 ft. in height, and from 3 to 20 ft. in diameter. To this enormous size and close growth are due many of the wonderful qualities of the timber.

The lumber is light; soft, moderately strong; grain fine, even, straight, sometimes curly; annual rings wide in the young timber; summer-wood thin, dark colored, hard, conspicuous; medullary rays numerous, and very obscure; color light to dark red, the thin sapwood nearly white; splits and works easily and polishes well; very durable in contact with the soil.

Uses of Redwood.

Redwood is a superior timber for exterior finish (siding, cornice, window and door frames, porches, columns, doors, sash, etc.), and interior trim; for shingles and shakes of roofs and sides of houses; for pergolas, summerhouses, flower boxes and vases; for special farm uses—such as silo construction—and for hot-bed sash, beehives and incubators; for pattern stock, candy boxes, organ pipes and wine chests, storage battery separators, large clock hands, fireless cookers, for lattice trusses; for tanks, pipes, flumes, culverts, and cesspools; for greenhouse construction; for interior finish wherever great beauty of grain, freedom from knots or blemishes, and immunity from shrinkage or warping is desired in a finish wood; wherever wide paneling from one piece is required; for railroad ties and telegraph poles.

Lasting Qualities of Redwood.

Redwood is in every sense a specialty wood whose proper use presupposes a knowledge of its valuable qualities, chief amongst which, for outdoor uses, is its longevity. The botanical name of Redwood, "Sequoia Sempervirens," meaning "ever living," describes its ability to resist decay under the most severe conditions. It will endure unimpaired for years, under or above ground, without even a protecting coat of paint.

This great durability is probably due in part to the age of the trees and in part to a peculiar preservative which nature has put into the wood.

Resistance to Fire.

Redwood, containing practically no pitch or other resinous substance, is slow to ignite and offers unusual resistance to fire. There has never been any loss from forest fires in Redwood timber. As Redwood absorbs water readily, fire can be quickly extinguished once

it has taken hold. At many places in the great San Francisco fire of 1906 the conflagration was stopped where buildings made of Redwood faced the flames.

Railroad Construction.

For any type of construction that is much exposed to the elements, such as tunnel timbers and lagging, bridges, culverts, water tanks, and railroad ties, where water and earth conspire to produce decay, Redwood is the first choice of those who understand its exceptional qualities. Redwood ties are famous the world over. They are used in England and on the continent of Europe; in India, China, the Philippine Islands; in South Africa, in Mexico, and in South America. These uses of the wood are due to its extraordinary durability, and its comparative freedom from attack by destructive insects, such as the white ant.

Containers of all Kinds.

Redwood is universally used in California for all kinds of tanks, silos, pipe, flumes, culverts and cesspools. Many years ago, Redwood logs bored through the center were used as water mains in various cities, and these are still sound and tight after from 35 to 50 years of service. The water supply of San Francisco is carried through flumes built of Redwood 40 and 50 years ago. California wines are stored in tanks made of Redwood. Mining companies use it in their operations, as it is unaffected by acids. Redwood tanning vats that were built in 1859 are found still in use in San Francisco.

Cost.

Generally speaking, Redwood sells at about the same price as other woods for similar uses.

Facilities.

The Redwood producing sections in California now have direct rail connection, and shipments can be made to any point in the United States or Canada without being transferred.

Redwood is now handled in hundreds of cities and towns throughout the East; but if any one is unable to get it in any particular locality, he can be supplied if he will write to the Association.

Co-operative Service.

The Service Department of the CALIFORNIA REDWOOD ASSOCIATION will furnish literature, samples or any other information about Redwood and its products, and full advice as to its proper use.

Different booklets and pamphlets are issued from time to time, bearing upon the specific applications of the wood.

AMERICAN HARDWOOD MANUFACTURERS ASS'N.

OAK DEPARTMENT

Bank of Commerce and Trust Building
MEMPHIS, TENN.

Products.

OAK TIMBERS, MILL STOCK, LUMBER, DIMENSION, VENEERS.

Kinds of Oak.

White oak and red oak. Commercially there is very little difference except that where great strength and durability are the essential requirements white oak is usually preferred. Normally there is but little variation in price, but when there is a difference it is in favor of white oak.

Scope of Use.

In the United States the growth of oak is widely distributed, but commercial timber is confined principally to the Southern states including Missouri, and to the states east of the Mississippi and north of the Ohio as far north as New York. Oak from time immemorial has been used practically for every purpose for which wood is suitable. Wherever the requirements are for great strength, hardness, durability (and great beauty of restrained and dignified type), oak is appropriate. It has ever been to mankind the symbol of strength, durability, might, dignity and sturdiness, because of the inherent qualities of the wood.

Value to the Engineer.

When wood enters into the engineer's problem oak is an unfailing reliance. Oak is suitable for almost every purpose. It is not recommended above every wood for every purpose, but there is hardly a use for wood in which it will not serve satisfactorily. Oak has been a standard for so long a time that every complete engineers' manual has full mechanical data regarding it.

Mill Construction.

Oak is typically superior when used in mill construction—mill construction being defined as that type of building construction in which the interior framing and floors are of timber; arranged in heavy solid masses, and smooth, flat surfaces, so as to expose the least number of corners, and to avoid concealed spaces which may not be readily reached in case of fire.

Oak has the combination of bending and compression strength, shearing strength and shock resisting ability above any other commercial hardwood. For columns, girders, cross beams and other parts it has continued to demonstrate its practical value ever since the type known as mill construction has been employed.

Factory Flooring.

When flooring is to be subjected to severe wear as is usually the case in the typical manufacturing plant or warehouse, no other wood is so practical as oak. It makes a solid foundation for the fastening of machinery and is sufficiently resilient to absorb some of the strain that must otherwise be carried by the machinery. It withstands the rough usage caused by truck wheels and other severities of factory and warehouse use.

Bridges and Trestles.

Oak is extensively used for bridge and trestle

timbers because of its great shock resisting ability which exceeds that of most other woods. Wood is subjected to no severer strain than in bridges, but the strength of oak meets all the requirements. Its durability adds great value to its use for it reduces the amount of replacements.

Bridge Plank.

Millions of feet of oak are manufactured into bridge plank every year and oak really has no competitor for railroad and turnpike flooring. Oak above all other woods, fills the requirements of this particular use of wood. Almost every kind of strain is placed on bridge plank and because of its strength, toughness, durability and resiliency oak is almost universally preferred.

Switch and Cross Ties.

In the case of switch and cross ties, strength, durability and resistance to decay are the important requirements. No other wood in this or any other country approaches anywhere near oak in the number used. Oak ties are the standard for practically every trunk line in the United States. They are also used extensively in mining and timber railroad operations.

Poles, Cross Arms, Brackets.

Oak is not usually thought of as material for telephone, telegraph, and other wire lines yet the annual use of such in the United States reaches the respectable total of 236,842 ft. Oak is specially qualified for cross arms for electric lines for here strength and durability are particularly needed. Brackets are employed to fasten wires to poles where no cross arms are used. Oak fills this place in larger numbers than all other woods combined.

Ships and Boats.

Before the introduction of armor plate, oak was used almost exclusively in the building of ships and boats. The keels of every great wooden vessel now sailing the ocean are of oak, their ribs and rails are of oak and all those parts that absorb the severe strain and that are not easy of replacement. There has been very little attempt to substitute any other wood in these particular places.

Car Stock.

Oak is peculiarly adapted for car construction purposes. The beams and framing of freight and passenger cars are constantly undergoing strain, carrying heavy weights and subjected to severe jolts. Oak has every quality that makes it ideal in these places. About 25% of all wood used in the construction of cars is oak.

Agricultural Implements.

A purpose for which oak is peculiarly adapted is in agricultural implements. It is readily bent, and will stay bent, and is easily workable. Agricultural implement stock requires peculiar qualities of strength in small strips and here oak excels.

Vehicles.

Oak finds one of its principal uses in vehicle stock. This is another case of where strength and durability are required in small parts and that is why oak is of such value to the manufacturers of vehicles of all kinds.

Mine Timbers.

For props, poles, shafts, ties and planking used in mines, oak is essentially advantageous. The mine timbers undergo severe strain from heavy weights, rough usage and frequently from dampness. Oak resists all of these in an unusual degree and is therefore in great demand by mine operators.

Machine Construction.

Much machinery, particularly the heavier types, require strong wood foundations, supporting rails and strong handles that will not crack or break when subjected to rough usage and severe jar. Oak is exceedingly well adapted for these purposes for it has all the needed strength, toughness and elasticity.

Other Industrial Uses.

Frequently the engineer must decide industrial problems of almost every conceivable nature. It may be of advantage to know that oak reaches its largest

consumption in planing mill products. For furniture it leads all other woods and is nearly half of the entire amount of wood consumed by furniture plants. It leads its nearest competitor by 328,815,422 ft. It is used in making all kinds of fixtures for stores, banks and the like, for cooperage stock, boxes, electrical appliances, dowels, gates, pulleys and conveyors, pumps, wood pipes, playground and amusement park equipment, foundry flasks, machinshop patterns, silos, tanks, stirrups, trees, horns, hames, line rings, trunk frames, and various other articles made from wood.

Supply of Oak.

A consideration which has great weight with users is that the supply of oak is almost inexhaustible. Oak is our most abundant hardwood, and the amount of oak standing in the forests is approximately 40% of all the American hardwoods combined. It is therefore certain that the supply of oak will last indefinitely. This splendid wood will continue to be used, so the users of it may plan as far ahead as they will, with the assurance that when oak is needed it will be available.

Information.

Engineers are invited to write to us for any kind of information on the subject of oak.



OAK STERN POST AND RUDDER POST OF WOODEN SHIP
Photo by U. S. Forest Products Laboratory



PROPELLER AND OAK STERN POST OF WOODEN SHIP
The propeller shaft runs through oak shaft logs and the stern post shown in illustration to left

GREAT SOUTHERN LUMBER COMPANY

BOGALUSA, LA.

Products.

LUMBER and LUMBER PRODUCTS of extra dense SOUTHERN LONG LEAF PINE (*Pinus Palustris*) from an exceptionally fine stand of virgin timber. Especial facilities for Marine, Railway and Heavy Industrial Material.

Brand.

Every shipment of Bogalusa product is identified by the trade-mark Bogalusa imprinted, wherever practicable, upon the lumber itself. This signifies our guaranty of superior manufacture and accurate and uniform grading.

Uses.

Long leaf pine is widely used for practically all purposes to which any of the so-called soft woods are adapted. Its chief uses are in all portions of frame structures including trim and floors; railway ties, timbers, planking, and car material; bridge timbers; poles; piling; ship timbers and planking; timbers and flooring in "mill construction"; in short, Bogalusa Brand extra dense long leaf pine is pre-eminent in all structural uses, heavy and light.

Facilities.

The plant of the GREAT SOUTHERN LUMBER COMPANY is the largest single sawmill installation in the world, with a capacity of 1,000,000 ft. daily. It is able to care in the promptest and most efficient manner for every requirement from the largest to the smallest.

Standard Specifications.

For the convenience of engineers herewith is appended standard specifications as adopted by the Associated Factory Mutual Insurance Companies, the American Society for Testing Materials, and the Southern Pine Association. Specifications adopted by the American Railway Engineering Association also appear in "The Bogalusa Book." See last paragraph on next page.

Specifications Suggested for a Special Grade of Long Leaf Pine for Use in Mutual Factories*.

In making contracts for beams, columns and plank to be used in "Slow Burning Construction," the following specifications are recommended:

DENSITY—No part of the material shall have a density of less than 30 lbs. per cu. ft. when tested by boring smooth holes 1 in. in diameter and 2 ins. deep in ends of the stick, drying to constant weight at 212° Fahr. and weighing borings and computing density from volume of the hole.

ROSIN—None of the heartwood shall show less than 4% of rosin by weight when borings are taken with a 1-in. bit with a hole 2 ins. deep, dried to constant weight at 212° Fahr. and extracted with benzole, the extracted rosin evaporated until it is not soft or sticky when touched with the finger at 70° Fahr.

HEARTWOOD—Heartwood shall show in all four faces of every stick, and sapwood shall not extend more than 2 ins. from the corner at any place, measured perpendicularly to the corner across the face.

GROWTH RINGS—For timbers 6 by 8 ins., or larger, there must show on the cross section between the third and fourth inch measured radially from the heart center or pith, not less than 6 annual rings of growth, a majority of which shall show at least one-third summer wood, which is the dark portion of the annual rings; but wide ringed material excluded by this

*See "Dry Rot in Factory Timbers," by F. J. Hoxie, 1915; Inspection Department Associated Factory Mutual Insurance Companies, Boston.

BOGALUSA
Trade Mark Reg. U. S. Pat. Office

rule will be acceptable, providing that in the majority of the annual rings the dark ring is hard and in width equal to or greater than the adjacent light colored ring.

For pieces in which the center is not included, there must show on the cross section an average of not less than 6 annual rings of growth, with not less than one-third summer wood. Timbers will be rejected in which there is no sharp contrast in color between the spring wood and summer wood.

DEFECTS—No timber with knots greater than 1 in. in diameter, or rot, or injurious shakes will be accepted.

BRANDING—Long leaf pine sold under this specification shall be branded with the letters "F. M.", the name of the lumber manufacturer, the location of the sawmill from which it comes, and the date of sawing, in letters at least 1 in. high.

Specifications for Southern Yellow Pine Timbers, Adopted by the Southern Pine Association, October, 1915.

The grades of timber are as follows: Select Structural Material, Merchantable Timbers, Square Edge and Sound Timbers, No. 1 Common Timbers.

GENERAL TIMBER SPECIFICATIONS—All timber except No. 1 Common must be free from defects such as injurious ring or round shakes, and through shakes that extend to the surface; unsound and loose knots, and knots in groups that will materially impair strength. Seasoning checks and discolored sap shall not be considered defects in any grade.

KNOTS—Knots shall be classified as round and spike in form and for quality as sound, incased, loose and unsound.

A round knot is oval or circular in form.

A spike knot is one sawn in a lengthwise direction.

A sound knot is one solid across its face, is as hard as the wood which surrounds it, may be either red or black, and fixed by growth or position so that it will retain its place in the piece.

An incased knot is one surrounded in whole or in part by pitch or bark and when grown fast to the piece or fixed by position so that it will retain its place in the piece it shall be considered a sound knot.

A loose knot is one not held firmly in place by growth or position.

An unsound knot is one not as hard as the wood surrounding it, or one having a hole in it.

WANE—Wane is bark on the corner of the piece, or the absence of the corner.

SHAKES—Shakes are cracks appearing on the ends of timbers, either intersecting the annual growth rings or separating the same. They shall be classified as ring or round shakes and through shakes.

A ring or round shake is an opening between the annual rings.

A through shake is one extending from the region of the center to the surface of the piece or extending between two faces.

Shakes not hereintofores described unless known to have extensive penetration shall not be considered a defect under this classification.

SIZES AND LENGTHS—All rough timber, except No. 1 Common, must be full size when green; ¼ in. shall be allowed for each side surfaced.

Standard lengths are multiples of 2 ft., 8 to 20 ft. inclusive. Extra lengths are multiples of 2 ft., 22 ft. and longer. When lineal average is specified, standard of lengths shall be multiples of 1 ft.

GRADES—The grades of timber shall be designated as follows: (1) Select structural material; (2) merchantable timbers; (3) square edge and sound timbers; (4) No. 1 common timbers.

HEART TIMBERS—All timber specifications, except "Merchantable," specifying heart requirements, shall be considered as a special contract.

Rule for Select Structural Material.

(A rule incorporating suggestions by the United States Forest Service. Adopted by the American Society for Testing Materials, August 21, 1915. Copyright, 1915.)

Continued on next page

REQUIREMENTS FOR DENSITY AND RATE OF GROWTH—Shall contain only sound wood and be well manufactured.

Shall conform to the definition of dense southern pine as adopted by the American Society for Testing Materials, August 21, 1915, as follows:

Dense southern yellow pine shall show on either end an average of at least 6 annular rings per in. and at least one-third summer wood, or else the greatest number of rings shall show at least one-third summer wood, all as measured over the third, fourth and fifth inches on a radial line from pith.

Wide ringed material excluded by this rule, will be acceptable, provided the amount of summer wood, as above measured, shall be at least one-half.

The contrast in color between summer wood and spring wood shall be sharp and the summer wood shall be dark in color except in pieces having considerably above the minimum requirements for summer wood.

For the purpose of determining whether any given piece meets the requirements for density and rate of growth, the following rule, suggested by the United States Forest Service, shall be applied. It will be sufficient if either end passes the inspection.

(1) *Pith Present or Accurately Located*—(A) Radial line of 5 ins. present. Apply inspection over third, fourth and fifth ins.

(B) Radial line of 5 ins. not present. (a) Apply inspection to the second inch on 2 by 3 ins., 2 by 4 ins., 2 by 6 ins., 3 by 3 ins., 3 by 4 ins., 4 by 4 ins., or any other dimension material that has less than 16 sq. ins. on the cross section. (b) In the larger material apply inspection to the 3 ins. farthest from the pith.

(2) *Pith Not Present or Can Not Be Accurately Located*—(A) Material over 3 ins. thick, apply inspection to 3 ins. nearest the pith. (B) Dimension material 3 ins. or less in thickness, apply inspection to second inch of the piece nearest the pith.

(3) The radial line chosen shall show a representative number of annual rings of growth and per cent of summer wood.

DEFINITION FOR SOUTHERN YELLOW PINE—This term includes the species of yellow pine growing in the southern states from Virginia to Texas, that is, the pines hereto known as long leaf pine (*Pinus palustris*), short leaf pine (*Pinus echinata*), loblolly pine (*Pinus taeda*), Cuban pine (*Pinus heterophylla*), and pond pine (*Pinus serotina*).

Under this heading two classes of timber are designated: (A) dense southern yellow pine and (B) sound southern yellow pine. It is understood that these two terms are descriptive of quality rather than of botanical species.

(a) *Dense southern yellow pine* shall show on either end an average of at least 6 annular rings per inch and at least one-third summer wood, or else the greater number of the rings shall show at least one-third summer wood, all as measured over the third, fourth and fifth inches on a radial line from the pith. Wide ringed material excluded by this rule will be acceptable, provided that the amount of summer wood as above measured shall be at least one-half.

The contrast in color between summer wood and spring wood shall be sharp and the summer wood shall be dark in color, except in pieces having considerably above the minimum requirement for summer wood.

(b) *Sound southern yellow pine* shall include pieces of southern pine without any ring or summer wood requirement.

RESTRICTIONS ON KNOTS IN BEAMS—Shall not have in Volume 1 sound knots greater in diameter, than one-fourth the width of the face on which they appear—maximum knot 1½ ins. Shall not have in Volume 2 sound knots greater in diameter than one-half the width of the face on which they appear—maximum knot 3 inches.

The aggregate diameter of all knots within the center half of the length of any face shall not exceed the width of that face.

The diameter of a knot on the narrow or horizontal face of a beam is to be taken as its projection on a line perpendicular to the edge of the timber. On a wide or vertical face, the smallest dimension of a knot is to be taken as its diameter.

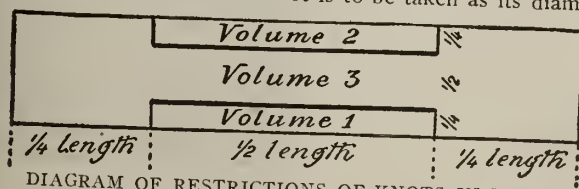


DIAGRAM OF RESTRICTIONS OF KNOTS IN BEAMS

RESTRICTIONS ON KNOTS IN COLUMNS—Shall not have sound knots greater in diameter than one-third the least width of the column—maximum knot 4 ins.

RESTRICTIONS ON SHAKES AND CHECKS IN BEAMS—Round

or ring shakes shall not occupy, at either end of a timber, more than one-fourth the width of green material, nor more than one-third the width of seasoned material.

Any combination of checks and shakes which would reduce the strength to a greater extent than the allowable round shakes will not be permitted. Shakes shall not show on the faces of either green or seasoned timber.

RESTRICTIONS ON CROSS GRAIN IN BEAMS—Shall not have diagonal grain with slope greater than 1 in 20 in Volume 1.

MERCHANTABLE TIMBERS—May be either dense or sound pine. All merchantable timbers shall be well manufactured and conform to the General Timber Specifications. (See preceding page.)

Sizes under 9 ins. on the largest dimension shall show two-thirds or more heart surface on one of the wide faces; sizes 9 ins. and over on the largest dimension shall show two-thirds or more heart on both of the wide faces. When sticks are square the face showing the most heart shall govern the inspection on sizes under 9 ins. and the two faces showing the most heart shall govern the inspection when 9 ins. and over. Heart showing the full length, even if not two-thirds of the area as above, shall meet the requirement of this quality.

Wane not exceeding one-eighth of the dimension of the face and one-fourth of the length of the piece on one corner, or the equivalent on two or more corners on not to exceed 10% of the pieces, shall be admitted.

SQUARE EDGE AND SOUND TIMBERS—May be either dense or sound pine.

Square edge and sound timbers shall be well manufactured and conform to the General Timber Specifications, admitting sound knots, and shall be free from wane.

No. 1 COMMON TIMBERS—May be either dense or sound pine. Common timbers, rough 4 by 4 ins. and larger, shall not be more than ¼ in. scant at any point when green, and be well manufactured, and may have 1½ ins. wane on one corner one-third the length of the piece, or its equivalent on two or more corners; the wane measured on its face.

Timbers 10 by 10 ins. in size may have 2 ins. wane as above; the larger sizes may have wane as above in proportion to sizes.

The diameter of any one knot shall not exceed 2 ins. in 4 by 4 to 6 by 6 ins.; 2½ ins. in 6 by 8 to 8 by 10 ins.; 3 ins. in 10 by 10 to 10 by 12 ins.; 3½ ins. in 12 by 12 to 12 by 14 ins.; 4 ins. in 14 by 14 to 14 by 16 ins.; 4½ ins. in 16 by 16 to 16 by 18 ins. In sizes not mentioned the diameter of knots admissible will increase or decrease in proportion to the size of the timbers on same basis as above specified.

In determining the size of knots, mean or average diameter shall be taken, or the equivalent of the above in grouped knots at any one point. Shakes one-sixth the length of the piece, small unsound knots and a limited number of pinworm holes, well scattered, are admissible.

Information.

Engineers, and others, are invited to consult the company for any information desired regarding qualities, uses and prompt availability of Bogalusa Brand material. An authoritative booklet, including the above and other specifications as well as tables of working unit stresses, load limits, etc., will be sent gratis on request.



SECTION OF 260-ACRE SAWMILL OPERATION, BOGALUSA, LA.

THE LONG-BELL LUMBER CO.

R. A. Long Building
KANSAS CITY, MO.

Products.

LONGLEAF and SHORLEAF SOUTHERN PINE LUMBER.

OAK LUMBER; OAK FLOORING.

CREOSOTED LUMBER including TIES, POSTS, POLES, PILING and WOOD BLOCKS.

CALIFORNIA WHITE PINE LUMBER including SASH and DOORS, SCREEN DOORS, 3-PLY VENEER and BOX SHOOKS.

Gum Lumber.

Long-Bell
THE MARK ON QUALITY LUMBER
TRADE-MARK

Among its universal uses are posts, girders, joists, flooring, dimension, boards, interior and exterior trim, ceiling, sash and doors, siding, framework, newel posts, sheathing, lath, wood blocks for floors and paving, etc.

Source of Supply and Facilities.

THE LONG-BELL LUMBER CO. operates 13 large, modern sawmill plants. Ten of them manufacture Southern pine: 6 of them are in Louisiana, 2 in Texas, 1 in Mississippi and 1 in Arkansas. There are 2 oak plants: 1 in Arkansas and 1 in Mississippi.

A most complete and up-to-date oak flooring plant is operated at Pine Bluff, Ark.

This company's white pine lumber, etc., are manufactured at Weed, Cal.

THE LONG-BELL LUMBER CO. has an aggregate annual capacity of 620,000,000 ft.

This company is the largest manufacturer of



ONE OF THIRTEEN SAWMILLS OF THE LONG-BELL LUMBER CO.

All Long-Bell mills are equipped with the latest type of lumber making machinery

Southern pine in the United States. Its product is branded with the trade-marked name *Long-Bell*.

The company's exceptional railroad facilities permit shipments with dispatch and immense reserve stocks are constantly on hand. All mills have common rates to all territories.

Scope of Use.

Southern pine is an all-purpose wood unequalled by any other in its wide range of adaptability.

Of all the lumber consumed in America, 36% is Southern pine.

Bulletin No. 99 of the United States Department of Agriculture, "Uses of Commercial Woods of the United States," says of Southern pine: "In a large part of the country it is so universally used that there are few places of importance it does not fill."

Its use ranges from beautiful interior trim and finish to the giant timbers of the heaviest construction.



ILLUSTRATING THE BEAUTY OF THE GRAIN OF SOUTHERN PINE

From an unretouched photograph. Stain or varnish enhances the grain, producing striking effects in interior trim. This wood is equally adaptable to painting and enameling

Advantages of Long-Bell Southern Pine.

United States Government tests show that long-leaf Southern pine has greater breaking, bending, shearing, crushing and tensile strength than any other wood generally used in building construction.

The illustration shown herewith furnishes a striking example of the remarkable bending and tensile strength of longleaf Southern pine. Southern pine is practically unequalled for durability. In the humid climate of the South there are hundreds of structures in a perfect state of repair that were built of Southern pine 100 years ago, and, in not a few instances, 150 years ago.



ILLUSTRATING THE REMARKABLE STRENGTH OF LONGLEAF SOUTHERN PINE

This pine was bent over in a storm by a falling tree. Though its top was pinned to the ground and its trunk twisted, the fibers remained intact

Grades of Southern Pine.

THE LONG-BELL LUMBER Co. specializes on such grades of timber as will meet all requirements for permanence, strength, safety and economy in mill construction work. Particular attention is given to structural timbers and this company is prepared to handle unlimited quantities of stock under the density specifications prescribed by the American Society for Testing Materials, from the largest sizes of posts and girders down to the 3-in. thickness of factory flooring.

For residential and small building construction, THE LONG-BELL LUMBER Co. produces Southern pine in all of the various grades adopted by the Southern Pine Association.



LONG-BELL TIMBERS MADE OF LONG-LEAF SOUTHERN PINE
Can be supplied in lengths up to 60 ft., either creosoted or untreated

Method of Finishing Southern Pine.

Southern pine takes and holds, perfectly, paint, stain, enamel and varnish, and so offers a wide variety of color schemes for architectural uses. Complete instructions for finishing will be sent on request.

Oak Flooring.

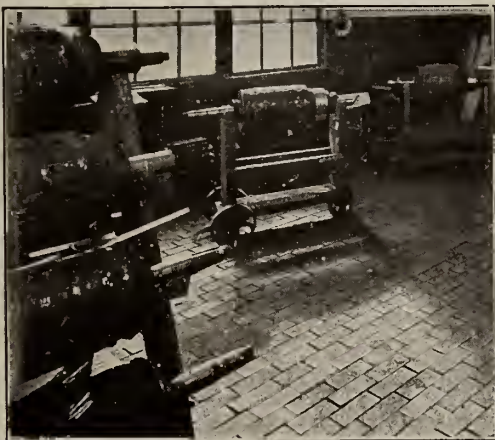
This company manufactures the famous Long-Bell forked leaf oak flooring, unsurpassed for beauty, wear and ultimate economy in interior floors. It is even in color and texture, superior as to grade and manufacture.

Creosoted Products.

THE LONG-BELL LUMBER Co. operates its own creosote treating plants and its unexcelled facilities enable it to make large shipments without delay. The exceptional qualities of Southern pine make it especially adaptable to the Long-Bell pressure-vacuum creosoting treatment.

Creosoted Wood Blocks.

Southern pine wood blocks, when creosoted by the Long-Bell process, make an ideal pavement for all industrial plants, barns, stables, garages, loading platforms, railroad shops, warehouses, driveways and streets. Under heavy traffic wood blocks are far more durable



FACTORY FLOOR OF LONG-BELL CREOSOTED WOOD BLOCKS
Long-Bell creosoted wood blocks make a factory floor that will withstand the heaviest use for a lifetime.
They also make an ideal floor for stables, driveways, garages, etc.

than other forms of paving and are sanitary, dustless, noiseless and economical, cutting upkeep to the minimum.

Creosoted Poles and Piling.

Long-Bell poles cut from selected longleaf Southern pine and treated under hydraulic pressure with distilled creosote are not an experiment. Many years of service in the United States and abroad have proved conclusively that poles properly treated with creosote in airtight cylinders, under hydraulic pressure, give far longer life than ordinary poles.

Creosoted Fence Posts.

Thousands of large estates and farms are being fenced yearly with Long-Bell creosoted fence posts, known as "The Post Everlasting." These posts are stronger, more durable and more attractive than any other fence posts ever placed upon the market. They are treated full length and give satisfactory service for a life time. They are branded on one end with the L-B mark.



LONG-BELL CREOSOTED BARN POLES AS USED IN GARAGE CONSTRUCTION

Creosoted Ties and Timber.

Southern pine hewed and sawn ties cut from our own timber and in our own mills and creosoted at Long-Bell creosoting plants are reducing maintenance-of-way costs for many large railways.

Long-Bell creosoted timbers for heavy construction—bridges, trestles, docks—can be supplied up to 60 ft. in length. Because Southern pine is a wood of extraordinary strength and durability, it is universally chosen for piling, trestles, beams, sills, sleepers, columns and joists used in all classes of construction. When creosoted by the hydraulic-pressure-vacuum process, the endurance of Long-Bell Southern pine timbers is limited only by their ability to resist mechanical wear.

California White Pine, Sash and Doors, etc.

THE LONG-BELL LUMBER Co. has long been interested in and has recently acquired the controlling interest of the Weed Lumber Company, Weed, Cal. This plant is well known for the high quality of its California white pine lumber, sash and doors, screen doors, 3-ply veneers and box shooks. THE LONG-BELL LUMBER Co. is now prepared to supply these materials.

Long-Bell Trade-mark.

The products of THE LONG-BELL LUMBER Co. are branded at the mills during the process of manufacture with the trade-marked name, *Long-Bell*, an assurance to the user that he is obtaining the best stock it is possible to make in modern plants and by a strict adherence to the most exacting grading rules.

Literature and Information.

Attractive literature and full information concerning this company's products will be sent to interested persons on request.

AMERICAN STEEL & WIRE COMPANY

Manufacturers of Triangle Mesh Concrete Reinforcement

SALES OFFICES

CHICAGO, 208 South La Salle Street
 WORCESTER, 94 Grove Street
 BOSTON, 120 Franklin Street
 PHILADELPHIA, Widener Building
 PITTSBURGH, Frick Building
 BUFFALO, 337 Washington Street
 DETROIT, Foot of First Street
 CINCINNATI, Union Trust Building
 CLEVELAND, Western Reserve Building

NEW YORK, 30 Church Street
 BALTIMORE, 32 South Charles Street
 WILKES-BARRE, PA., Miners Bank Building
 ST. LOUIS, Third National Bank Building
 ST. PAUL-MINNEAPOLIS, Pioneer Building, St. Paul
 OKLAHOMA CITY, State National Bank Building
 BIRMINGHAM, ALA., Brown-Marx Building
 DENVER, First National Bank Building
 SALT LAKE CITY, Walker Bank Building

EXPORT REPRESENTATIVES, UNITED STATES STEEL PRODUCTS CO., 30 Church Street, New York

PACIFIC COAST REPRESENTATIVES, UNITED STATES STEEL PRODUCTS CO., San Francisco, Los Angeles, Portland, Seattle

Product.

TRIANGLE MESH CONCRETE REINFORCEMENT.

For Wire Rope, see pages 78-84; for Wire Fencing, see pages 378-79; for Electric Wires and Cables, see pages 1092-1108.

Uses.

Triangle mesh reinforcement is used for floor and roof slabs, arch construction, dams and retaining walls, water and culvert pipe, pavements and roadways, river revetment, silos, fireproofing steel framing, bridge floors, reservoirs, sewers, and stucco work.

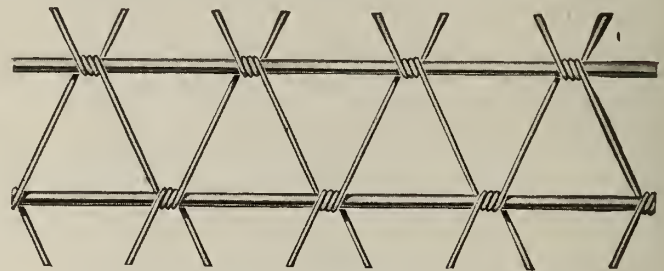
Description.

Triangle mesh woven wire reinforcement for concrete is made with either solid or stranded longitudinal members, properly spaced by means of diagonal cross wires, so arranged as to form a series of triangles between the longitudinal or tension members; the longitudinal members being spaced 4 in., the cross wires either 4 or 8 in. as desired, providing either a 4-in. or an 8-in. mesh.

The sizes of both longitudinals and cross wires are varied in order to provide the cross-sectional areas of steel required to meet the conditions.

Advantages.

- (1) Provides even distribution of steel.
- (2) Reinforces in every direction.
- (3) Tension or carrying members accurately spaced.
- (4) Low cost of inspection.
- (5) Properly distributes over a large area stresses due to concentrated load.
- (6) Due to cold drawing, higher elastic limits and ultimate strengths with same quality of steel.
- (7) Continuous action from one end of the structure to the other.
- (8) Impossible to leave out or otherwise reduce the necessary steel, if specific style number of fabric or area of steel is specified.
- (9) Perfect mechanical bond.
- (10) Easily handled and stored on the work.
- (11) Minimum cost of installation.
- (12) It is the only design of woven wire fabric in which the cross wires assist the longitudinal or tension members in carrying the load.
- (13) By using stranded longitudinals in the heavy fabrics the necessary strength is furnished, and the finished material is more flexible and therefore more easily handled from the rolls.



TRIANGLE MESH CONCRETE REINFORCEMENT
 Solid longitudinals

Grade of Steel.

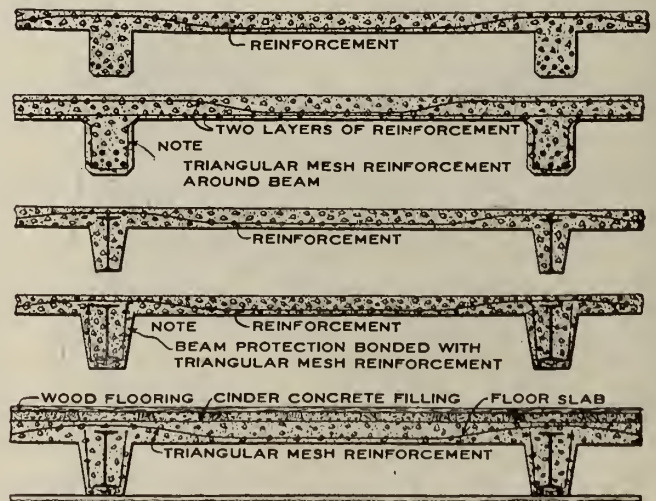
High carbon, high tensile strength steel has its advantages over the low carbon, low tensile strength steel, mainly because of the higher allowable working stresses; therefore, a smaller sectional area of steel is required, or, with the same sectional area of steel, an added factor of safety is secured.

The main disadvantage to a high carbon product is the stiff, brittle nature of the material.

By cold drawing a mild steel, the advantages of the high carbon steel are secured with an elimination of the disadvantages.

Triangle mesh reinforcement is manufactured from a cold drawn mild steel having an ultimate tensile strength of from 70,000 to 85,000 lbs. per sq. in.

Higher or lower strengths can be furnished if desired.

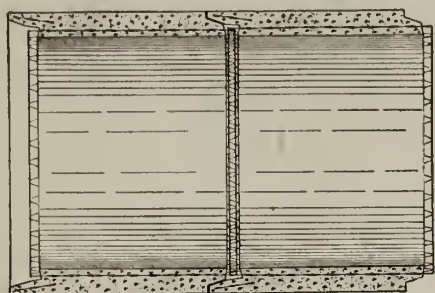


TYPES OF FLOOR CONSTRUCTION

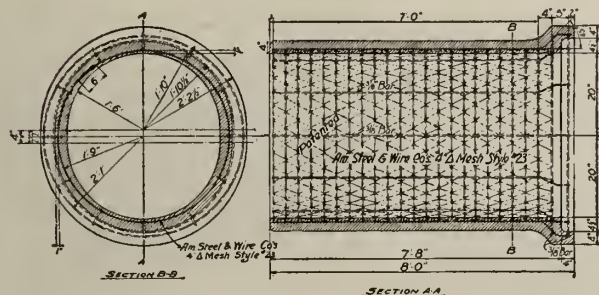
Triangle mesh reinforcement can be furnished either plain or galvanized.

Except for special cases, the plain material is preferable, as the adhesion of the concrete is then directly to the steel and not to a coating.

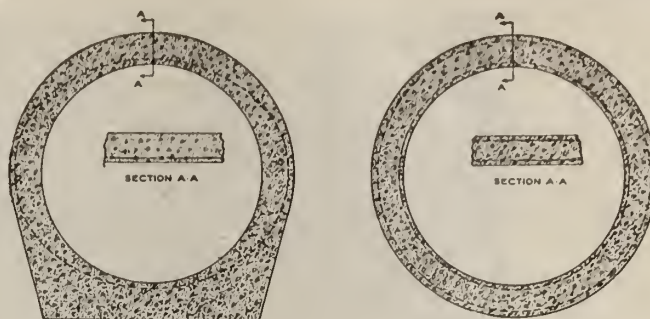
Galvanized material must of necessity cost more; and since nothing is added to the strength of the finished construction, this increased cost is not justified.



MERIWETHER SYSTEM REINFORCED CONCRETE PIPE,
LOCK JOINT PIPE CO., NEW YORK
Reinforced with Triangle mesh



TRIANGLE MESH REINFORCED CONCRETE PIPE AS MADE BY
C. F. MASSEY CO., CHICAGO



One Layer of Triangle Mesh Reinforcement

Two Layers of Triangle Mesh Reinforcement

TYPICAL SEWER SECTIONS
Note continuous reinforcement

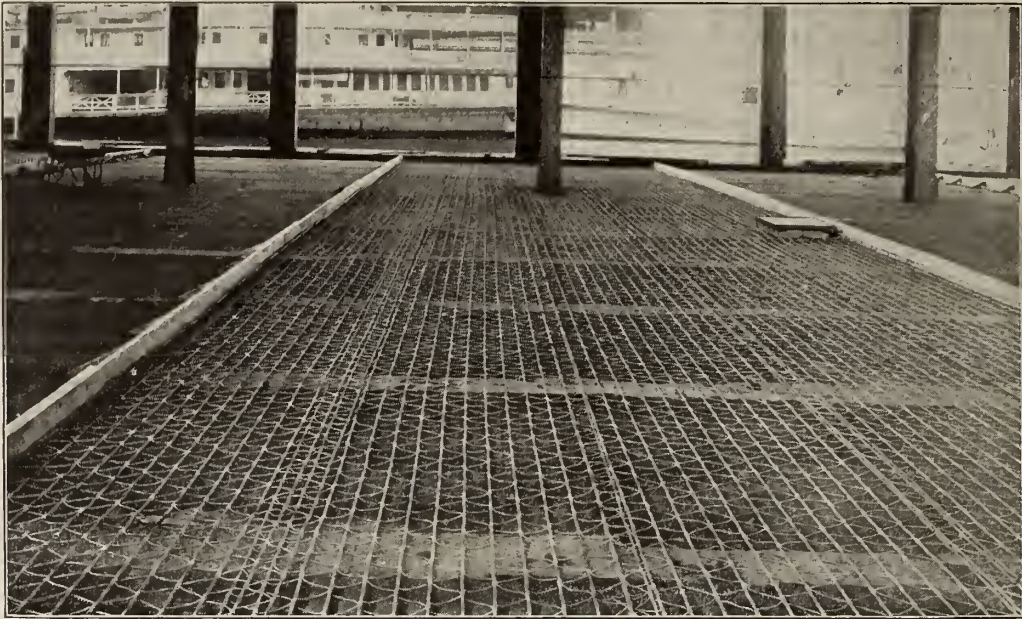


TRIANGLE MESH REINFORCED
CONCRETE PIPE AS MADE BY
THE INDEPENDENT CONCRETE
PIPE CO., INDIANAPOLIS, IND.



KAW RIVER IMPROVEMENT, KANSAS CITY, MO.

2,000,000 sq. ft. AMERICAN STEEL & WIRE COMPANY'S Style 28 Triangle Mesh Reinforcement used in this work



PIER 42, NORTH RIVER, 56,000 SQUARE FEET, STYLE 40, TRIANGLE MESH REINFORCEMENT USED

Note the large area of reinforcement with its heavy stranded longitudinals. Excellent results obtained with minimum installation cost

Triangle Mesh Wire Reinforced Concrete Pavements and Roadways.

This rapidly increasing form of construction renders the following data and specifications of great value and assistance to consulting engineers, contractors and municipal authorities.

NECESSITY FOR REINFORCING CONCRETE ROADWAYS—It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time, a fabric of steel must be incorporated in the concrete. Several great states have so ruled.

Reinforced concrete is the future type of roadway construction, since it is obvious that only the most permanent and rigid form of construction will be adopted, and this being the only type that will withstand the constantly growing motor traffic. Many miles of reinforced concrete roads already placed and thoroughly tried have met the test.

ADVANTAGES OF REINFORCING WITH WIRE MESH—The concrete is bound with the strength of the steel so that to the granite nature of the concrete is added the structural steel power of a bridge. The steel fabric keeps the parts of the slab from separating in case cracks are formed, also overcomes the danger of cracking due to spongy soil such as that of Illinois, or where there is improper drainage and otherwise defective foundations; also cracking due to changes of temperature. And finally, the possibility of reduction in the thickness of the concrete slab.

The fabric is so constructed as to give the degree of flexibility demanded where the slab to be reinforced is relatively thin, as in road work.

The indeterminate stresses set up in a concrete road by heat, cold and moisture conditions, as well as the concrete setting, produce contraction and expansion in the concrete, which in time tends to make unsightly and dangerous cracks which may eventually cause disintegration of the concrete and finally the failure of the entire road. There is also always the danger of a sinking subsoil which brings about the same cracks unless proper amount of reinforcing is used.



TRACTOR POWER AND MAINTENANCE COST SAVED BY REINFORCED CONCRETE PAVEMENTS IN AND AROUND INDUSTRIAL PLANTS

Value of this class of construction for distribution of shop materials demonstrated at Santa Fe shops, Topeka, Kans.

It has been proved that a 7-in. reinforced concrete road with the AMERICAN STEEL & WIRE COMPANY'S Triangle Mesh wire reinforcement is stronger and better in every way than an 8-in. road without reinforcing. The cost of 1 in. of additional concrete will pay for the reinforcing required.

RELATIVE COST OF MAINTENANCE OF DIFFERENT KINDS OF ROADS—New York state shows interesting figures of relative costs.

For the period of January, 1915, to December, 1918, the maintenance expense of roads is given as follows:

	Per Mile per Year
284 miles of brick roads.....	\$210.00
2793 miles of bituminous macadam, penetration method	490.00
2451 miles water bound macadam.....	911.00
173 miles gravel macadam.....	843.00
208 miles concrete roads.....	138.00

RELATIVE GASOLINE CONSUMPTION ON VARIOUS KINDS OF ROADS—Actual road tests prove that gasoline

consumption is as much as 50% less per mile as compared with other forms of road.

In co-operation with the White Company, tests were recently made at Cleveland, Ohio, to determine the gasoline consumption of loaded 2-ton motor trucks over various types of roads, with the following results:

	Miles per Gallon
Earth road.....	5.78
Fair gravel road.....	7.19
Good gravel road.....	9.39
Bituminous macadam.....	9.48
Fair brick road.....	9.88
Good brick road.....	11.44
Concrete road.....	11.78

The sinkages in a concrete road that is not reinforced add to the vibration of the car and increase the fuel consumption. The reinforcement holds the surface true as well as binding the body of the concrete with the strength of steel.

COST OF CONCRETE MATERIALS WITH REINFORCING INCLUDED—The enormous increase in the cost of concrete materials within the last few years and the additional strength required for heavy motor car traffic are points in favor of a more extended use of reinforcement.

The following comparative statement of road building cost in Massachusetts compiled by the State Highway Commission shows the fluctuations in the price of concrete and other materials from 1916 to 1919. Concrete shows an increase from \$15.00 to \$24.33 per cu. yd. The price of reinforcing has increased from \$1.50 to \$2.75 a hundred pounds, f. o. b. Pittsburgh:

	1916	1918	1919
Earth excavation, per yard.....	\$0.77	\$1.50	\$1.36
Ledge, per yard.....	2.50	4.50	3.92
Borrow, per yard.....	.82	1.63	1.27
Local broken stone, per yard.....	1.86	2.90	3.05
Trap rock (by rail), per yard.....	2.57	3.60	4.13
Bituminous, application, sq. ft.....	.06	.10	.08
Concrete, 1: 2½: 5, per cu. yd.....	15.00	23.33	24.33
10-in. vitrified pipe, ft.....	.75	1.00	1.10
Catchbasins, each.....	37.00	50.00	62.50

It will readily be seen from these figures that under certain conditions reinforcing may be used without any material increase in the cost of construction through saving of concrete; in fact, its use may result in actual saving besides adding materially to the durability and strength of the slab and providing a factor of safety to guard against unknown demands of future heavy motor car traffic and maximum of service with lowest cost of upkeep.

The use of heavy bars as reinforcing for roads is very unsatisfactory and costly owing to a waste of steel by placing too large an amount in one place. The steel should be distributed as thoroughly as possible throughout the concrete in order to take care of any fine cracks which may form. Triangle Mesh does this in an ideal manner.

Reinforcing the concrete road with Triangle Mesh also makes it possible to place the expansion joints much farther apart. A decided saving and a valuable advantage.

TRIANGLE MESH REINFORCED PAVEMENTS USED EVERYWHERE—Triangle woven wire reinforcement is in use wherever concrete roads are built. Many millions

of yards of this material have been placed in roads North, South, East and West, and its use is increasing enormously. It meets all the requirements of a perfect road reinforcement.

After many years of practical experiments and careful inspection of concrete roads in every part of the country, it is now the positive belief of every good concrete engineer that no concrete road should be built without being properly reinforced with a cold drawn wire fabric.

Many state road engineers in their standard specifications require wire reinforcing in all their concrete roads, and this demand is growing rapidly.

The standard specifications of the American Concrete Institute and the American Society for Testing Materials (the two societies of highest authority on concrete in the world) specify reinforcing and recommend it highly in every concrete road.



REINFORCED CONCRETE ROADWAY, DE KALB, ILL.
A. N. JOHNSON, State Engineer

TESTIMONIAL UNDER EXTREME CONDITIONS—Pavement 12 miles long, U. S. Proving Ground, Aberdeen, Md., has received the traffic of heavy tractors hauling big guns and tons of ammunition and testing materials. *The reinforcement fabric saved the pavement.*

That reinforced concrete is best adapted to meet the growing demands of future traffic is shown by this pavement, than which nothing in the country can show a heavier loading. On account of the unstable subgrade, and of the almost continuous vibration of the ground due to test firing of heavy cannon while the pavements were under construction, the concrete was proportioned 1: 1½: 3 and reinforced with our woven wire fabric. *On one stretch laid on a fill and always carrying the heaviest traffic, the slabs have settled ¼ of a foot without any cracks developing.* This is especially interesting to Illinois where the subsoil is very spongy.

EXTRACTS SHOWING WHY WIRE MESH REINFORCING SHOULD BE USED—From *Specifications of Second National Conference on Concrete Roads*—

Reinforcing: The use of reinforcing in concrete pavements is increasing.

From Report on Joplin, Mo., Roads—

The pavement has been down over a year now and has fulfilled all expectations. There are no cracks, and the surface shows no wear. It is reinforced with Style 27 Triangle Fabric.

*Paper Read by H. S. Van Scoyoc, M. A. S. C. E.,
Chief Engineer, Canadian Highway Commission—*

Station Street, Oakville, was paved in 1914. In about a mile there is only one spot where a crack has developed, and it is known there is a spring there. The work is reinforced and the crack has not opened to any extent. It has required no repairs to date.

Compare above with below, by the same author in the same paper:

Several miles of concrete road were laid in 1911 and 1912 near Winnipeg. It was laid on the natural soil. It developed transverse cracks about every 30 ft. and also a number of longitudinal cracks. The second winter opened up the longitudinal cracks until many of them were more than an inch wide. By another spring some of them looked like gullies. *This road was not reinforced.*

*Discussion before the A. S. C. E., Vol. 39, No. 7.
Sanford E. Thompson, M. A. S. C. E.—*

One of the problems to be considered in concrete pavements is that of contraction and expansion due to temperature changes. Contraction from lowering temperature causes cracks not only in concrete, if not reinforced, but also in brick and stone work.

*An article by A. T. Goldbeck, Engineer of Tests,
U. S. Dept. of Agriculture on "Causes of Cracks in Concrete Pavements"—*

Naturally as friction can best be developed along the length of the road, temperature changes and moisture are promotive of transverse cracks rather than longitudinal cracks.

Sliding of the concrete on the subbase develops frictional resistance of considerable magnitude—when this exceeds the tensile strength of the concrete a crack must form.

Extract from report of B. Woodyard, Chief Engineer of Wood County, West Va.—

The 1916 work will depart from past practice in that the roads will be reinforced. The engineer decided on this change because of a conviction that the addition of reinforcement will lengthen the life of the road and reduce the maintenance cost.

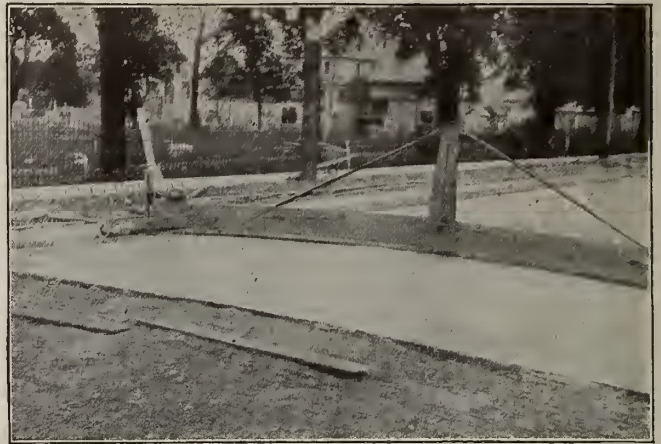
Extract from Bulletin No. 249, U. S. Department of Agriculture, Portland Cement Concrete Pavements by Moorefield and Voshell, Engineers—

Probably the most satisfactory method in point of efficiency for reducing objectionable cracks in concrete pavements is that of employing steel reinforcing. The reinforcing usually consists of woven wire or some similar material.

TYPICAL SPECIFICATIONS—Reinforcing Materials—The reinforcement for concrete pavement shall consist of woven steel



REINFORCED CONCRETE PAVEMENT, CONNERSVILLE, IND.
W. F. RIDPATH, City Engineer
GREENWOOD, CONNOR, BOOTS & GANT, Contractors
585 sq. ft. Triangle Mesh Reinforcement used



RESURFACING WITH REINFORCED CONCRETE, KIRKSVILLE, MO.

The 2-in. bitulithic top was removed and over the 5-in. concrete base (11 years old) was placed 4 in. of new concrete reinforced with Triangle Mesh Reinforcement weighing 45 lbs. per 100 sq. ft.

wire fabric. This material shall be manufactured from steel which shall develop an ultimate tensile strength of not less than 70,000 lbs. per sq. in., and shall bend 180° around one diameter and straighten without fracture; all reinforcement shall be free from excess rust, scale, paint or coating of any character which will tend to prevent its bond with the concrete.

Fabric reinforcement shall weigh not less than —* lbs. per 100 sq. ft.

In no case shall the parallel wires be spaced farther apart than 8 in.

*The State Highway Departments of New York and Pennsylvania require all concrete roads to be reinforced and will not allow the use of any fabric weighing less than 25 lbs. per 100 sq. ft.; however, many other states require not less than 40 or 45 lbs.

Always specify by weight and not by sectional areas.

Placing Reinforcement—The reinforcing fabric shall be placed not less than 2 in. below the finished surface with the main or heavy wires running crosswise of pavement. It shall extend to within 2 in. of all joints and 2 in. of the edges of pavement. Adjacent widths of fabric shall be lapped at least 4 in., and where more than a single length of fabric is required to extend across the pavement, the end laps of these strips shall be at least 12 in.

The weights and other characteristics of the various styles of Triangle Mesh reinforcement are given in the tables on following page.

Machines for Flattening Reinforcement.

The reinforcement is purchased in rolls and flattened on the job. The cost to straighten the fabric by means of these rolls varies from ¼¢ to ½¢ per sq. yd. of pavement. Straightening and cutting on the job, reinforcement is in much better condition than when shipped flat.



MACHINE FOR FLATTENING CONCRETE REINFORCEMENT IN ROLLS, HAND OPERATED

Flattening rolls recommended for paving work supplied without framework



REINFORCED CONCRETE PIECE CONSTRUCTED COLUMNS AND GIRDERS
Being erected in place by Union Stock Yard & Transit Co., Chicago. Triangle Mesh Reinforcement used

DATA, VARIOUS STYLES TRIANGLE MESH REINFORCEMENT
NUMBER AND GAGE OF WIRES, AREAS PER FOOT, WIDTH AND WEIGHTS PER 100 SQ. FT.
LONGITUDINALS SPACED 4 IN.

Style No.	No. of wires, each longitudinal	Gage of wire, each longitudinal	Sectional area of longitudinal, sq. in. per ft. width	Total effective longitudinal sectional area, sq. in. per ft. width	Approximate weight, lbs. per 100 sq. ft.
CROSS WIRES NO. 14 GAGE, SPACED 4 IN.					
032	1	12	.026	.032	22
040	1	11	.034	.040	25
049	1	10	.043	.049	28
058	1	9	.052	.058	32
068	1	8	.062	.068	35
080	1	7	.074	.080	40
093	1	6	.087	.093	45
107	1	5	.101	.107	50
126	1	4	.120	.126	57
146	1	3	.140	.146	65
153	1	¼-in.	.147	.153	68
168	1	2	.162	.168	74
180	2	6	.174	.180	78
208	2	5	.202	.208	89
245	2	4	.239	.245	103
267	3	6	.261	.267	111
287	3	5½	.281	.287	119
309	3	5	.303	.309	128
336	3	4½	.330	.336	138
365	3	4	.359	.365	149
395	3	3½	.389	.395	160

Style No.	No. of wires, each longitudinal	Gage of wire, each longitudinal	Cross-sectional area, sq. in. per ft. width	Sectional area of longitudinal, sq. in. per ft. width	Approximate weight, lbs. per 100 sq. ft.
CROSS WIRES NO. 14 GAGE, SPACED 8 IN.					
036P	1	12	.009	.036	17
044P	1	11	.009	.044	20
053P	1	10	.009	.053	24
062P	1	9	.009	.062	27
072P	1	8	.009	.072	31
084P	1	7	.009	.084	35
097P	1	6	.009	.097	40
CROSS WIRES NO. 12½ GAGE, SPACED 8 IN.					
041R	1	12	.014	.041	21
049R	1	11	.014	.049	24
058R	1	10	.014	.058	28
067R	1	9	.014	.067	31
077R	1	8	.014	.077	35
089R	1	7	.014	.089	40
102R	1	6	.014	.102	44

Length of rolls: 150, 200 and 300 ft. Rolls of any of these lengths may be used for the lighter styles. Material of medium weight is recommended to be used in 150-ft. or 200-ft. lengths, while with heaviest styles it is more conveniently handled in rolls of 150-ft. lengths.

Widths: 16, 20, 24, 28, 32, 36, 40, 44, 48, 52 and 56 in.

NOTE.—Material may be furnished either plain or galvanized. Unless otherwise specified, shipments will be made of material not galvanized.



MONROE STREET BRIDGE, SPOKANE, WASH.

Double tracked highway bridge requiring 25,000 yds. concrete. Cost, \$500,000.00. 100,000 lbs. of AMERICAN STEEL & WIRE COMPANY'S Triangle Mesh Reinforcement used in the floor construction of this bridge

THE BERGER MANUFACTURING CO.

Reinforcing and Metal Building Materials

CANTON, OHIO

BRANCHES

BOSTON, MASS., 160-166 Broadway Extension
CHICAGO, ILL., 20 North Market Street
MINNEAPOLIS, MINN., 300-312 10th Avenue, South
NEW YORK, N. Y., 516-524 West 25th Street

PHILADELPHIA, PA., 16th Street and Washington Avenue
SAN FRANCISCO, CAL., 1120 Mission Street
ST. LOUIS, MO., 16 South Tenth Street
KANSAS CITY, MO., 20th Street and Tracy Avenue

EXPORT DEPARTMENT: Berger Building, NEW YORK, N. Y.

Products.

BERLOY FLOOR-CORES; BERLOY $\frac{3}{4}$ -IN. RIB-
PLEX; BERLOY MULTIPLEX; BERLOY FERRO-
LITHIC; BERLOY METAL LUMBER; BERLOY
 $\frac{3}{8}$ -IN. RIBPLEX; BERLOY EXPANDED METAL
LATH.

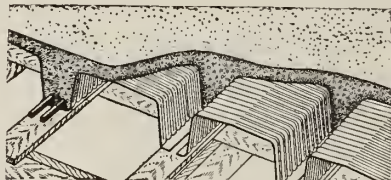
Berloy Corner Bead, and other Pressed Steel
Products.



Berloy Floor-Cores.

These pressed steel forms supply centering for T-
beam concrete floors in spans up to 30 ft. for live loads
up to 200 lbs.

Berloy Floor-
Cores are made of
Nos. 26- and 22-
gauge steel, in
lengths of 30 and 36
in.; in widths of 20
and 25 in.; and in
depths of 4, 6, 8, 10,
12 and 14 in.

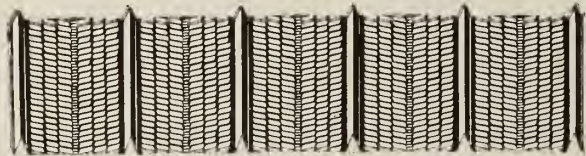


BERLOY FLOOR-CORES

Berloy $\frac{3}{4}$ -in. Ribplex.

This is an expanded metal lath with $\frac{3}{4}$ -in. ribs,
which answers for both centering and reinforcing in flat,
pitched and sawtooth roofs, in walls, ceilings, partitions
and floors.

Ribplex plates are carried in stock in Nos. 24-, 26-
and 28-gauge, in lengths of 4, 5, 6, 7, 8, 9, 10, 11 and 12
ft. Covering width, 24 in. Made of steel or Toncan
metal.



SECTIONS ACROSS PLATE TO SHOW RIBS AND MESH OF
BERLOY $\frac{3}{4}$ -IN. RIBPLEX

Berloy Ferro-Lithic.

These reinforcing plates are made of Nos. 24- and
26-gauge metal.

The dovetail corrugations, $\frac{1}{2}$, $\frac{5}{8}$ or $\frac{3}{4}$ in. deep,
give a firm clinch with plaster or concrete.

Ferro-Lithic is used for roofing, siding, floors,
lining for coal bunkers, etc. It forms a weathertight
job even without concrete.

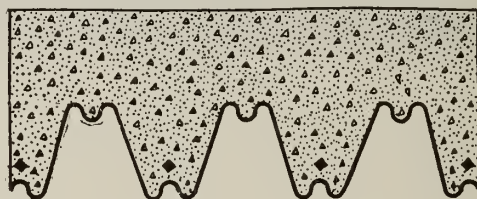


SECTION ACROSS END OF STANDARD FERRO-LITHIC PLATE,
TO SHOW DETAIL OF PLATE AND CONSTRUCTION

Berloy Multiplex.

These Nos. 16- to 24-gauge steel reinforcing
plates are curved, as shown below, for heavy
floor construction.

Multiplex is extensively used in powder
mills, sugar refineries and other places where a
clean ceiling, free from droppings, is essential.

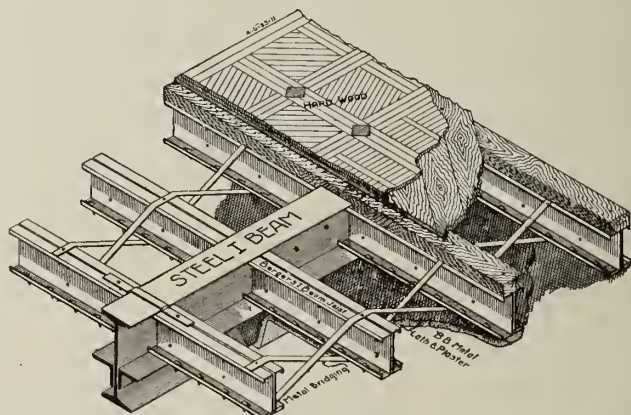


BERLOY MULTIPLEX REINFORCING PLATE

Berloy Metal Lumber.

This is a system of joists and studs of pressed steel
—a light, strong fireproof construction.

The members are made in many sizes and weights
to conform to requirements, and cut to size from stock
at the factory. Bulletin No. 12 gives complete informa-
tion.

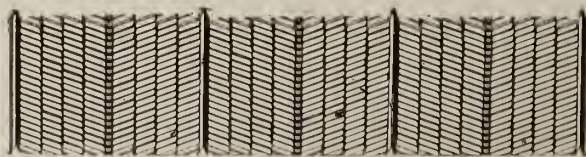


DETAIL OF STANDARD FLOOR CONSTRUCTION

Berloy $\frac{3}{8}$ -in. Ribplex.

For all straight run lathing partitions, outside walls
and ceilings, $\frac{3}{8}$ -in. Ribplex has proven itself the ideal
material to use.

It is an expanded lath with ribs $\frac{3}{8}$ -in. deep on $\frac{3}{8}$ -in.
centers, which give great stiffness. Made in sheets 8 ft.
long; covering width, 24 in.



SECTIONS ACROSS PLATE TO SHOW RIBS AND MESH OF
BERLOY $\frac{3}{8}$ -IN. RIBPLEX

WICKWIRE SPENCER STEEL CORPORATION

Manufacturers of Electrically Welded Wire for Concrete Reinforcing

WORCESTER, MASS.

BUFFALO, N. Y.

BRANCH OFFICES

NEW YORK, N. Y., 120 Broadway
CHICAGO, ILL., 33 West Austin Avenue

PHILADELPHIA, PA., 410 Commerce Street
SAN FRANCISCO, CAL., 111 Townsend Street

Products.

"CLINTON" ELECTRICALLY WELDED WIRE FABRICS for Reinforcing Concrete.

"Clinton" Woven Wire Lath; "Clinton" Welded Sheathing for interior plastering and stucco work; Wire Cloth, Netting and Perforated Grilles and Metals of all kinds.

For Wire Rope, see page 85.

Electrically Welded Wire Fabric.

SCOPE OF USE—"Clinton" welded fabric is especially adapted for roofs, floors, walls, roads, sidewalks, sewers, reservoirs, levees and all kinds of slab construction.

This material is also used to advantage in all kinds of work involving the covering or protection of steel with concrete, as in buildings, bridges, subways and tunnels.

THE MATERIAL—"Clinton" electrically welded fabric is a wire mesh made up of a series of parallel longitudinal steel wires, spaced certain distances apart and held at intervals by means of transverse wires arranged at right angles to the longitudinal wires, to which they are welded by a patented electrical device. The intersecting wires are actually fused together by electricity, producing thereby an immovable connection between the wires.

This at all times assures a rigid mesh.



"CLINTON" ELECTRIC WELD

In this view the two wires have been cut through at their point of union, revealing a perfectly smooth surface. It is a perfect weld; the two wires are actually fused together.

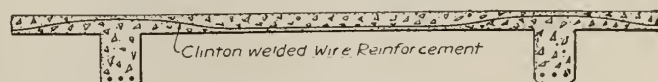
THE WIRE—"Clinton" electrically welded fabric is fabricated from a special grade of good quality steel wire possessing such strength, elasticity and ductility as to render it especially adapted to structural use. The wire will develop an average ultimate strength of 70,000 to 80,000 lbs., with a maximum, in some cases, of 85,000 lbs. per sq. in.

GALVANIZING—Unless otherwise ordered, "Clinton" electrically welded fabrics are made from wire which has been galvanized before being welded. If galvanizing is not required, these fabrics can be made from plain steel longitudinal wires and galvanized transverse wires.

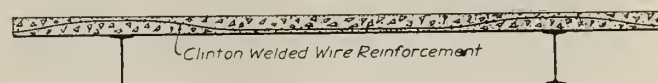
Reinforced Concrete Slabs.

Because of the unaccountable strength of short span slabs as shown by actual tests, the city of New York, after long consideration of the subject, has finally

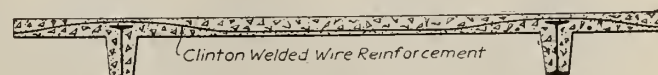
adopted an empirical formula to be used in designing slabs of 8-ft. span and less when confined between steel beams. This formula is for the conditions of continuous wire mesh reinforcement, and the designs shown are therefore in accord with the regulations now in force in New York City.



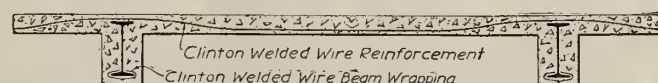
Slab Supported on Concrete Beams



Slab Supported on Top of Steel Beams



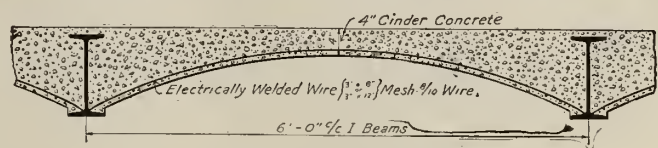
Steel Beams with Concrete Haunches



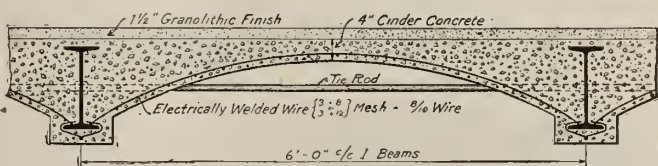
Steel Beams with Complete Concrete Fireproofing



Fireproof System Showing Finished Floor and Ceiling



Segmental Arch Construction



Segmental Arch Construction

REINFORCED CONCRETE SLABS

Information and Special Publications.

For complete information concerning "Clinton" structural products, write for special publications:

"Concrete Floors," and "Miscellaneous Construction," illustrating the uses of "Clinton" welded wire; "Handbook on Lath and Plaster," describing wire lath and giving complete specifications for furring, lathing and plastering; also other booklets describing sizes and uses of welded sheathing and other specialties.

COMPOSITE METAL LATH CO.

110 West 40th Street
NEW YORK, N. Y.

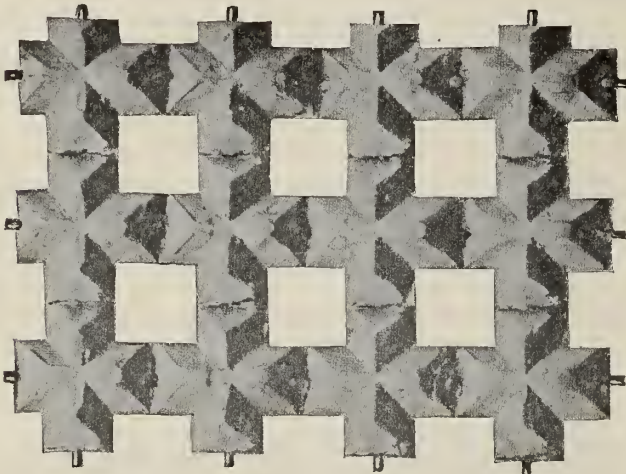
CHICAGO OFFICE, 6 North Michigan Avenue PHILADELPHIA OFFICE, 1619 Chestnut Street

Products.

BRIKLATH or "COMPOSITE METAL LATH," a Brick Covered Metal Lath; a Plastering Base; Monolithic Partition Base; Structural Fireproofing Base; Boiler Insulating Base; Pipe and Electric Cable Fireproofing Base.

Briklath or "Composite Metal Lath."

A mesh of annealed wire, upon which brick clay has been placed under high pressure and baked, so as prac-



A FULL SIZE SECTION FROM A SHEET OF BRIKLATH

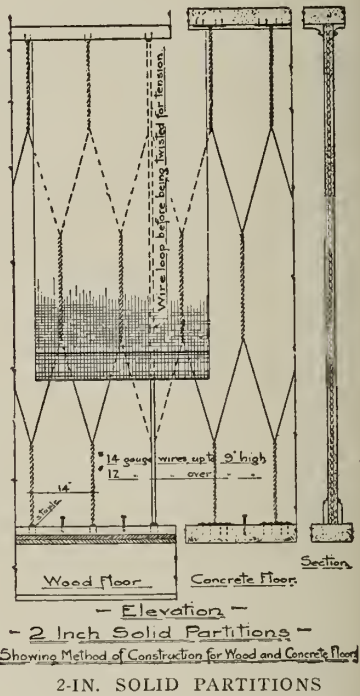
tically to enclose the wire. A plastering base that insures a positive bond as well as an ideal key through the openings without loss of material by pushing through.

A self-centering, fireproof lath that may be used wherever metal lath is applicable; that is easy to apply; economical of material and inexpensive in cost.

Standard sheets are 16 ft. 4 in. long by 40 in. wide, and are shipped in rolls containing 6 sq. yds., weighing 55 lbs. Special lengths furnished to order.

Special Uses.

BRIKLATH 2-IN. SOLID PARTITIONS—These are rigid and economical; eliminating the use of angles, channels and studs and producing a solid slab in which the plaster is not weakened at regular intervals by the ordinarily necessary members. The lath is secured to wires drawn drum-tight from ceiling to floor along the center line of the partition and an equal quantity of plaster is assured on each side of the base. These walls are less sound reverberating than hollow walls, less susceptible to settlement cracks than the channel studded solid partitions and are approved by the New York City Building Department for use in fireproof buildings.



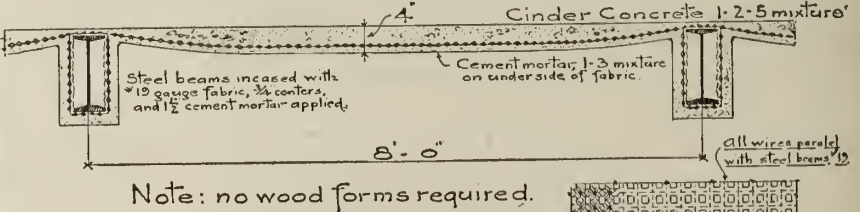
FIREPROOFING MILL CONSTRUCTION FRAME BUILDINGS—Posts are wrapped with Briklath and plastered.

The brick firmly baked onto the wire mesh bonds with the cement, holding it securely in place under any degree of heat.

ELEVATOR ENCLOSURES—Briklath 2-in. solid partitions are especially recommended for elevator and hatchway enclosures; not only for their fireproof qualities, but



METHOD OF ERECTING WIRE SUPPORTS FOR 2-IN. MONOLITHIC PARTITIONS ON BRIKLATH



Total Load lb	Steel Area Lin foot	Fabric.	Kind of Building
135	.111	13 gauge 3/4 4	Office
188	.154	do 10 gauge 2 1/4 4	Loft
117	.0955	14 do 12 4	Residence

DETAIL OF FIREPROOF FLOOR CONSTRUCTION

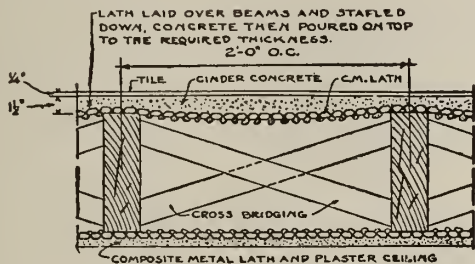


Fireproof Floor of Concrete Reinforced with brick fabric reinforcement

for the advantages they present in the saving of space and in the saving of cost.

SURFACING CONCRETE FOR PLASTERING—Briklath laid in the forms in which concrete is to be placed bonds securely to the concrete, and when the forms have been removed presents a clay surface for the application of finish plaster.

TILE AND CONCRETE FLOORS OVER FRAME CONSTRUCTION—Sheets of Briklath are drawn taut over the top of floor timbers, as shown in details, and stapled down. The required depth of concrete is then placed and finished as desired.



TILE FLOOR ON CINDER CONCRETE ON BRIKLATH

BOILER COVERINGS—Portions of the boiler where insulation is desired are covered with Briklath, securely wired in place, and plastered to the desired thickness with any refractory cement or with magnesia or asbestos plastic compositions, as may be preferred. The perfect bond between the covering and the base insures the permanency of the mass, and the physical characteristics of Briklath results in a mass of dead air cells between the body of the boiler and the covering, which materially increase its insulating properties.

PIPE AND ELECTRIC CABLE CONDUIT FIREPROOFING—For these purposes the lath is cut in strips of convenient width, and is wrapped spirally about the pipe or cable, the lath being securely wired. A 2 to 1 mixture of portland cement is then applied to a thickness of $\frac{5}{8}$ in. This method has been efficiently used by the New York Edison Co., United Electric Light and Power Co. of New York, and the Edison Companies of Brooklyn, Boston and Detroit; also by other large corporations.



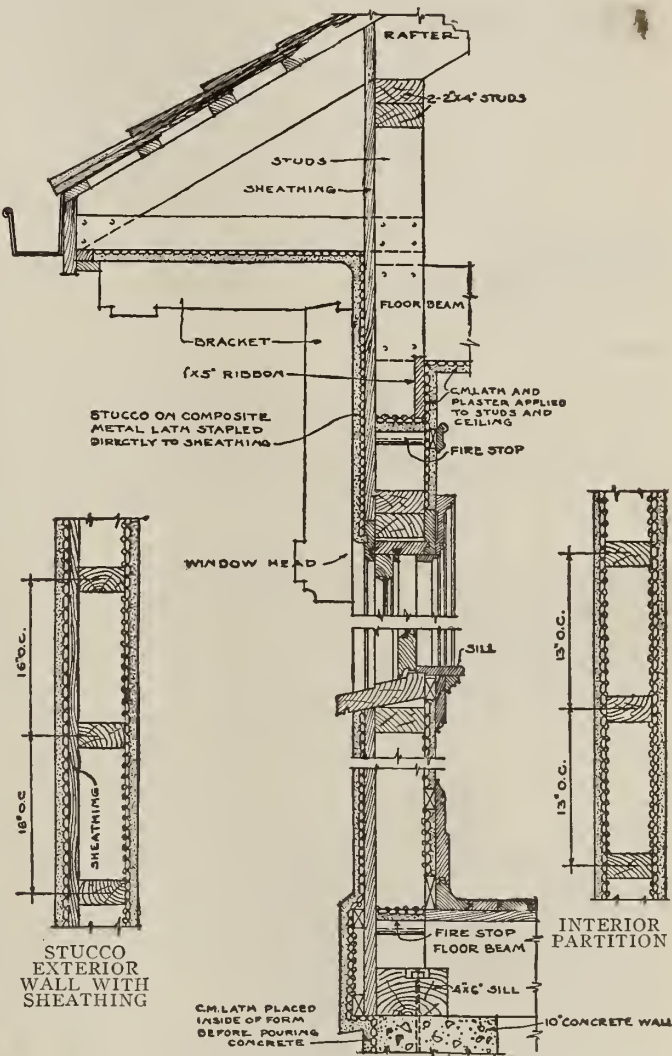
BRIKLATH USED AS A BASE FOR CEMENT FIRE PROTECTION ON $2\frac{1}{2}$ -IN. ELECTRIC CABLE

WORKMEN'S HOMES—Briklath effectively solves the problem of durable, practical and sightly homes at low cost.

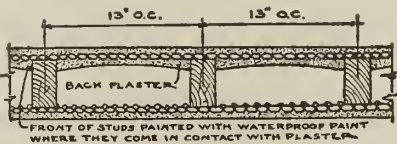
Briklath is self-furring and may be applied directly to the sheathing, some waterproofing material usually being interposed.

Method of Attaching.

Ordinary forms of metal lath must of necessity be attached to their support around the metal which, rusting away at such points, leaves the stucco slab unsecured and results very soon in cracks and falling stucco. Briklath, on the contrary, is attached by means of staples or tie wires placed diagonally over the little bricklets which serve as permanent anchors in the cement mass, and hold the stucco sheet in place even if the wire should in time disintegrate. This feature alone makes Briklath the best possible base for stucco.



SECTION THROUGH WALL OF FRAME BUILDING



STUCCO EXTERIOR WALL WITHOUT SHEATHING

General Application.

Briklath may be applied, in general, in much the same way as ordinary metal lath. More complete specifications covering specific applications will be forwarded on request.

CONCRETE STEEL COMPANY

42 Broadway
NEW YORK, N. Y.

SALES OFFICES

CHICAGO	BIRMINGHAM	PHILADELPHIA	BOSTON	CLEVELAND	SYRACUSE
DETROIT	ST. LOUIS	KANSAS CITY	OMAHA	MINNEAPOLIS	EL PASO
HARTFORD		BALTIMORE	NORFOLK	WASHINGTON	

WAREHOUSES AND FABRICATING WORKS

YOUNGSTOWN	PHILADELPHIA	NEW YORK	BOSTON	CHICAGO
BIRMINGHAM	ST. LOUIS	KANSAS CITY		DETROIT

Products.

HAVEMEYER DEFORMED BARS (patented) for Reinforcing Concrete; COLLAPSIBLE SPIRALS for Columns; TY-CHAIRS; BAR-TYS; EASEL CHAIRS; SECURO BAR SPACERS; BEAM SADDLES and SEPARATORS; HY-CHAIRS; SLOTTED, DAYTON ADJUSTABLE and "Y" SOCKET CONCRETE INSERTS; ROUND and ANGLE NOSE CURB BARS; SECURITY WALL-TY and ANCHOR.

Fabricated Unit Frames; X-Tension Soffit Clips; Chair Spacers; "Sanitread" Safety Treads.

Engineering.

The CONCRETE STEEL COMPANY maintains experienced and efficient Engineering Departments in its district sales offices for the use of customers. These Engineering Departments would be glad to co-operate in making up designs, estimates and plans on any type of reinforced concrete structure.

Description of Havemeyer Bars: Rounds, Squares, Flats.

Rolled deformed bars with the axes of the projections, forming the mechanical bond, parallel to the axis of the bar; designed to secure at all points constant uniform area of cross section equal to area of cross section of a plain bar of same size. Projections and depressions, being rolled longitudinally, allow all steel to be of value when bar is under tension. No sharp angles tending to start cracks when bar is bent. Full tensile strength of all metal is developed throughout length of bar, equalizing strength at all points. As Havemeyer bars are rolled to same weight and area as plain bars, a strong mechanical bond is obtained with same weight of metal used in rolling a plain bar.

The deformations furnish a mechanical bond more than sufficient to develop strength of bar, as proved by many testing laboratories.

ADVANTAGES OF HAVEMEYER BARS—Bending and handling costs are reduced to a minimum through the following important features: (1) Havemeyer bars bend easily, because metal in longitudinal projections follows bend as readily as metal in body of bar. (2) Both ends



SQUARE BAR



ROUND BAR



FLAT BAR

of a "double bend" lie in same plane without extra work. (3) No abrupt changes in cross section to start cracks. (4) Bars easily wired at intersections, the projections and depressions preventing wire from slipping. (5) Bars easily selected on the work, because readily gaged.

SIZES—Havemeyer bars are rolled at many mills in the various steel centers of the United States. They are carried in stock, ready for prompt shipment, in principal cities, in sizes indicated in the following table:

WEIGHTS AND AREAS, HAVEMEYER SQUARE, ROUND AND FLAT DEFORMED BARS

Size, in.	SQUARE		ROUND		Size, in.	FLAT	
	Area, in.	Weight per ft., lbs.	Area, in.	Weight per ft., lbs.		Area, in.	Weight per ft., lbs.
1/4	0.0625	0.212	0.0491	0.167	1 x 1/4	0.2500	0.850
3/8	0.0977	0.332	0.1104	0.375	1 x 3/8	0.3750	1.280
1/2	0.1406	0.478	0.1963	0.667	1 1/4 x 3/8	0.4690	1.590
5/8	0.2500	0.850	0.3068	1.043	1 1/2 x 3/8	0.4688	1.590
3/4	0.3906	1.328	0.4418	1.502	1 1/2 x 1/2	0.5625	1.913
7/8	0.5625	1.913	0.6013	2.044	1 3/4 x 3/8	0.7500	2.550
1	0.7656	2.603	0.7854	2.670	1 3/4 x 1/2	0.6563	2.230
1 1/8	1.0000	3.400	0.9940	3.379	1 3/4 x 5/8	0.7656	2.600
1 1/4	1.2656	4.303	1.2272	4.173	1 3/4 x 1	0.8750	2.980
1 1/2	1.5625	5.312					

We can furnish 1 3/8-in. and 1 1/2-in. square Havemeyer bars from Pittsburgh Mills. Do not carry them in stock.

NOTE—A size extra of 10¢. applies against 1 x 1/4-in. and 1 1/2 x 5/8-in. flats; all other sizes tabulated take the base price.

Specifications for Steel.

Havemeyer bars can be rolled to any standard specification. Manufacturers' Standard Specifications for concrete reinforcing bars, adopted 1910, are recommended because large tonnages are regularly going through mills on these specifications, and orders complying with them will be shipped in shortest possible time.

Havemeyer Bar Service.

Havemeyer bars can be shipped, cut to special lengths, direct from the mills when mill conditions will permit. Immediate shipments can always be made from large stocks of round and square Havemeyer bars that are carried in warehouses at Youngstown, Camden, Chicago, Birmingham, Boston, Kansas City, St. Louis, Detroit and New York. Stocks are also maintained in other principal cities by agents.

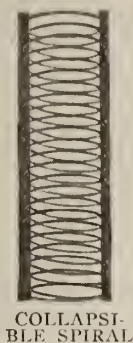
Shop Bending and Fabricating.

The fabricating works are equipped with the most modern machines for bending and fabricating bars accurately and economically. Shop bending is more economical to the contractor than field bending, with no waste, so very low prices can be made.

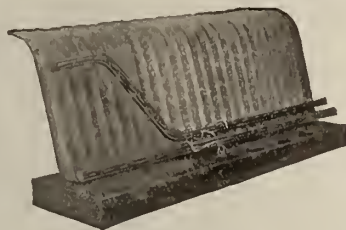
Fabricated units for girders, beams, columns, etc., ready to drop into form boxes, can be shipped promptly.

Havemeyer Collapsible Spirals.

Made of highest grade rods or wire to size specified, and manufactured in the company's own shops, accurately coiled to proper diameter and correctly spaced, using a rigid spacer, insuring rigidity, strength and uniformity; and unless otherwise ordered, are equipped with two spacers and shipped collapsed, ready to be placed in form. An angle spacer is used, size varying with size and weight of spiral. This type has proven the most economical and satisfactory.

COLLAPSI-
BLE SPIRAL**Havemeyer Easel Chairs.**

Made from high grade spring steel wire. Used in terra cotta or steel tile construction. Standard distance from underside of bar to forms is 1 in. Made double (2 bars) and single (1 bar). Carried in stock.

EASEL CHAIR IN STEEL TILE
No tools required**Hy-chairs.**

Made from pressed steel. Used in flat slab construction for supporting head rods over columns and bent up bars in slab. Maximum size bar, $\frac{3}{4}$ in. Made up on order.

HY-CHAIR
No tools required**Havemeyer Ty-chairs.**

Made from high grade spring steel wire. Used for tying and supporting bars in slab. Standard distance from underside of bar to forms is 1 in. Carried in stock.

TY-CHAIR IN POSITION
No tools required**Havemeyer Bar-ty's.**

Made from high grade spring steel wire. Used for tying bars in walls, bent up bars to supporting rods in slab, tying stirrups to beam bars, fabricating columns, etc. Carried in stock.

No. 2 BAR-TY'S
No tools required**Securo Bar-spacers.**

Made from hoop steel. Locking prongs and legs are self-contained. Used for supporting, spacing and locking bars in the slab. Standard height from underside of bar to form, $\frac{1}{2}$, $\frac{3}{4}$ and 1 in. Made up on order.

BAR SPACERS
No tools required**Havemeyer "Y" Socket Inserts.**

Made from highest grade malleable iron. Has a broad nailing base with 4 nailing holes and made to accommodate bolts with standard threads from $\frac{3}{8}$ to $\frac{3}{4}$ in., both inclusive. Carried in stock.

"Y" SOCKET
INSERT**Dayton Adjustable Inserts.**

Made from highest grade malleable iron, cast in one piece with keyhole slot.

Made in sizes from $\frac{1}{4}$ to $\frac{7}{8}$ in., both inclusive. Carried in stock.



No. 3

No. 5

DAYTON ADJUSTABLE INSERTS

Slotted Inserts.

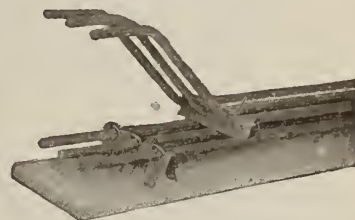
Made from high grade pressed steel. In standard lengths of 1 ft., 18 in., 2 ft. and 3 ft. to accommodate $\frac{1}{2}$ -, $\frac{5}{8}$ - and $\frac{3}{4}$ -in. bolts. Has 6 nailing holes and closed slot. Carried in stock. $\frac{7}{8}$ -in. bolt special.



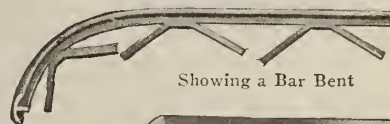
SLOTTED INSERT

Havemeyer Beam Saddles and Separators.

Made from sheet steel. Used in beams, girders and lintels, for supporting, spacing and locking the bars. Standard heights from bottom of bar to forms are $1\frac{1}{2}$ and 2 in. Made up on order.

BEAM SADDLE AND SEPARATOR
No tools required**Round and Angle Nose Curb Bars.**

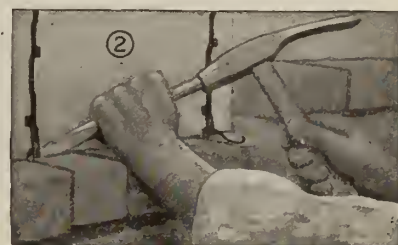
ROUND NOSE— Anchors are flared from the web and bent. Occur every 6 in. and serve as a reinforcement as well as an anchorage. There is no web to weaken or split the concrete, and the bar may be easily bent. Stocked in 8-, 10- and 12-ft. lengths, galvanized.



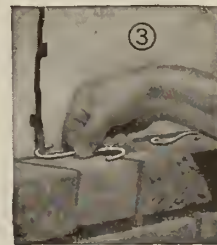
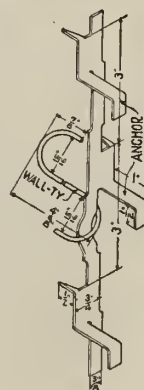
Showing a Bar Bent

View of Section
ROUND NOSE CURB BAR

ANGLE NOSE— Similar to the round nose curb bar in method of anchorage. Carried in stock in 10-ft. lengths, galvanized.

**Security Wall-ty and Anchor.**

Made from rustproof hoop steel with nailing barb and anchors occurring every 3 in. By prying out the loop of the anchor and inserting the Wall-ty an accurate bond may be secured. Used for brick and terra cotta veneering, tile wainscoting, suspended ceilings, screeds, etc.

Picture No. 2—Prying Out the Loop.
Picture No. 3—Placing the Wall-Ty for Direct Anchorage

SECURITY WALL-TY AND ANCHOR

CONCRETE ENGINEERING COMPANY

Fireproofing and Reinforcing Materials

Omaha National Bank Building
OMAHA, NEBR.

DISTRICT OFFICES

CHICAGO, ILL., 140 South Dearborn Street
MILWAUKEE, WIS., 606 First Wisconsin National Bank Building

KANSAS CITY, MO., Railway Exchange Building
DETROIT, MICH., 908 Marquette Building
OKLAHOMA CITY, OKLA., Patterson Building

DES MOINES, IOWA, 406 Iowa Building

Products.

CECO REINFORCING BARS; CECO COLUMN SPIRALS, MEYER REMOVABLE STEELFORMS; CECO ROUND COLUMN FORMS.

Ceco Triangle Mesh Concrete Reinforcement, Expanded Metal and Rib Reinforcing, Metal Lath, Self-furring Metal Lath, Wire Lath, Cold Rolled Channels; Corner, Base and Rail Beads.

Ceco Reinforcing Bars.

Rolled in both new billet and rail steel. In either plain or deformed rounds and squares. Conform to the Manufacturers' Standard Specifications for both new billet and rail steel. Furnished cut to length, and bent to specifications, at mill or warehouse.

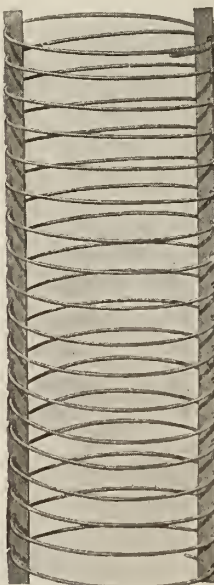


CECO REINFORCING BARS
Sizes, Weights, Areas and Extras

Size	Round Bars		Square Bars		Size extras
	Area	Weight	Area	Weight	
1/4"	.049	.167	.063	.212	50¢ per cwt.
3/8"	.110	.376	.141	.478	25¢ per cwt.
1/2"	.196	.668	.250	.850	10¢ per cwt.
5/8"	.307	1.043	.391	1.328	05¢ per cwt.
3/4"	.442	1.502	.563	1.913	Base
7/8"	.601	2.044	.766	2.603	Base
1"	.785	2.670	1.000	3.400	Base
1 1/8"	.994	3.380	1.265	4.303	Base
1 1/4"	1.227	4.172	1.563	5.313	Base

Ceco Column Spirals.

Accurately shaped to required diameter by machinery, and held in correct pitch by the new slotted "V" spacer, accurately spacing each wire, preventing distortion, and allowing spirals to be collapsed for shipment and then readily expanded to required diameter. Unless otherwise specified, two spacers furnished with each spiral. Hooping given an extra turn at each end and securely wired in position, so no slipping is possible.



CECO COLUMN SPIRALS

Meyer Removable Steelforms.

Economically adapted for all buildings with long spans. A series of concrete joists is formed, eliminating all concrete useless in resisting stresses, and effecting a great saving in form work through the early removal and speedy re-use possible. No. 16-gauge sheet steel. Shaped exactly by heavy presses, extremely rigid, so maximum re-use is secured.



MEYER REMOVABLE STEELFORM

Rented to contractors, the labor of placing and removing being handled by



MEYER STEELFORMS WITH REINFORCEMENT IN PLACE READY FOR CONCRETING

Contract Department. Furnished in 6-, 8-, 10- and 12-in. depths, in 20-in. widths, and 12- and 15-in. depths in 30-in. widths as well as special widths; and with both single tapered and double tapered end forms—also an economy.

Ceco Round Column Forms.

In standard adjustable sections, all snugly fitted together by tongue and groove joints, and held in place with both flat and tee-iron clamps. All parts completely interchangeable; columns with diameters of 12 to 48 in., of any height, quickly formed. The natural rigidity of heavy gauge sheet steel, with added reinforcement of tongue and groove joint between clamps, makes an absolutely stiff and rigid form. Column section always uniform throughout, and smooth surface a certainty. Used with any type floor construction, special column caps being furnished when necessary. Constant re-use effects great economy.

Contract Department will erect Ceco round column forms in place ready for concrete, guaranteeing complete satisfaction. Or they will be rented to responsible parties without labor of installation.



CECO ROUND COLUMN FORMS

Ceco Service.

The CONCRETE ENGINEERING COMPANY's Contract Department will erect all materials when the quantity is large enough to warrant doing so.

The Engineering Department will prepare complete designs on all types of reinforced concrete construction at a nominal charge. Preliminary estimates of cost, layouts, etc., are a part of the service and incur no obligation.

Shipping Facilities.

Adequate stocks are always maintained in warehouses at Omaha, Chicago and Kansas City. Prompt shipments of any size order made without delay.

THE CONCRETE REINFORCING AND ENGINEERING CO.

Reinforcing Steel and Engineering Service

1900 Euclid Building
CLEVELAND, OHIO

STOCK AND FABRICATING PLANT, CLEVELAND, OHIO

Products.

RIVET GRIP FABRICATED UNITS; RIVET GRIP BARS.

Plain, Deformed, Square and Round Reinforcing Bars of standard sections; Spacing Devices and Bar Supports; Factory Built Spirals.

Engineering Services.

THE CONCRETE REINFORCING AND ENGINEERING Co. furnish engineering services for reinforced concrete structures of all kinds. This service is co-operative. The cost of this service may be included in our estimate or may be paid for separately on the fee basis.

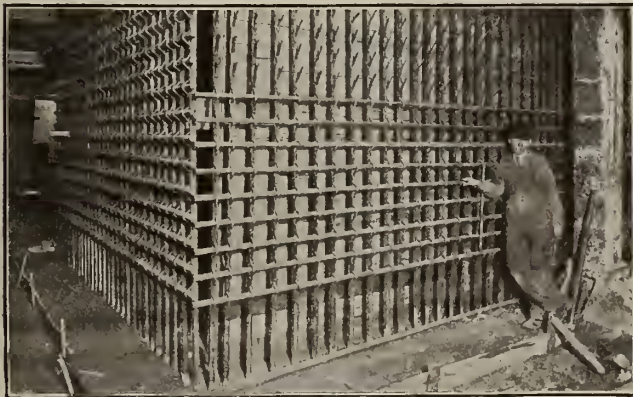
Co-operative service is offered architects in connection with any work of a preliminary nature. An efficient estimating and engineering department is maintained for service of this character. Suggestions are freely offered regarding type of construction which can be most economically used, and estimates are furnished of comparative cost of various types suggested. Standardization of estimating and designing methods enables this company to offer a very efficient service.

Rivet Grip Bars.

Rivet Grip bars are rolled in sections equivalent to standard square bars.

SIZES, AREAS, PERIMETERS AND WEIGHTS OF RIVET GRIP BARS

R. G. bars	Equivalent sq. bar	Area, sq. in.	Perimeter, in.	Weight per ft., lbs.
$\frac{3}{8}$ " R. G.	$\frac{3}{8}$ "	.1406	1.63	.478
$\frac{1}{2}$ " R. G.	$\frac{1}{2}$ "	.3906	4.00	1.328
$\frac{5}{8}$ " R. G.	$\frac{5}{8}$ "	.5625	4.25	1.913
$\frac{3}{4}$ " R. G.	$\frac{3}{4}$ "	.7656	4.75	2.603
$\frac{7}{8}$ " R. G.	$\frac{7}{8}$ "	1.0000	5.19	3.400
1" R. G.	1"	1.2656	5.75	4.303
$1\frac{1}{8}$ " R. G.	$1\frac{1}{8}$ "	1.5625	6.50	5.313



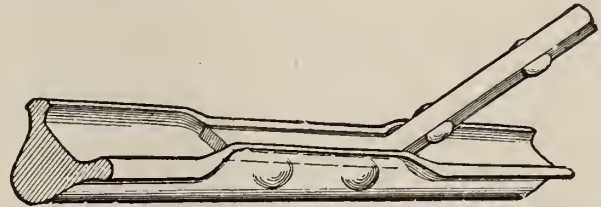
SHOWING APPLICATION OF RIVET GRIP BARS IN TANK, RESERVOIR OR OTHER WALL CONSTRUCTION

Rivet Grip Fabricated Units.

A compact, rigid unit reinforcement, fabricated in shop strictly according to individual designs; tagged, bundled and shipped ready to place.

Rigidly attached shear members are generally recognized by authorities to have decided advantages over loose bent bars and stirrups wired in place.

Refer to joint committee final report for definite and authoritative statements.



SHOWING METHOD OF ATTACHING SHEAR MEMBERS

APPLICATIONS—Rivet Grip fabricated units are effectively and economically used as beam, girder or joist reinforcements in building and ship construction.

Rivet Grip reinforcement is ideally applicable for wall reinforcement of vaults, tanks, retaining walls, abutments, reservoirs, dry docks, dams, etc.

ADVANTAGES—By using Rivet Grip fabricated units, all errors of field fabrication and placing of reinforcements are eliminated. Field cost of handling is reduced to a minimum.



CARLOAD OF RIVET GRIP FABRICATED UNITS
Excellent travellers



RIVET GRIP FABRICATED UNIT BEAM FRAMES
Note simplicity in handling

THE CONSOLIDATED EXPANDED METAL COMPANIES

GENERAL OFFICES AND WORKS

BRADDOCK, PA.

(In the Pittsburgh District)

SALES OFFICES

PHILADELPHIA, PA.

CHICAGO, ILL.

PITTSBURGH, PA.

EXCLUSIVE REPRESENTATIVES

NEW YORK, N. Y., EXPANDED METAL ENGINEERING CO.
BOSTON, MASS., PENN METAL CO.

DALLAS, TEX., SOUTHERN WIRE & IRON CO.
TORONTO, CAN., BAINES & PECKOVER

Products.

"STEELCRETE" EXPANDED METAL for reinforcing concrete.

Also, Beam Wrapping; Metal Lath; Channel Furring; Galvanized Metal Corner Bead; Special Meshes for Lockers, Machine Guards, etc.; Rib-mesh Expanded Metal for Lath and for Concrete Reinforcing.

Sectional Area.

A 16-ft. long sheet of expanded metal, for reinforcing concrete, can now be obtained with sectional area of 1.00 sq. in. Heretofore this long length and heavy section has been unobtainable. It will reduce cost of placing reinforcing in concrete. Reinforcing meshes range from sectional area of 1.00 sq. in. down to a light section to be used for temperature stresses.

Scope of Use.

"Steelcrete" mesh, the oldest and most widely used of concrete reinforcement, is adapted for reinforced concrete work such as floor and roof slabs, sewers, conduits, tanks, highway bridges, culverts, retaining walls, etc.

Description.

"Steelcrete" mesh possesses great unit strength and a high elastic limit. It is cold drawn to its mesh shape under enormous speed, being previously covered with oil. This process, together with the use of soft carbon steel, give uniformity of quality and stiffness.

Tensile strength of the open hearth steel used is from 55,000 to 60,000 lbs. It has an elastic limit of not less than one-half its ultimate strength, an elongation of about 25% in 8 in., and cold bending test of 180°. Ultimate strength of finished product is raised to a value of 70,000 to 80,000 lbs. and elastic limit increased by 100%.

Severe loading tends to close the diamonds, giving fabric a ductility unencountered in any other reinforcement of high elastic limit. It causes compression in concrete in the plane of the steel, and thus reinforces the construction against sudden rupture.

Advantages.

As the structure of "Steelcrete" provides a perfect distribution of steel in a horizontal direction, so its stiffness insures a like perfect distribution in vertical direction. There are no waves or warps to be hammered out or to offer an element of weakness.

Due to mesh shape, "Steelcrete" attains a perfect bond in concrete. There is no peeling or scaling of concrete when subjected to heavy loads.

Temperature stresses are guarded against. The form of "Steelcrete" mesh provides positive reinforcement against these known but indeterminate stresses.

"Steelcrete" is cheap to install. It arrives in flat sheets of standard lengths and is easily handled, requiring very little storage room. Bending of "Steel-

crete" in a circular shape or round bend is exceedingly simple.

DECIMAL STANDARDS FOR "STEELCRETE" EXPANDED METAL

Designation of mesh	Size of mesh		Sect. in sq. in. per ft. of width	Wt. per sq. ft. in lbs.	Size of standard sheets
	Width of diamond	Length of diamond			
3-13-075	3"	8"	.075	.27	6'0"x 8'0" 6'0"x 12'0" 6'0"x 16'0"
3-13-10	3"	8"	.10	.37	6'9"x 8'0" 6'9"x 12'0" 6'9"x 16'0"
3-13-125	3"	8"	.125	.46	5'3"x 8'0" 5'3"x 12'0" 5'3"x 16'0"
3-9-15	3"	8"	.15	.55	7'0"x 8'0" 7'0"x 12'0" 7'0"x 16'0"
3-9-175	3"	8"	.175	.64	6'0"x 8'0" 6'0"x 12'0" 6'0"x 16'0"
3-9-20	3"	8"	.20	.73	5'3"x 8'0" 5'3"x 12'0" 5'3"x 16'0"
3-9-25	3"	8"	.25	.92	4'0"x 8'0" 4'0"x 12'0" 4'0"x 16'0"
3-9-30	3"	8"	.30	1.10	7'0"x 8'0" 7'0"x 12'0" 7'0"x 16'0"
3-9-35	3"	8"	.35	1.28	6'0"x 8'0" 6'0"x 12'0" 6'0"x 16'0"
3-6-40	3"	8"	.40	1.46	7'0"x 8'0" 7'0"x 12'0" 7'0"x 16'0"
3-6-45	3"	8"	.45	1.65	6'3"x 8'0" 6'3"x 12'0" 6'3"x 16'0"
3-6-50	3"	8"	.50	1.83	5'9"x 8'0" 5'9"x 12'0" 5'9"x 16'0"
3-6-55	3"	8"	.55	2.01	5'3"x 8'0" 5'3"x 12'0" 5'3"x 16'0"
3-6-60	3"	8"	.60	2.19	4'9"x 8'0" 4'9"x 12'0" 4'9"x 16'0"
3-1-75	3"	8"	.75	2.74	5'9"x 8'0" 5'9"x 12'0" 5'9"x 16'0"
3-1-100	3"	8"	1.00	3.63	4'3"x 8'0" 4'3"x 12'0" 4'3"x 16'0"

"STEELCRETE" SPECIAL MESHES

Designation of mesh	Size of mesh		Weight per sq. ft. in lbs.	Size of standard sheets
	Width of diamond	Length of diamond		
1/2" No. 18	.43"	1.2"	.74	3'0"x 8'8"
3/4"-13-25	.95"	2"	.80	6'0"x 8'8"
1 1/2"-13-20	1.36"	3"	.60	6'0"x 8'0"
2-13-15	1.82"	4"	.50	5'0"x 8'0"
3/4" No. 9	.95"	2"	1.80	4'0"x 8'0"
1 1/2" No. 9	1.36"	3"	1.28	5'0"x 8'0"
2" No. 9	1.82"	4"	.90	4'0"x 8'0"
Floor Binder	1.82"	4"	.20	5'0"x 8'8"
Beam Wrapper	3"	8"	.20	0'6"x 8'8"

Note that in the decimal standard for "Steelcrete" expanded metal, the width is designated as the short way of the diamond and the length is designated as the long way of the diamond.

Co-operation and Literature.

The Engineering Department of this firm will co-operate with engineers and concrete workers. While no contracting is done for any construction work, assistance will be gladly rendered in practical operations.

CORRUGATED BAR COMPANY

Concrete Reinforcement

Mutual Life Building
BUFFALO, N. Y.

DISTRICT OFFICES

NEW YORK, N. Y., Whitehall Building, 17 Battery Place
CHICAGO, ILL., 20 West Jackson Boulevard
PHILADELPHIA, PA., Transportation Building
BOSTON, MASS., 27 School Street
DETROIT, MICH., 400 Penobscot Building
ST. LOUIS, MO., Boatmen's Bank Building
ST. PAUL, MINN., Pioneer Building

KANSAS CITY, MO., 1505 Waldheim Building
SYRACUSE, N. Y., Union Building
MILWAUKEE, WIS., 820 Wells Building
WASHINGTON, D. C., Munsey Building
HOUSTON, TEX., 700 North San Jacinto Street
ATLANTA, GA., 1017 Grant Building

Products.

CORRUGATED BARS; CORR-BAR UNITS; SPIRALS;
CORR-PLATE FLOORS; CORR-MESH, a ribbed expanded
metal.

Corrugated Bars.

All bond is mechanical—it is the entering of cement into irregularities in surface of reinforcing material. In smooth bars, such adhesion as takes place is entering of cement into the microscopic surface pores of the metal. This is very small, particularly in small bars, which are somewhat cold rolled, and in which surface pores are of negligible value for this purpose. Furthermore, when working stress of 16,000 lbs. per sq. in. is developed in steel, diameter has been materially reduced; i.e., material when compared to depth of surface pores.



CORRUGATED ROUNDS (PATENTED)

Corrugated Bars are rolled both round and square in cross section and have ridges or corrugations which effect a positive mechanical bond with concrete. Made of medium, intermediate and hard grade steel.

BOND TESTS—Many bond tests on beams under stress, made at different places, have invariably shown the Corrugated Bar to be superior in a marked degree to all other types of reinforcement.

SIZES—The following standard sizes are carried in stock, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$ and 1 in. round; and $\frac{1}{2}$, 1, $1\frac{1}{8}$ and $1\frac{1}{4}$ in. square.

Column Spirals.

Spirals for columns are shop fabricated, made of cold drawn wire with T-section spacers and furnished in any length, in diameters of 10 to 36 in., pitch 1 to 4 in. A large stock is at all times available for immediate shipment.



SPIRALS
FOR
COLUMNS

Corr-Bar Units.

Insure correct reinforcement in accordance with specifications and save much labor cost because only one piece has to be handled instead of fifteen to twenty. Shop fabricated and self-positioning reinforcement for concrete beams and girders. Each unit, representing the entire reinforcement for beam, anchored rigidly together, is made collapsible for shipment, and is opened on the job and set in the form wherein it positions itself.



CORR-BAR UNITS (PATENTED) READY TO PLACE

Corr-Plate Floors.

A 2-way system of reinforcing that has been determined by the Research Department of this company to be scientifically correct and far more economical than any "umbrella" form of reinforcing for a flat slab concrete floor. This Department's extensive laboratory and field tests have proved that in over 90% of the area of the panel, the lines of principal stress are parallel to sides of panel. Corr-Plate floors satisfy these requirements.

In Corr-Plate floors, a cap about 2 in. thick is used around column to take care of stresses which are much greater there, at the same time saving much concrete. Cap can be underneath the floor or, if wood flooring is used, on top, leaving a perfectly smooth ceiling.

Corr-Plate floors save in total height of structure for given clear story heights. Forms and ease of erection are simpler; lighting and ventilation are better. Large savings are effected in cost of sprinkler, shafting, piping, elevators and other installations.

Corr-Mesh.

Corr-Mesh is an expanded metal with integral stiffening ribs connected by a diamond mesh. It is so expanded that no internal stresses are produced in the metal; it is not necessary to handle it carefully in order to avoid splitting, a condition peculiar to the over-expanded products. A protective coating of paint is applied after expansion.

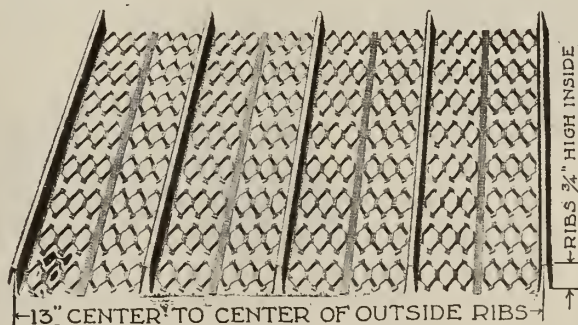
Ribs obviate necessity of studs for partitions, practically eliminate centering for floor and roof construction, and materially reduce amount of light steel framing required for suspended ceilings.

KINDS—There are 2 kinds of Corr-Mesh; one with $\frac{3}{4}$ -in. ribs and the other with $\frac{5}{8}$ -in. ribs. The former is called " $\frac{3}{4}$ -in. Rib Corr-Mesh," the later " $\frac{5}{8}$ -in. Rib Corr-Mesh."

GAGES—Standard sheets of both kinds are made in Nos. 24, 26 and 28 U. S. gages, painted. Other gages can be furnished if required.

General.

Catalogues, detailed information, etc., sent in response to requests on business letterheads.



$\frac{3}{4}$ -IN. RIB CORR-MESH

THE GENERAL FIREPROOFING COMPANY

Expanded Metal Reinforcement, Expanded Metal Lath and Steel Forms
for Floor Construction

YOUNGSTOWN, OHIO

BRANCH OFFICES

CHICAGO, ILL., 325 West Madison Street
ATLANTA, GA., Third National Bank Building
BUFFALO, N. Y., 40 Builders Exchange
WASHINGTON, D. C., 711 Woodward Building
MINNEAPOLIS, MINN., 754 Builders Exchange
BOSTON, MASS., 125 Federal Street

PHILADELPHIA, PA., 512 Bulletin Building
KANSAS CITY, MO., 1009 Waldheim Building
OMAHA, NEBR., 213 Kennedy Building
MILWAUKEE, WIS., 1201 First National Bank Building
SAN FRANCISCO, CAL., 444 Market Street

EXPORT DEPARTMENT: 395 Broadway, NEW YORK, N. Y.

Products.

SELF-SETERING, an Expanded Metal Reinforcement for Concrete, made up of diamond mesh and stiff ribs so that it acts as both form and reinforcement or as lath and stud; **EXPANDED METAL**, the general purpose Reinforcement for Concrete Work; **TRUSSIT**, a patented Reinforcement for Curtain Walls and Partitions, which entirely eliminates the use of studding.

STEEL-TILE and END-TILE: Steel Forms for T-beam Concrete Floors; light, safe, economical.

GF PEDS; **GF STEEL LUMBER**.

HERRINGBONE RIGID METAL LATH, Painted, Galvanized or made from Armco Iron, universally used because of its stiffness; **KEY EXPANDED METAL LATH**.

Cold Rolled Channels, used as a studding for metal lath partitions, as furring for suspended ceilings, cornices, false beams and ornamental plaster work; **Gen-fire Sheet Steel Lath**—in fact, Metal Lath for every purpose for which it can and should be used; **Corner Bead**, carrying a heavy plaster coat for exposed corners; **Reinforced Concrete Construction**; **Machinery Guards**; **Roof Slab Construction**.

For Waterproofings, Dampproofings and Technical Paints, see page 206.

Self-Sentering.

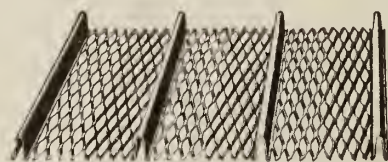
Self-Sentering is a combined reinforcement and form used extensively for floor and roof construction. It is adaptable for solid and hollow walls, light partitions, etc., making possible a light weight, thin slab, built without expensive formwork, and equal in every way to heavy reinforced concrete.

Roofs of any design and pitch can be built with Self-Sentering, requiring little more than the permanent purlins and trusses for centering, and no solid forms at all.

Self-Sentering is an expanded metal sheet of the most effective form—the diamond mesh, with a series of cold rolled ribs, $\frac{1}{16}$ in. high spaced $3\frac{3}{8}$ in. on centers, which act as stiffeners.

The ribs carry the weight of the concrete till set; the diamond mesh forms a perfect bond for the concrete and with the ribs carries the tension in the slab.

SIZES—Sheets are 29 in. wide and can be furnished in foot lengths varying from 4 to 12 ft. Long



SELF-SETERING
Patented March 25, 1913. Other patents pending



TRADE-MARK
Reg. U. S. Pat. Off.

sheets make for rapid erection and minimum laps. The side ribs nest snugly. Ask for the "Fireproofing Handbook."

STOCK GAUGES AND WEIGHTS

Gauge	Painted weight	Galvanized weight	Sec. area per foot of width
28	.58 lbs.	.73 lbs.	.173 sq. in.
26	.70 lbs.	.83 lbs.	.208 sq. in.
24	.93 lbs.	Not made.	.277 sq. in.

SAFE UNIFORMLY DISTRIBUTED LIVE LOADS PER SQUARE FOOT ON SELF-SETERING SLABS

Assumptions:

Stress in steel, 16,000 lbs. per sq. in.

Ratio between the moduli of elasticity, 15.

Center of gravity, .19 of an in. above bottom of slab.

R. M., Resisting Moments per ft. width in in. lbs.; f c, maximum extreme fiber stress in concrete.

Gauge Self-Sentering	Thickness of slab above mesh	R. M.	f c	Span					
				3 ft.	4 ft.	5 ft.	6 ft.	7 ft.	8 ft.
28	2 in.	4360	660	310	164	98	61	...	...
26	2 in.	5190	760	359	192	128	92	49	...
24	2 in.	6210	800	476	258	166	110	64	30
28	2½ in.	5625	560	419	233	150	93	57	...
26	2½ in.	6710	650	484	279	186	118	76	50
24	2½ in.	8720	680	...	377	254	165	111	76
28	3 in.	6920	500	561	311	184	114	73	45
26	3 in.	8240	560	...	386	231	147	97	64
24	3 in.	10820	660	...	512	322	210	143	100
28	3½ in.	8250	460	...	368	218	135	80	50
26	3½ in.	9800	500	...	455	274	174	115	76
24	3½ in.	12750	610	...	...	375	245	166	116
28	4 in.	9500	425	...	439	261	164	105	68
26	4 in.	11300	460	...	533	320	206	136	91
24	4 in.	14800	560	...	...	436	286	196	137

Expanded Metal Reinforcement.

Expanded metal, made by expanding sheets of steel into elongated diamond shape mesh, has greater reinforcing strength, pound for pound, than any other material. It can be cut and expanded to a great variety of sizes adapted for particular classes or sizes of work.

The larger mesh is used for concrete reinforcement in construction of floors, roofs, sidewalks over basements, bridge decks, retaining walls, sewers, conduits, tanks, reservoirs, etc. Smaller mesh widely used in lighter cement work and for railings, window guards, machinery guards, elevator and tool room enclosures.

Style 3-10-176
(3-in. mesh, No. 10-gauge, .176 sq. in. sectional area), illustrated, is the type most commonly used for general work.



EXPANDED METAL

EXPANDED METAL STYLES, WEIGHTS AND STANDARD SIZE SHEETS

Style	Approx. weight per sq. ft., lbs.	Deliveries	Standard size sheets	
			Lengths	Widths
			Long way of diamond	Short way of diamond
3-10-176	.60	Carried in stock in standard sheets	6', 8', 9', 10' 8"	3', 4', 5', 6'
3-10-265	.90		6', 8', 9', 10' 8"	4', 5', 4"
3-10-353	1.20		6', 8', 9', 10' 8"	3', 4', 6'
3-12-150	.51		6', 8', 9', 10' 8"	3', 4', 6'
3-12-194	.66		6', 8'	3', 4', 6'
3-12-246	.84		6', 8'	3', 4', 6'

Descriptive matter covering complete line of large and small meshes will be mailed on request.

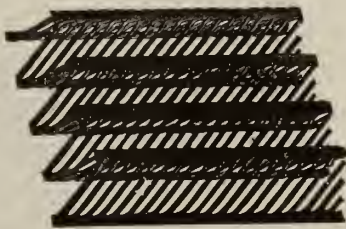
Trussit.

Trussit is an expanded steel reinforcement which is particularly adaptable to the construction of light, fireproof walls and partitions from 1½ to 3 in. thick; also, of solid and hollow walls, curtain walls, elevator enclosures, small individual structures or offices in a larger building, wherever a fireproof, soundproof partition is required.

Trussit eliminates the usual studding, a few temporary braces being required only till the plaster coat on one side is set. Sheets are attached to floor and ceiling with expanded metal angles that render them free from vibration and the danger of cracking.

Trussit is uniformly expanded in both directions. This makes it possible to plaster upon each side exactly alike; and when the wall is set, steel and concrete are so uniformly distributed that expansion or contraction stresses in any direction are met by the Trussit reinforcement.

Stocked in sheets 8, 10 and 12 ft. long; sheets uniformly 19 in. in width. Furnished painted, galvanized or made from Armco (American Ingot) Iron.



TRUSSIT (PATENTED)
WEIGHT PER SQUARE FOOT

Gauge	Plain or painted	Galvanized
27	.57 lb.	.68 lb.
26	.62 lb.	Not made
24	.83 lb.	.88 lb.

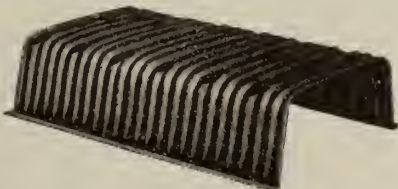
Steel-Tile and End-Tile.

GF Steel-Tile are simply light weight steel forms for concrete floors, designed on the well-known T-beam principle—deep reinforced joists and thin connection slabs of concrete.

One of the advantages of Steel-Tile construction is its substantial reduction in weight. Lazy concrete is reduced to the minimum, saving a good percentage of the load upon girders, columns, foundations and footings, and permitting a lighter construction throughout.

GF Steel-Tile make the old expensive, solid form work unnecessary. Centering along the line of joists, which are 25 in. apart, is sufficient. This closes the only opening and prevents leakage when concrete is poured.

Cost of transporting and handling Steel-Tile is much less than that of terra cotta tile, which involves the same principle of construction, and there is no loss due to breakage. Steel-Tile are adaptable in such structures as schools, hotels, office buildings,



GF STEEL-TILE

department stores, apartments, warehouses, lofts, etc. Wherever long spans are required, GF Steel-Tile construction will be found most economical.

Flat ceilings are easily constructed under Steel-Tile floors. The most dependable method is illustrated. Another is to lay Herringbone lath directly on forms before setting Steel-Tile and pouring concrete. Suspended ceilings are built upon hangers suspended through joists before concrete is poured.



GF END-TILE



CEILING CONSTRUCTION UNDER GF STEEL-TILE, GF CHANNELS AND HERRINGBONE

GF Steel-Tile with End-Tile to match are made of corrugated steel in sizes and weights shown below. A complete Steel-Tile Handbook mailed on request.

STEEL-TILE

Size	Approx. weight per 100 pieces, lbs.		Weight per 100 lin. ft., lbs.
	30" long	35" long	
6"	490	570	195
8"	560	650	223
10"	610	710	243
12"	660	770	264

Width at bottom, exclusive of flanges, 20 in.

END-TILE

Size	Approx. weight per 100 pieces, lbs.
6"	90
8"	117
10"	140
12"	180

PROPERTIES OF STEEL-TILE FLOORS
2 inches of concrete above Steel-Tile

Width of joists C. to c. of joists	Size, Steel-Tile	6"	8"	10"	12"	14"
	Average wgt. per sq. ft., lbs.	40.1	46.0	53.5	61.0	72.6
4"	Cu. ft. of concrete per sq. ft. of floor.....	.278	.319	.371	.423	.505
	Core area per cent of section	58.3	61.7	63.0	63.8	62.2
	Average wgt. per sq. ft., lbs.	42.3	49.4	57.1	65.3	78.4
5"	Cu. ft. of concrete per sq. ft. of floor.....	.293	.342	.396	.452	.537
	Core area per cent of section	55.9	59.2	60.3	61.2	.597

GF Peds.

GF Peds are a new GF product, covered by basic spot ground patents, manufactured and sold exclusively by THE GENERAL FIREPROOFING Co. They are used for attaching wood and metal trim to walls and screeds to floors. A Ped consists of a nailing block of wood forced into a circular metal plate. The old-fashioned methods of grounding are eliminated by the use of GF Peds. GF Peds are fastened to walls, floors and beams with a little plaster.

Wall Peds afford a firm foundation for attaching plumbing fixtures, hand rails, telephone boxes, electrical fixtures, and for putting up composition wall or plaster board over masonry walls.

Floor Peds anchor screeds or sleepers to the floor, and eliminate all bracing, wedging and shimming.

Peds not only save a great deal of labor over the old method of laying floors, but also afford more satisfactory results than can possibly be obtained in any other way.



GF PEDS

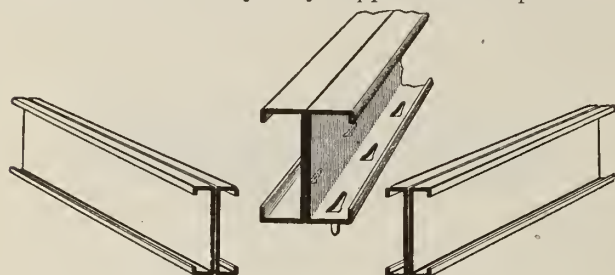
GF Steel Lumber.

GF Steel Lumber for floor or partitions gives the most economical type of fireproof construction.

GF Steel Lumber is manufactured in a variety of sizes and shapes to meet all conditions. Steel joists are made for all requirements of span and loading, and are cut to exact length and fabricated, when necessary, ready to place in position.

Steel studs are cut exactly and are "pronged" for the attaching of metal lath.

No forms or temporary supports are required and



GF STEEL LUMBER SECTIONS

the light weight of the sections facilitates ready handling and placing in the building.

All GF Steel Lumber sections are manufactured from a special grade of steel, formed cold into sections giving the best possible distribution of the metal. GF Steel Lumber studs or joist sections can be furnished in any desired length up to 100 ft. without splicing. All joist sections formed from two special channel sections, electrically spot-welded together.

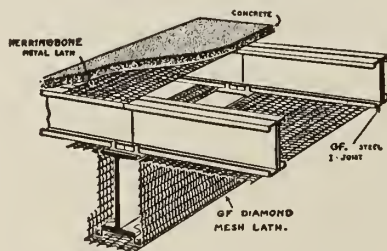
For floors in schools, offices, hotels, apartments, residences, and similar structures, GF Steel Lumber gives fire resistive construction that is light in weight and which is erected more quickly and more economically.

GF Steel Lumber construction is absolutely durable and permanent. It is soundproof and verminproof and will not warp, twist or shrink as does wood. Plaster ceilings and walls on GF Steel Lumber and Herringbone rigid metal lath, are absolutely free from cracks as is a cement or terrazzo floor supported by it.

GF Steel Lumber may be supported by bearing walls or by steel or concrete beams.

Joists are placed with speed and accuracy and are covered with Herringbone rigid metal lath which supports 1½ or 2 in. of concrete, in which sleepers for the finish wood floor may be embedded.

Herringbone rigid metal lath attached to the underside of joist section by prongs punched therein, forms the ideal base for a permanent crack-free ceiling.



GF STEEL LUMBER BEAM AND GIRDER CONSTRUCTION

Herringbone Rigid Metal Lath.

The lath that is universally recognized as best wherever metal lath is known. Stiff ribs running full length of sheets and set at an angle of 45° make Herringbone rigid and strong. It is easily handled, quickly put up, and does not sag nor buckle under plasterer's trowel.

Heavy strands connect the ribs and are so flattened that, instead of cutting the plaster, they curl it around, completely enveloping the metal. A perfect key is the

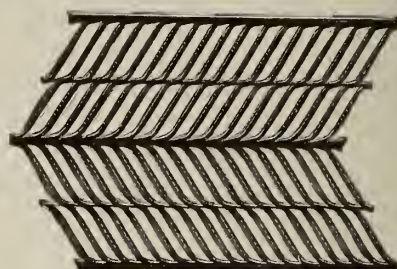
result, and with the lath entirely covered there is no danger of rusting. As a further precaution where salt air or industrial gases are present, Herringbone can be furnished galvanized or made from Armco (American Ingot) Iron.

There is the minimum of waste in erecting Herringbone, for the end laps are short and easily wired; while, on the side, one rib interlocks with the other, making the surface even stronger at the joint than elsewhere.

Style "BB" Herringbone is standard for practically any class of work. Sheets are 20¼ by 96 in.; mesh 7/32 by 1¼ in.; 15 sheets (22½ sq. yds.) to the bundle.

Style "AAA" Herringbone has heavier ribs and strands than Style "BB," which make it a stiffer lath throughout and permit a wider spacing of studs (see table below) or the use of a lighter gauge lath over usual distance between studs. "AAA" Herringbone will be found more satisfactory for ceiling work, and will give uniform satisfaction for partitions, interior and exterior walls.

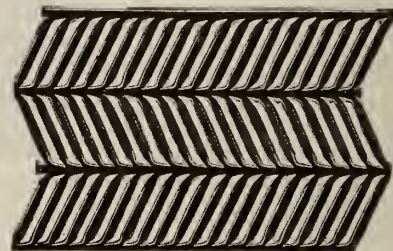
Sheets are 18 by 96 in.; mesh 3/32 by 1¼ in.; 15 sheets (20 sq. yds.) to the bundle.



HERRINGBONE "BB" EXPANDED METAL LATH (PATENTED)

APPROXIMATE WEIGHT PER SQUARE YARD

Gauge	Painted	Galvanized
27	2.25 lbs.	2.82 lbs.
26	2.50 lbs.	
24	3.37 lbs.	3.91 lbs.
22	4.21 lbs.	



STYLE "AAA" HERRINGBONE LATH

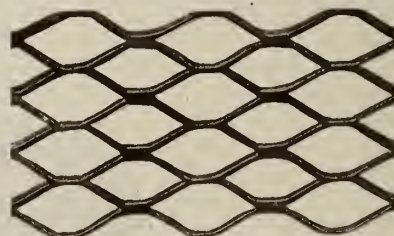
WEIGHT PER SQUARE YARD, STYLE "AAA"

Gauge	Painted	Galvanized	Studding center to center	
			Walls	Ceilings
27	2.53 lbs.	3.17 lbs.	16" to 18"	16"
26	2.81 lbs.		20"	18"
24	3.79 lbs.	4.39 lbs.	22" to 24"	20", 22", 24"
22	4.74 lbs.		26" to 28"	26" to 28"

Key Expanded Metal Lath.

Suitable for all classes of work where any metal lath can be used; especially adaptable for lathing domes, cornices — in fact for any ornamental plaster work; also, for fireproofing beams and columns. Mesh equally pliable in all directions.

Key lath furnished in large sheets, 24 by 96 in., saving time in erection. Strands act as shelves and clinch plaster firmly; 15 sheets (26⅔ sq. yds.) to the bundle.



KEY EXPANDED METAL LATH

APPROXIMATE WEIGHT PER SQUARE YARD

Gauge	Plain or painted	Galvanized
27	2.30 lbs.	2.73 lbs.
26	2.50 lbs.	2.94 lbs.
25	3.03 lbs.	3.32 lbs.
24	3.40 lbs.	3.74 lbs.
22	4.00 lbs.	Not made

INLAND STEEL COMPANY

Concrete Reinforcing Bars

First National Bank Building
CHICAGO, ILL.

BRANCH OFFICES

ST. PAUL, MINN., Pioneer Building
ST. LOUIS, MO., National Bank of Commerce Building
MILWAUKEE, WIS., Majestic Building
DETROIT, MICH., Ford Building
KANSAS CITY, MO., Commerce Building

DENVER, COLO., 918 17th Street
DALLAS, TEX., Practorian Building
SAN FRANCISCO, CAL., 22 Battery Street
SEATTLE, WASH., L. C. Smith Building
LOS ANGELES, CAL., Washington Building

WORKS

INDIANA HARBOR, IND.

CHICAGO HEIGHTS, ILL.

Products.

OPEN HEARTH STEEL INLAND DEFORMED, PLAIN SQUARE, ROUND and FLAT CONCRETE REINFORCING BARS; RAIL CARBON STEEL INLAND DEFORMED, PLAIN SQUARE, ROUND and FLAT CONCRETE REINFORCING BARS.

Facilities.

Manufacture, from mining of iron ore to finished products, enables this company to guarantee quality, according to standard specifications or special arrangements. Riehle 200,000-lb. testing machine at service of patrons, at both works, for making tests; also complete bending facilities. Rolling capacity, 500 tons per day.

Inland Deformed Bars.

Rolled from open hearth billets, medium or hard grade, and rail carbon steel, rerolled; $\frac{3}{8}$ to $\frac{5}{8}$ in. with single row of stars, and $\frac{3}{4}$ to $1\frac{1}{4}$ in. with double row of stars on each side. Corners rounded to prevent splitting of concrete. The mechanical bond is theoretically correct and ample.

Lengths up to 85 ft. can be furnished without extra charge.



INLAND DEFORMED BARS

Plain Open Hearth Steel Bars.

Open hearth steel square, round and flat bars are furnished in soft, medium (structural grade) or high carbon (hard grade) from new billets. Flats are made in all sizes, squares and rounds as per table herewith. All subject to Manufacturers' Standard Specifications.

Rail Carbon Steel Concrete Reinforcing Bars.

Made in Inland deformed, $\frac{3}{8}$ to 1 in.; plain squares, $\frac{3}{8}$ to 1 in.; rounds, $\frac{3}{8}$ to $1\frac{1}{4}$ in.; flats, all sizes.

Conforming to the Manufacturers' Standard Specifications for hard grade and to the American Society for Testing Materials Specifications.

Elastic limit 50,000 lbs. or over per sq. in. Prices on this material somewhat lower than on open hearth steel bars.

The reheating and rerolling of this material improves its quality—a fact well known.

SIZES AND WEIGHTS CONCRETE REINFORCING BARS

SQUARES		INLAND DEFORMED		ROUNDS	
Size, in.	Weight per ft., lbs.	Size, in.	Weight per ft., lbs.	Size, in.	Weight per ft., lbs.
$\frac{3}{8}$	.478	$\frac{3}{8}$	.485	$\frac{3}{8}$	.375
$\frac{1}{2}$	.850	$\frac{1}{2}$	.862	$\frac{1}{2}$	.511
$\frac{5}{8}$	1.328	$\frac{5}{8}$	1.341	$\frac{5}{8}$	.667
$\frac{3}{4}$	1.913	$\frac{3}{4}$	1.932	$\frac{3}{4}$	.845
$\frac{7}{8}$	2.603	$\frac{7}{8}$	2.630	$\frac{7}{8}$	1.043
1	3.400	1	3.434	1	1.502
$1\frac{1}{8}$	4.303	$1\frac{1}{8}$	4.343	$1\frac{1}{8}$	2.044
$1\frac{1}{4}$	5.312	$1\frac{1}{4}$	5.365	$1\frac{1}{4}$	2.670
$1\frac{3}{8}$	6.428			$1\frac{3}{8}$	3.379
$1\frac{1}{2}$	7.650			$1\frac{1}{2}$	4.173
				$1\frac{3}{4}$	5.049
				$1\frac{7}{8}$	6.008
				2	7.051
					8.178
					9.388
					10.680

STANDARD SPECIFICATIONS FOR CONCRETE REINFORCING BARS (ADOPTED 1914)

Properties considered	STRUCTURAL STEEL GRADE Medium open hearth		HARD GRADE High carbon open hearth	
	Plain	Deformed	Plain	Deformed
Phosphorus, max. open hearth.....	.06	.06	.06	.06
Ultimate tensile strength, lbs. per sq. in.....	55/70,000	55/70,000	80,000 min.	80,000 min.
Yield point, min. lbs. per sq. in.....	33,000	33,000	50,000	50,000
Elongation, per cent in 8" min.....	1,400,000	1,250,000	1,200,000	1,000,000
	T. S.	T. S.	T. S.	T. S.
Cold bend without fracture:				
Bars under $\frac{3}{4}$ " in diam. or thickness..	180°d. = 1t.	180°d. = 1t.	180°d. = 3t.	180°d. = 4t.
Bars $\frac{3}{4}$ " in diam. or thickness and over..	180°d. = 1t.	180°d. = 2t.	90°d. = 3t.	90°d. = 4t.

References.

Important recent work on which Inland concrete reinforcing bars have been used:

Studebaker Plant, South Bend, Ind.
Philipsborn Building, Chicago, Ill.
Somerset Hotel, Chicago, Ill.
Du Pont Chevrolet Building, Chicago, Ill.
Wilson & Co., U. S. Yards, Chicago, Ill.
Goetz Apartment, Chicago, Ill.
National Suit Co., Kansas City, Mo.
Dixie Terminal, Cincinnati, Ohio.

THE NATIONAL PRESSED STEEL CO.

Manufacturers of Steel Lumber Sections

MASSILLON, OHIO

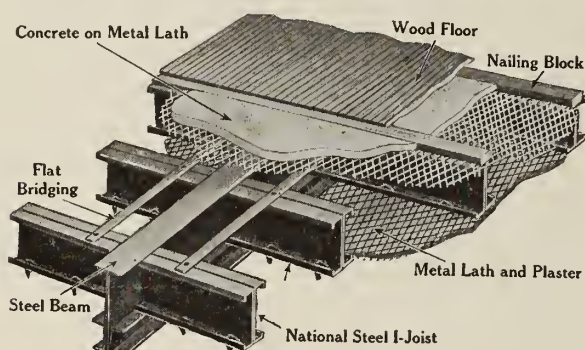
Products.

STEEL LUMBER SECTIONS consisting of JOISTS and STUDS for Fireproof Building Construction.

Sizes and Capacity.

Special analysis and alloy strips and plates, widths 3-in. to 24-in. (below 8-in., edges sheared)—gauge 1-in. to .065—armor plate.

National steel lumber sections are made from National quality strip steel in lengths up to 100 ft. The process of manufacture is such as to insure uniformity and an ultimate tensile fiber stress exceeding 64,000 lbs. per sq. in.



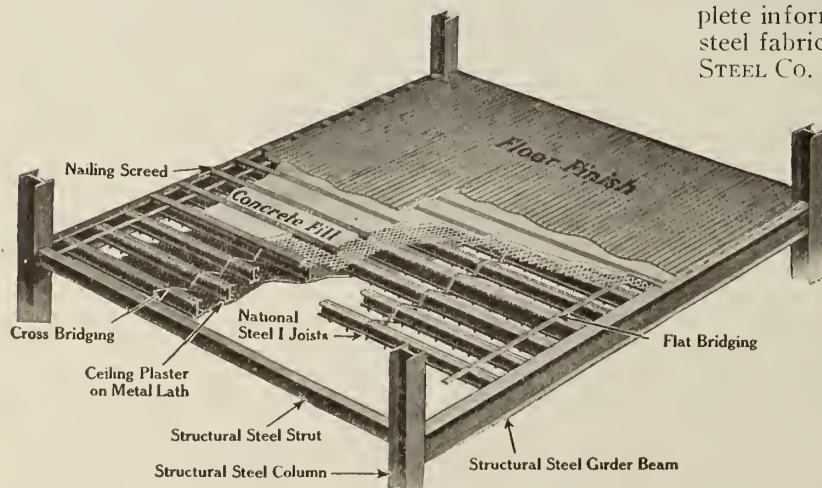
STEEL JOIST FLOOR CONSTRUCTION
Supported by rolled steel beam and resting on shelf angle

Construction Details.

Nailing blocks and metal lath are secured to top of joists with 12d nails driven into webs of joists.

Bridging is secured to joists in a similar manner.

Metal lath is attached to underside by means of prongs, as illustrated in cuts, or by wiring with No. 18-gauge tie wire through holes punched in flanges of joists, or by means of specially designed clips or fasteners.

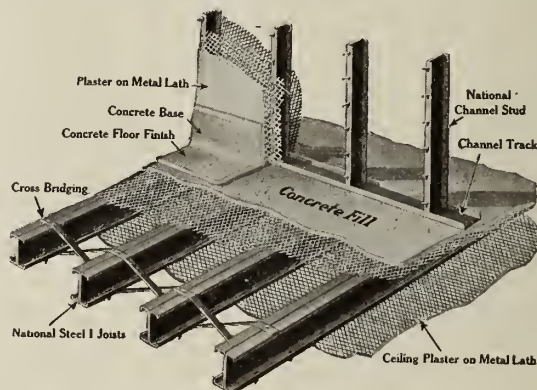


STRUCTURAL STEEL COLUMNS AND BEAMS SUPPORTING STEEL JOIST FLOOR PANEL

The concrete fill applied on metal lath for fireproofing purposes can be of 1: 2½: 5 mixture composed of sand, cement and gravel, or a standard cinder concrete fill.

The mixture should be comparatively dry and applied without forms or supports of any kind—the metal lath being amply rigid to carry the weight of the concrete fill.

Where concrete finish is desired as shown in illustration, wood nailing strips are eliminated and concrete fill of 2-in. thickness is applied continuously over joists. The finished surface should be approximately ½ in. thick, of proper mixture and application as employed in standard practice.



STEEL JOIST CONSTRUCTION
• With steel stud hollow partition

Distribution.

National steel lumber sections are marketed through steel fabricators. The result is an opportunity for close co-operation in designing and prompt deliveries.

Handbook.

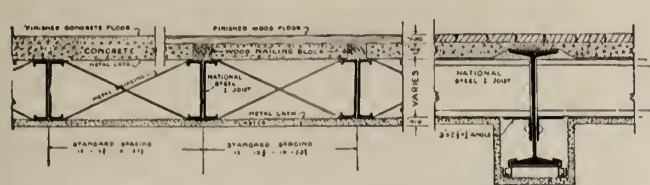
The National Steel Lumber Handbook gives complete information. Copy may be obtained through local steel fabricators or direct from THE NATIONAL PRESSED STEEL CO.

WEIGHT OF NATIONAL STEEL LUMBER FLOORS

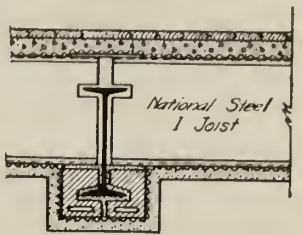
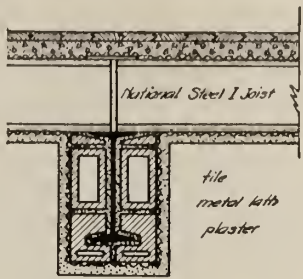
	Weight per sq. ft.
Wood flooring.....	3 lbs.
1¾ in. concrete.....	21 lbs.
National steel joists (average).....	3 lbs.
Plaster ceiling.....	7 lbs.
Total.....	34 lbs.



STEEL JOIST SUPPORTED BY MASONRY WALL

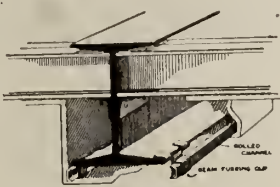


CROSS SECTION—STEEL JOIST FLOOR CONSTRUCTION



Tile supporting Steel Joists and fireproofing Structural Steel.

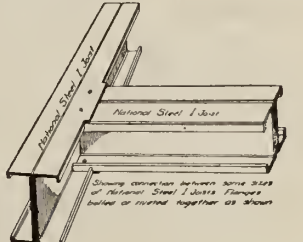
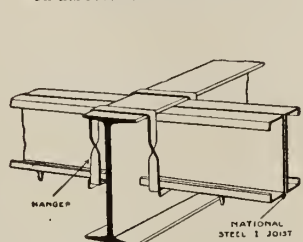
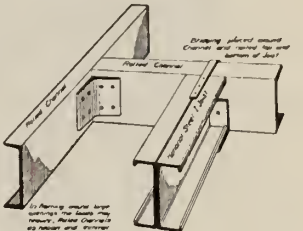
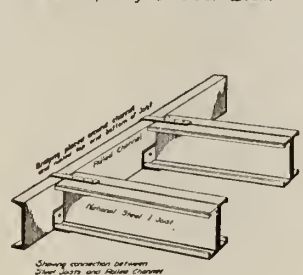
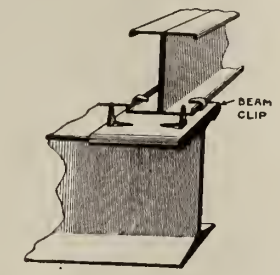
NATIONAL STEEL PARTITION STUDS
Total safe load in pounds for each stud. Using column formulae for fiber stress ($f=19,000 \text{ lbs} - \frac{1000}{r}$) with maximum of 13,000 lbs. per sq. in.
R. About axis A-A is for studs plastered both sides.
R. About axis B-B is for unplastered studs.



Structural Beam supporting Steel Joists with fireproofing Structural Beams

Size	Axis A-A plastered on both sides allowance made for prongs		Axis B-B Unplastered studs allowance made for prongs		Size
	4" C	4" I	4" C	4" I	
Weight	1.75	3.50	1.75	3.50	Weight
2			6500	13000	2
3			6500	13000	3
4			6000	12000	4
5			5250	10500	5
6	6500	13000	4500	9000	6
7	6500	13000	3500	7000	7
8	6500	13000	3125	6250	8
9	5750	11500	2650	5300	9
10	5500	11000	2250	4500	10
11	5250	10500	1750	3500	11
12	4750	9500	1500	3000	12
13	4500	9000			13
14	4000	8000			14
15	3750	7500			15
16	3380	6760			16
17	3250	6500			17
18	3000	6000			18

Safe load values above heavy horizontal lines are for ratios of 1/r not over 120.
No loads given for ratios of 1/r greater than 200.



STEEL JOIST FLOOR CONSTRUCTION DETAILS

NATIONAL STEEL I JOISTS

Total safe load in lbs., uniformly distributed for National Steel Floor Joists. Safe loads below are figured for fiber stress of 16,000 lbs per sq. in., and include weight of joists.

For loads below horizontal lines, deflection will be greater than the allowable limit for plastered ceilings. ($\frac{3}{16}$ of the span.)										No deflections greater than $\frac{3}{16}$ of the span produced by the given safe loads.									
Size	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.					
Weight	3.50	4.00	4.50	5.25	6.00	7.00	8.00	3.50	4.00	4.50	5.25	6.00	7.00	8.00					
Clear span in ft.	6	2222	3022	3912				2222	3022	3912									
	7	1905	2590	3353				1905	2590	3353									
	8	1667	2266	2933	4000			1667	2266	2933	4000								
	9	1479	2015	2608	3555	4620	5820	1333	2015	2608	3555	4620	5820						
	10	1333	1813	2347	3200	4150	5240	6350	1075	1813	2347	3200	4150	5240	6350				
	11	1215	1650	2134	2909	3770	4760	5780	887	1505	2134	2909	3770	4760	5780				
	12	1110	1510	1956	2667	3455	4370	5300	743	1266	1956	2667	3455	4370	5300				
	13	1020	1395	1805	2461	3190	4030	4880	1080	1689	2461	3190	4030	4880					
	14	950	1295	1675	2285	2962	3745	4530	931	1445	2285	2962	3745	4530					
	15		1210	1562	2130	2767	3492	4230		1261	2000	2767	3492	4230					
	16		1133	1465	2000	2595	3275	3970		1110	1762	2595	3275	3970					
	17		1068	1380	1880	2442	3081	3740			1564	2325	3081	3740					
18		1008	1302	1775	2312	2911	3530			1389	2062	2911	3530						
19			1232	1682	2188	2759	3340				1860	2641	3340						
20			1172	1600	2078	2620	3170				1665	2380	3170						
21				1520	1980	2495	3020					2158	2880						
22				1450	1888	2380	2885					1970	2640						

PROPERTIES OF NATIONAL STEEL I JOISTS

Depth, in.	Weight per foot, lbs.	Area of section, sq. in.	Thick-ness of metal, in.	Width of flange F-in.	A-A			B-B		
					I	S	r	I	S	r
4	3.50	1.04	.072	3.00	2.50	1.25	1.55	.48	.32	.68
5	4.00	1.19	.072	3.00	4.25	1.70	1.89	.48	.32	.63
6	4.50	1.33	.072	3.00	6.59	2.20	2.22	.48	.32	.60
7	5.25	1.55	.072	3.50	10.48	3.00	2.60	.72	.41	.68
8	6.00	1.76	.072	4.00	15.60	3.90	2.97	1.04	.54	.77
9	7.00	2.04	.077	4.00	22.13	4.92	3.30	1.10	.56	.74
10	8.00	2.36	.083	4.00	29.84	5.97	3.58	1.19	.59	.71

I—Moment of inertia.
S—Section modulus.
r—Radius of gyration.

NATIONAL STEEL I JOISTS

Safe loads in lbs. per sq. ft. of floor area. Weight of floor construction included. Fiber stress not exceeding 16,000 lbs. per sq. in. No deflections greater than 3/16 of the span produced by the given loads.

Joists spaced 12 in. on centers								Joists spaced 15 1/4 in. on centers								Joists spaced 19 in. on centers								Joists spaced 23 1/2 in. on centers									
Size	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	Size				
Weight	3.50	4.00	4.50	5.25	6.00	7.00	8.00	3.50	4.00	4.50	5.25	6.00	7.00	8.00	3.50	4.00	4.50	5.25	6.00	7.00	8.00	3.50	4.00	4.50	5.25	6.00	7.00	8.00	Weight				
Clear span in ft.	6	370	505	653				282	382	496					234	318	412					189	257	332					6				
	7	272	370	478				207	282	365					172	234	302					139	189	244					7				
	8	208	284	367	500			158	216	279	381				131	179	236	316				106	145	187	255				8				
	9	148	224	290	396	513	650	785	113	170	221	300			94	141	183	250				76	114	148	201	262	332		9				
	10	108	181	235	320	415	524	635	82	138	179	244	316	399	483	68	114	148	202	262	351	400	55	93	120	163	212	268	324	10			
	11	81	137	194	264	343	433	525	62	104	148	201	261	330	400	51	87	123	167	216	273	332	41	70	99	135	175	221	268	11			
	12	62	105	163	222	288	364	442	47	80	124	169	219	277	336	67	103	140	182	230	278		54	83	113	147	186	225	12				
	13		83	130	190	246	310	376	63	99	144	187	236	286		52	82	119	155	196	237		42	66	97	125	158	192	13				
	14		62	103	163	218	268	324	50	78	124	166	204	247		65	103	138	169	205			56	84	114	147	186	225	14				
	15			84	133	184	233	282	64	101	140	177	215			53	84	116	147	178			43	68	94	119	144	174	15				
	16			69	110	164	204	248	53	84	125	155	189				70	104	129	157				56	84	104	127	156	16				
	17				92	137	181	220		70	105	137	168				58	87	114	139				47	70	93	112	137	17				
18				77	115	162	196		58	88	123	149				49	73	102	124					59	83	100	128	18					
19					98	139	176			75	106	134					61	88	111					50	71	90	119	19					
20					83	119	159			63	91	121					52	75	101					42	61	81	100	20					
21						102	137				76	105						65	87						52	70	90	119	21				
22						90	120				68	92						57	76						46	61	81	100	22				

PAUL J. KALMAN COMPANY

Reinforcing Steel

Merchants National Bank Building
ST. PAUL, MINN.

DISTRICT SALES OFFICES

CHICAGO, ILL.

MILWAUKEE, WIS.

OMAHA, NEBR.

MINNEAPOLIS, MINN.

WAREHOUSES AND SHOPS: CHICAGO, ILL., ST. PAUL AND MINNEAPOLIS, MINN.

Products and Services.

DEFORMED or PLAIN REINFORCING BARS, in Structural, Intermediate or Hard Grade rolled from new billet stock; COLD TWISTED SQUARE REINFORCING BARS; MACHINE MADE COLUMN SPIRALS.

Also Woven Wire Concrete Reinforcement.

Fabricating.

Modern machines afford the most complete facilities for bending and fabricating in the shops, and enable the company to do this work economically and without delay. Column spirals supplied completely fabricated with spacers.

Quality of Materials.

All reinforcement is rolled from the best quality new-billet steel; our years of experience having proved this the best quality for the purpose.

Deliveries.

Large and complete stocks of reinforcing bars, in lengths up to and including 60 ft., are carried in the warehouses at Chicago and the Twin Cities, from which immediate delivery can be made. Where delivery is not so urgent, shipment is made promptly from our mills. A wide reputation has been established for good service and for ability to ship as promised.

Recent Installations.

The structures listed below were all built with re-

inforcing steel furnished by PAUL J. KALMAN COMPANY.

Armour & Co., new Packing Plant, 22 buildings, South St. Paul, Minn.

U. S. Army General Hospital, Chicago, Ill.

St. Paul Public Library, St. Paul, Minn.

Plankinton Arcade Building, Milwaukee, Wis.

Y. M. C. A. Building, Minneapolis, Minn.

Aviation General Warehouse for U. S. Government, Little Rock, Ark.

James S. Kirk & Co., Soap Factory, Chicago, Ill.

Wisconsin-Minnesota Light & Power Co., Reinforced Concrete Dam and Power Plant, Wisconsin, Minn.

Picric Acid Plant for U. S. Government, Grand Rapids, Mich.

Midland Packing Co., Packing Plant, Sioux City, Iowa

Army Supply Base for U. S. Government, New Orleans, La.

Southwestern Milling Co., Kansas City, Kans.

Laclede Gas Light Co., addition for U. S. Government, St. Louis, Mo.

Ford Motor Co., Sales and Assembly Building, Minneapolis, Minn.

Crane & Co., Building C-4 and B-2 Extension, Chicago, Ill.

Cockran-Hill & Co., Packing Plant, Baltimore, Md.

Court Avenue Bridge, Des Moines, Iowa

Armour & Co., Ice Manufacturing Plant, Beef Cooler, Meat Loading Dock, South Omaha, Nebr.

Buildings for Philadelphia Quartz Co., Berkeley, Cal.

Pennsylvania Railroad Co., Northern Central Elevator, Baltimore, Md.

Eastern Michigan Power Co., Junction Dam and Power Plant, Wellston, Mich.

City National Bank Building, Shreveport, La.

Maxwell Motor Sales Corp., Sales and Assembly Building, Minneapolis, Minn.

Railroad Building, St. Paul, Minn.



COURT AVENUE BRIDGE OVER DES MOINES RIVER, DES MOINES, IOWA, SHOWING COMPLETE STRUCTURE
MARSH ENGINEERING Co., Engineers Koss Construction Co., Contractors, Des Moines, Iowa

ESTABLISHED 1884

NORTH WESTERN EXPANDED METAL CO.

TELEPHONES:
HARRISON 1701-2-3

GENERAL OFFICES
407 South Dearborn Street
CHICAGO, ILL.

CODE ADDRESS:
"KNOBURN"

BRANCH OFFICE: BOSTON, MASS.

WORKS: CHICAGO, ILL., JEANNETTE, PA.

Products.

The NEMCO LINE of EXPANDED METAL PRODUCTS includes T-Rib Chanelath and the following Flat or Plastering Laths: Kno-Burn, Eureka, XX Century, Pure Iron, P.O. Special, Diamond Mesh; also these Self-Furring Laths: Corrugated, and Kno-Fur.

ECONO DIAMOND MESH HEAVY EXPANDED METAL for Concrete Reinforcement, Machine Guards, etc.

NEMCO PRESTEEL LUMBER.

Nemco and Econo Sheathing Laths (mesh with waterproof felt backing).

Metal Lath Accessories: Corner Beads, Picture Mould, Base Screed, Base Ground, Tie Wire, Cold Formed Channels.

Nemco Products
TRADE-MARK

Stocks Carried in All Principal Distributing Points; Catalogues and Samples.

Stocks of Nemco Products are carried by selling agents located in all principal cities. Catalogues containing specifications and full details will be furnished on request, also samples. Our Engineering Department will be also glad to co-operate with anyone interested in the most effective and economical use of our products.

T-Rib Chanelath.

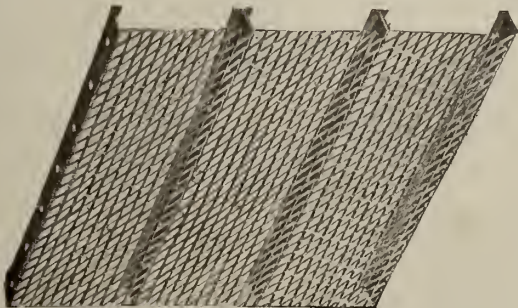
A combined form and reinforcement of expanded metal for concrete slabs of moderate spans and loads, such as roofs, floors, walls, tanks, culverts. Chanelath is also much used as a skeleton for solid plastered partitions, and as a plastering lath in suspended ceilings, furred walls, etc. It is furnished in 3 gauges: Nos. 24, 26 and 28.

The T-ribs (the flange of which provides a positive mechanical bond) are 4 in. apart, and $\frac{7}{8}$ in. high. They are connected by expanded metal having a small diamond mesh $\frac{3}{4}$ by $\frac{3}{8}$ in. of the popular Kno-Burn type, with no break in the key at the ribs. The rigidity of Chanelath and the large size of the sheets save time and labor in erection.



T-RIB COVERED COMPLETELY BY CONCRETE

Note knobs of concrete which have passed through mesh protecting underside of T-Rib

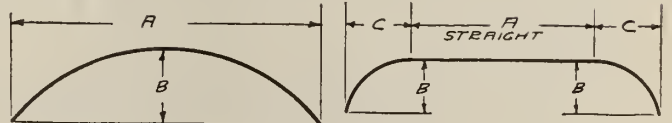


T-RIB CHANELATH

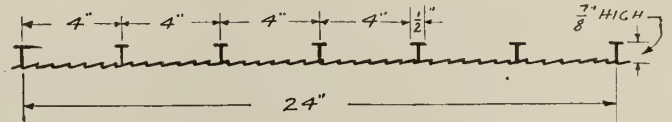
There are no projections to catch the trowel



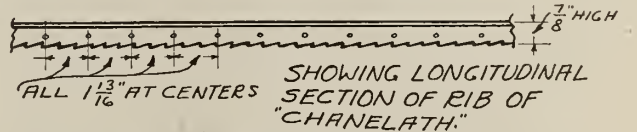
T-RIB CHANELATH
Notice the shaping of the ribs



CURVED CHANELATH

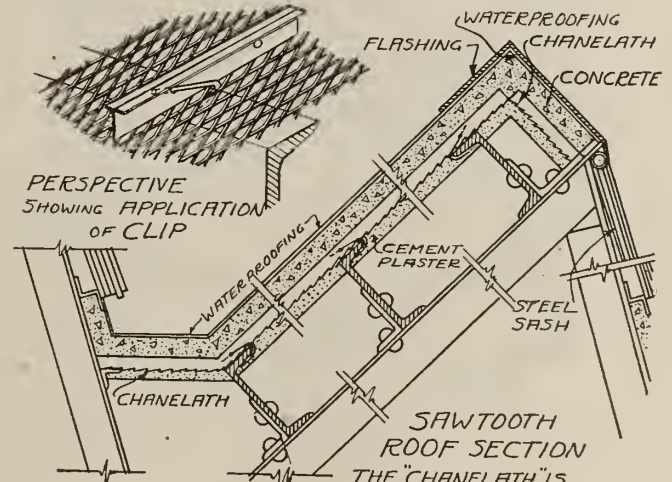


SHOWING CROSS SECTION



SHOWING LONGITUDINAL SECTION OF RIB OF "CHANELATH."

CROSS SECTION AND LONGITUDINAL SECTION OF RIB OF CHANELATH



THE "CHANELATH" IS CLIPPED TO PURLINS AS SHOWN ABOVE. CONCRETE IS POURED ON UPPER SIDE TO REQUIRED THICKNESS. (2" TO 4") THE UNDER SIDE IS PLASTERED WITH $\frac{1}{2}$ " TO $\frac{3}{4}$ " THICK COAT OF PLASTER.

CHANELATH CONSTRUCTION ON SLOPING ROOF

SIZES—Chanelath comes in sheets 4 in. to 4 ft. wide by 4-in. intervals; the 2-ft. size is most popular. Lengths vary from 3 to 12 ft. by 1-ft. intervals. Other lengths can be furnished to order.

T-Rib Chanelath can be furnished flat or curved (rib side out) to a minimum radius of 24 in. Dimensions shown in the cut or the equivalent should be furnished.

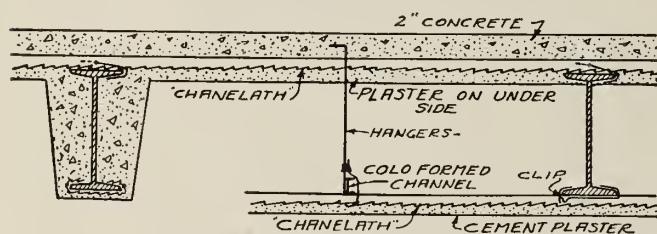
"Formless Concrete Construction" contains full information for the use of T-Rib Chanelath, designing tables, erection data, etc. Send for copy.

Specifications for use of Chanelath gladly sent on request.

WEIGHTS AND AREAS OF T-RIB CHANELATH

Size	Weight, painted, per sq. ft., lbs.	Weight, crated, per sq. ft., lbs.	Effective sectional area per ft. of width, sq. in.
28	.56	.70	.152
26	.67	.82	.183
24	.89	1.07	.244

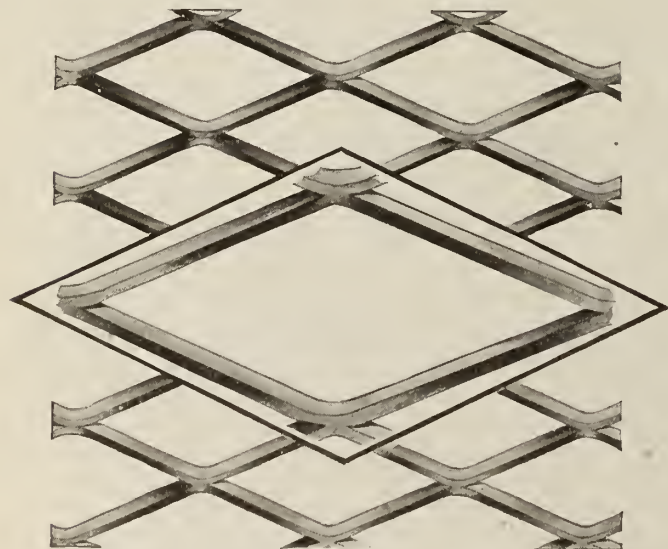
Chanelath is furnished painted only.



DETAILS OF VARIOUS TYPES OF CONSTRUCTION

Econo Expanded Metal.

An economical and highly satisfactory diamond mesh concrete reinforcement for all types of reinforced concrete structures. Econo is expanded from sheets of high grade open hearth mild steel. The process of expansion increases the tensile strength and ductility, rendering high working stresses safe. (New York and Boston building codes permit 20,000 lbs. per sq. in.) The diagonal strands integrally connected at intersections most effectually distribute concentrated loads.



ECONO EXPANDED METAL REINFORCING

The use of this material insures accurate location of reinforcement and perfect bond and the large area placed at one time lowers labor cost. Econo is furnished in a great variety of sizes, cross section areas, and meshes.

The smaller meshes ($\frac{1}{2}$ to $2\frac{1}{4}$ in.) are in demand for machine guards, tool room partitions, etc.

Full details in handbook, "Designing Data," sent on request.

PARTIAL LIST OF STOCK SIZES AND WEIGHTS OF ECONO REINFORCING

*No. Size	Weight per sq. ft., lbs.	Mesh and gauge	Widths, ft.	Lengths, ft.
06-3	.20	3"-16 ga.	3, 4, 6	6, 8 and 12
10-3	.34	3"-12 "	3, 4, 6	6, 8 and 12
15-3	.51	3"-10 "	3, 4, 6	6, 8, 10, 12
16-3	.55	3"-10 "	3, 4, 6	6, 8, 10, 12
20-3	.68	3"-10 "	3, 4, 6	6, 8, 10, 12
25-3	.85	3"-10 "	3, 4, 6	6, 8, 10, 12
30-3	1.02	3"-10 "	3, 4, 6	6, 8, 10, 12
35-3	1.19	3"-10 "	3, 4, 6	6, 8, 10, 12
40-3	1.36	3"-7 "	3½, 7	6, 8 and 12
10-2¼	.34	2¼"-16 ga.	3, 4, 6	6, 8 and 12
15-2¼	.51	2¼"-12 "	3, 4, 6	6, 8 and 12
20-2¼	.68	2¼"-10 "	3, 4, 6	6, 8, 10, 12
10-1½	.34	1½"-16 ga.	3, 4, 6	6, 8 and 12
15-1	.51	1½"-14 "	3, 6	6, 8 and 12
20-1½	.68	1½"-12 "	3, 4, 6	6, 8 and 12
15-¾	.51	¾"-16 ga.	3'-6", 7	6, 8 and 12
23-¾	.85	¾"-12 "	3, 4, 6	6, 8 and 12
20-1½	.68	1½"-18 ga.	3'-6", 4'	8 only
24-½	.82	½"-16 "	4'-8"	8 only

*The number of the size of product may be explained thus, for example: No. 15-3 has .15 sq. in. of steel in each 12 in. of width of the material; mesh is 3 in. wide.

Special sizes made to order

Nemco Presteel Lumber.

Presteel Lumber is a recent addition to the Nemco line. It consists of channel and I-sections of cold rolled steel in 4-, 5-, 6-, 7-, 8-, 9- and 10-in. sizes.

Presteel Lumber is designed to provide a fireproof construction lighter than any other type and at cost very little higher than that of inflammable construction. It is used as framing (joists, studs, etc.) in any type of building. The large illustration gives an excellent idea of the general construction.

Used in connection with other Nemco products, expanded metal lath, Chanelath, etc., it provides a structure that is moderate in cost, fireproof, permanent; the walls and ceilings of this type of building will not streak nor discolor and cracks in the plaster are prevented. Rats and mice, of course, are absolutely stopped by the barriers of steel, either lath or Presteel Lumber.

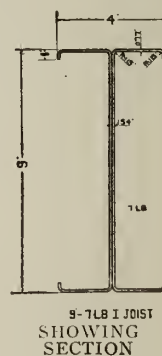
Construction details have been worked out so simply that untrained workmen with ordinary hand tools can erect Presteel Lumber properly and rapidly. Factory fabrication minimizes cutting or fitting on the job. There are fewer pieces to be handled than in any other construction material.

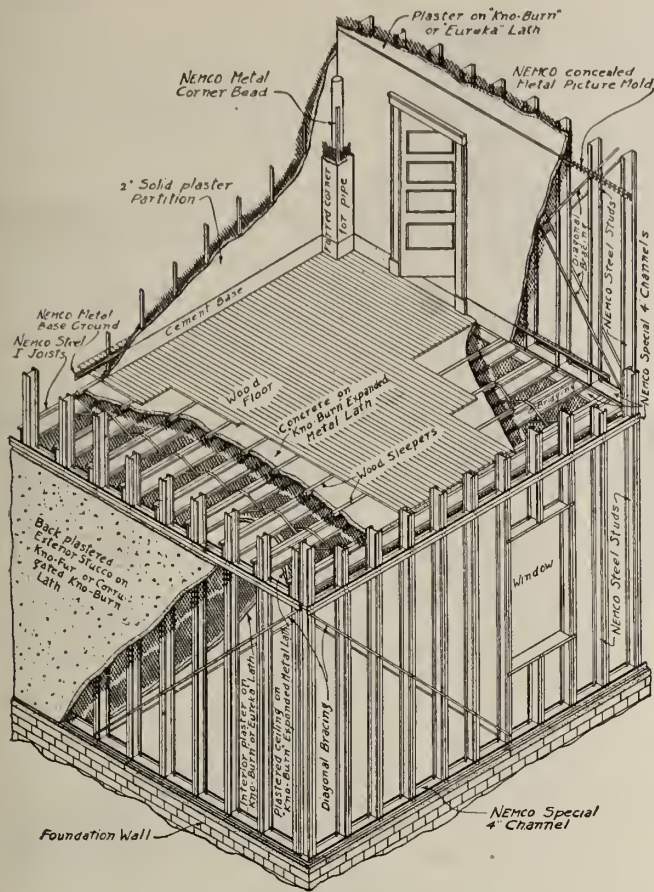
Presteel Lumber can be erected regardless of weather conditions, as the finished portions of the building need not be installed until after the walls and roof have been completed, thus providing enclosure and protection.

Convenient accessories have been devised, all of which are fully described in the Presteel Manual sent free on request. Full designing and construction information is also furnished in the Manual.

Stocks of Presteel Lumber are carried at convenient distributing and fabricating centers in principal cities throughout the country.

Our own Engineering Department, or the Engineering Departments of fabricators will gladly give information on any point desired.

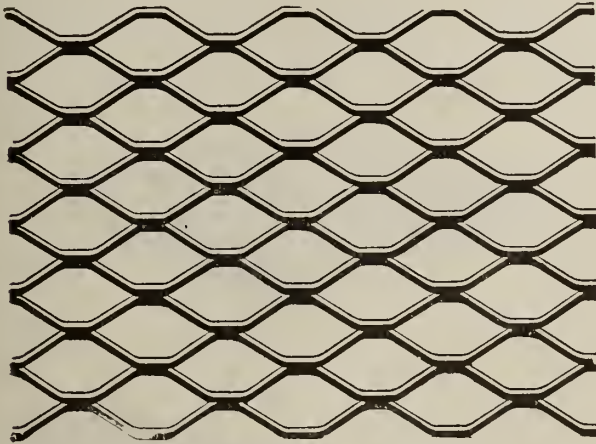




GENERAL ILLUSTRATION OF FLOOR, WALL AND PARTITION CONSTRUCTION

Expanded Metal Lath.

KNO-BURN—A practical and economical base for stuccoing or interior plastering, etc., also used for protecting concrete columns, fireproofing the enclosures about elevator shafts, beltways, etc., in mill construction. The diamond shaped meshes or openings are $\frac{3}{8}$ by $\frac{3}{4}$ in. with strands $\frac{1}{16}$ in. wide. Furnished in Nos. 24, 25, 26 and 27 gauge. Stock size of sheets 18 by 96 in. Special size 24 by 96 in. can be furnished if desired.



KNO-BURN EXPANDED METAL LATH

STOCK SIZES AND WEIGHTS OF KNO-BURN LATH

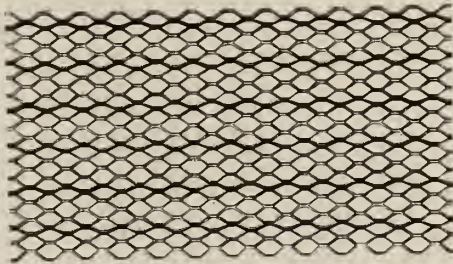
Number	Sheets per bundle	Yards per bundle	Weight per yard, lbs.	Weight per bundle, lbs.
27-gauge	9	12	2.3	28
26-gauge	9	12	2.5	30
25-gauge	9	12	3.0	36
24-gauge	9	12	3.4	40.8

Regular size of sheets, 18 x 96 in.
Special size, 24 x 96 in., 16 yds. per bundle, can be furnished.
All gauges furnished painted.

XX CENTURY—An expanded metal lath similar in size and shape of mesh to Kno-Burn but cut from a special copper bearing sheet and protected by a special carbon paint. Recommended for use with patent plasters or for use in damp climates. Furnished in the same sizes and weights as Kno-Burn.

Corrugated Expanded Metal Lath.

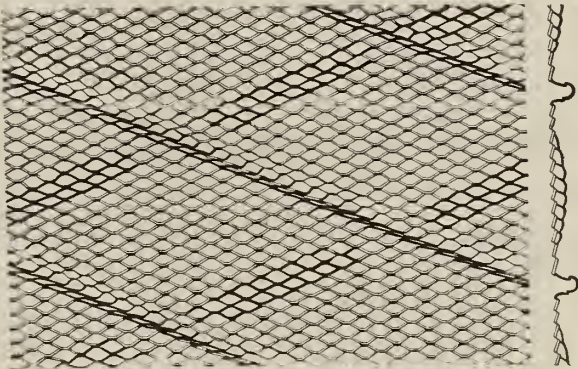
A self-furring plastering lath furnished in either the Kno-Burn, XX Century, or Eureka types of mesh.



CORRUGATED EXPANDED METAL LATH

Kno-Fur Expanded Metal Lath.

A self-furring lath and furnished in 2 styles—Kno-Fur Special, having the Eureka mesh and cut from standard steel sheets, and Kno-Fur Regular, having the Kno-Burn mesh but cut from special acid resisting copper bearing sheets.



KNO-FUR EXPANDED METAL LATH

STOCK SIZES AND WEIGHTS OF KNO-FUR LATH

No.	Sheets per bundle	Size of sheets, in.	Yards per bundle	Weight per yard, lbs.	Weight per bundle, lbs.
27-ga. Reg.	9	22 x 96	14 $\frac{1}{2}$	2.62	39.0
26-ga. Spec.	9	19 $\frac{1}{2}$ x 96	13	2.40	31.2
24-ga. Spec.	9	20 $\frac{1}{2}$ x 96	13 $\frac{1}{2}$	3.08	42.0
24-ga. Reg.	9	22 x 96	14 $\frac{1}{2}$	3.8	56.0

TRUSCON STEEL COMPANY

(TRUSSED CONCRETE STEEL COMPANY)

Manufacturers of Reinforcing Steel, Metal Lath, and Specialties
YOUNGSTOWN, OHIO

REPRESENTATIVES IN THE FOLLOWING CITIES

ATLANTA, GA. DALLAS, TEX.
BALTIMORE, MD. DAYTON, OHIO
BIRMINGHAM, ALA. DENVER, COLO.
BOSTON, MASS. DETROIT, MICH.
CHICAGO, ILL. EL PASO, TEX.
CINCINNATI, OHIO INDIANAPOLIS, IND.
CLEVELAND, OHIO KANSAS CITY, MO.
COLUMBUS, OHIO LOS ANGELES, CAL.

LOUISVILLE, KY.
MEMPHIS, TENN.
MILWAUKEE, WIS.
MINNEAPOLIS, MINN.
NEW YORK, N. Y.
NEW ORLEANS, LA.
NORFOLK, VA.
OMAHA, NEBR.

OKLAHOMA CITY, OKLA.
PHILADELPHIA, PA.
PITTSBURGH, PA.
PORTLAND, ORE.
ROSWELL, N. M.
SALT LAKE CITY, UTAH

SAN ANTONIO, TEX.
SAN FRANCISCO, CAL.
SEATTLE, WASH.
SPOKANE, WASH.
ST. LOUIS, MO.
SYRACUSE, N. Y.
TOLEDO, OHIO
WASHINGTON, D. C.

Products.

REINFORCING STEEL; KAHN TRUSSED BARS;
RIB BARS; RIB METAL; COLUMN HOOPING;
STEEL FLORETYLES and FLOREDOMES; HY-RIB;
METAL LATH; PRESSED STEEL JOISTS and STUDS;
INSERTS; CURB BARS; ARMOR PLATES.

Corner Beads; Base Screeds.

For Standard Buildings, see page 28; for
Steel Windows, see pages 352-54.

Service.

Owing to the wide range of detail of these products and the value of the technical experience of the company, it is suggested that engineers and architects avail themselves of the service offered by our corps of engineers that is at all times ready to furnish suggestions, estimates and details.

The following is necessarily only an outline of products and not an attempt to suggest their wide application and extensive use.

Kahn Trussed Bars.

Open hearth steel, concrete beam, girder, floor and arch reinforcement. Unit bars with 45° rigid diagonals formed from flanges on the main body producing 12% to 30% stronger beams than loose stirrups; save steel in design, labor in installation; safe; strong; fireproof and shockproof.

RIGID CONNECTION



KAHN TRUSSED BAR



SECTION KAHN TRUSSED BAR

D & B in.	Wt. per lin. ft.	Area, sq. in.
$1\frac{1}{2} \times 1\frac{1}{2}$	1.4 lbs.	0.41
$\frac{3}{4} \times 2\frac{3}{4}$	2.7 lbs.	0.79



SECTION KAHN TRUSSED BAR

D & B in.	Wt. per lin. ft.	Area, sq. in.
$1\frac{1}{2} \times 2\frac{1}{4}$	4.8 lbs.	1.41
$1\frac{3}{4} \times 2\frac{3}{4}$	6.8 lbs.	2.00
$2 \times 3\frac{1}{2}$	10.2 lbs.	3.00

*NOTE—The special lengths enclosed in parentheses are ordinarily available only for items of 5 tons or more.



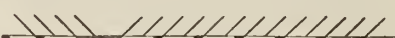
STANDARD SHEAR
Middle portion left unsheared



CENTER SHEAR
Entire bar sheared to center



ONE-WAY SHEAR
All diagonals sheared, inclining in one direction



SPECIAL SHEARING
As directed by purchaser

LENGTH OF DIAGONALS

Size, in.	Standard lengths, in.	*Special lengths, in.
$1\frac{1}{2} \times 1\frac{1}{2}$	12	(6) 8 (18)
$\frac{3}{4} \times 2\frac{3}{4}$	12, 24	8 (18) 30
$1\frac{1}{2} \times 2\frac{1}{4}$	12, 24, 36	8 (18) 30
$1\frac{3}{4} \times 2\frac{3}{4}$	36	(24) 30 (48)
$2 \times 3\frac{1}{2}$	36	(24) 30 (48)



TRADE-MARK

Collapsible Column Hooping.

Accurately constructed column reinforcement, shipped flat in coils of exact diameter attached to spacing bars, ready for field erection. Sizes as follows:

Size of wires, in.	Diameter, in.	Pitch, in.
$\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{8}$, $\frac{1}{2}$	9 to 36	$1\frac{1}{4}$ to 12



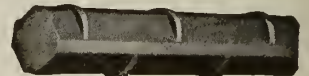
COLUMN HOOPING

Rib Bars.

Special rolled steel section with series of cross ribs to secure maximum grip. Carried in stock, square or round, straight or bent as ordered.

PROPERTIES OF RIB BARS

Area, in.	Equivalent to	Wt. per ft., lbs.
.110	$\frac{3}{8}$ " Round	.379
.196	$\frac{1}{2}$ " Round	.674
.250	$\frac{1}{2}$ " Square	.86
.307	$\frac{5}{8}$ " Round	1.054
.442	$\frac{3}{4}$ " Round	1.517
.601	$\frac{7}{8}$ " Round	2.065
.785	1" Round	2.697
1.000	1" Square	3.46
1.266	$1\frac{1}{8}$ " Square	4.38
1.563	$1\frac{1}{4}$ " Square	5.41



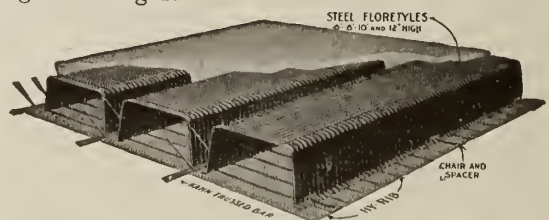
SQUARE RIB BAR



ROUND RIB BAR

Floretyles and Floredomes.

FLORETYLES—Rows of specially formed steel tiles, separated by reinforced concrete joists, covered with thin layers of concrete, produce strong, deep, light weight, flat ceilings on long spans; require but inexpensive centering and are soundproof. Accuracy of spacing assured by special spacer-chairs. $\frac{3}{8}$ in. Hy-Rib used for ceilings. Furnished in 2 types: (1) ribbed with deep stiffening ribs across top, corrugated sides, rounded corners, corrugated flanges; (2) corrugated with deep corrugations extending completely around tile, with corrugated flanges.



RIBBED STEEL FLORETYLES

Approximate width at base, $20\frac{1}{2}$ in.; standard lengths, 3 and 4 ft.; standard heights, 6, 8, 10 and 12 in.

Corrugated Steel Floretyles—

Approximate width at base, $20\frac{1}{2}$ in.; standard lengths, 2 ft. $4\frac{1}{2}$ in. and 3 ft. 9 in.; standard heights, 6, 8, 10 and 12 in.

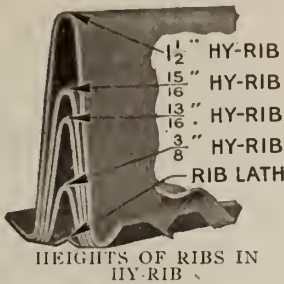


CORRUGATED STEEL FLORETYLES

FLOREDOMES—Closed and with reinforcements, on four sides, carrying load in two directions to support.

Hy-Rib.

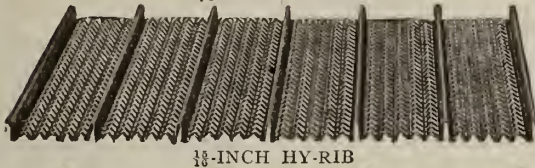
A reinforcement obtained by shearing and pressing sheet steel, making a unit of lath and stud. The ribs eliminate forms and save studs in concrete and plaster work, reducing cost and simplifying construction, saving labor, time and expense. Used in construction of floors, roofs, walls, sidings, partitions, ceilings, furring, tanks, sewers, culverts, conduits, etc.



HEIGHTS OF RIBS IN HY-RIB



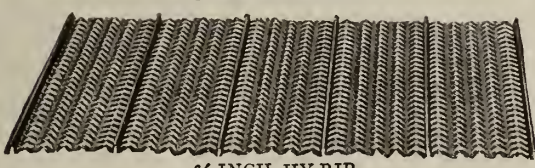
1 1/2-INCH HY-RIB



1 5/8-INCH HY-RIB



1 3/4-INCH HY-RIB



1 3/8-INCH HY-RIB

DIMENSIONS OF HY-RIB

Type of Hy-Rib	Formerly called	Height of ribs	Spacing of ribs	Width of sheets	Wt., lbs. per sq. ft.			
					22 gage	24 gage	26 gage	28 gage
1 1/2" Hy-Rib	Deep-Rib	1 1/2"	7"	14"	1.340	1.072	.804	
1 5/8" Hy-Rib	7-Rib	1 5/8"	4"	24"		1.057	.793	.661
1 3/4" Hy-Rib	4-Rib	1 3/4"	5 1/2"	16"		.793	.595	.496
1 3/8" Hy-Rib	6-Rib	1 3/8"	4"	20"		.635	.476	.397

Standard lengths, 6, 8, 10 and 12 ft. Other lengths cut without charge except for waste.

SOLID PARTITIONS OF HY-RIB LATH AND CHANNELS

Metal lath	Spac. of studs or channels, in.	Height, ft.	Thickness, in.	Reinforcement	
				Reinforcement	
No. 24 3/8" Hy-Rib Lath	36 to 42	10	1 3/4	No. 28, 3/8" Hy-Rib	
No. 26 3/8" Hy-Rib Lath		12	2	No. 26, 1/2" Hy-Rib	
No. 28 3/8" Hy-Rib Lath	32 to 36	14	2 1/4	No. 28, 1/2" Hy-Rib	
1-A Hy-Rib Lath		16	2 1/2	No. 26, 3/4" Hy-Rib	
Rib Lath No. 4	24 to 30	18	2 3/4	No. 28, 1/2" Hy-Rib	
Rib Lath No. 2		20	3	No. 24, 1 1/2" Hy-Rib	
Rib Lath No. 1	14 to 16			No. 26, 1 1/2" Hy-Rib	

HY-RIB SIDE WALLS

Spac. supports, ft. in.	Thickness of wall, in.	Reinforcement	Spac. supports, ft. in.	Thickness of wall, in.	Reinforcement
1 4	1 3/4	Rib Lath No. 2 or 1-A Hy-Rib Lath	3 6	1 3/4	No. 24, 3/8" Hy-Rib Lath or No. 28, 1/2" Hy-Rib
1 8	1 3/4	Rib Lath No. 4 or 1-A Hy-Rib Lath	6	1 3/4	No. 26, 1/2" Hy-Rib or No. 28, 1/2" Hy-Rib
2 0	1 3/4	No. 28, 3/8" Hy-Rib Lath or 1-A Hy-Rib Lath	8	2	No. 24, 1 1/2" Hy-Rib or No. 26, 1 1/2" Hy-Rib
2 8	1 3/4	No. 26, 3/8" Hy-Rib Lath	10	2	No. 24, 1 1/2" Hy-Rib
			12	2 1/2	No. 24, 1 1/2" Hy-Rib

HY-RIB CEILINGS

Spac. supports, ft. in. to ft. in.	Reinforcement	Spac. supports, ft. in. to ft. in.	Reinforcement
1 0 to 1 2	Rib Lath No. 1 or 1-A Hy-Rib Lath	2 9 to 2 11	No. 24, 3/8" Hy-Rib Lath
1 2 to 1 6	Rib Lath No. 2 or 1-A Hy-Rib Lath	2 11	No. 28, 1/2" Hy-Rib
1 4 to 1 11	1-A Hy-Rib or Rib Lath No. 4	3 11	No. 26, 1/2" Hy-Rib or No. 28, 1/2" Hy-Rib
1 11 to 2 2	No. 28, 3/8" Hy-Rib Lath	4 11	No. 24, 1 1/2" Hy-Rib or No. 26, 1 1/2" Hy-Rib
2 6 to 2 9	No. 26, 3/8" Hy-Rib Lath	5 11	No. 24, 1 1/2" Hy-Rib

SAFE LOADS IN POUNDS PER SQUARE FOOT FOR SLABS REINFORCED WITH HY-RIB

(Safe loads include weight of slab. For safe live loads, deduct weight of slab)

B. M. = $\frac{1}{10} w l^2$ For B. M. equals 1/12 w l² add 20% to loads.

For B. M. equals 1/8 w l² deduct 20% from loads.

1 1/2" Hy-Rib (4-Rib)

Thickness of slabs above base of Hy-Rib	Gage	Moment of resistance per ft. of width	Span in feet							
			3	4	5	6	7	8	9	10
2" thick slab, weight 24 lbs. per sq. ft.	28	3000	277	156	100	69				
	26	3625	356	189	122	84	61			
	24	4775	441	249	159	110	81	63		
2 1/2" thick slab, weight 30 lbs. per sq. ft.	28	4000	371	209	134	93	68			
	26	4750	440	248	159	110	80	60		
	24	6550	578	325	209	145	106	82		
3" thick slab, weight 36 lbs. per sq. ft.	28	4925	455	255	164	104	84	64		
	26	5790	545	305	196	135	100	76	60	
	24	7750	702	402	257	179	131	101	79	64
3 1/2" thick slab, weight 42 lbs. per sq. ft.	28	5800	546	307	196	137	102	78	61	
	26	7000	644	365	234	163	109	92	73	
	24	9210	881	438	308	214	157	120	95	76
4" thick slab, weight 48 lbs. per sq. ft.	28	6845	632	355	228	158	116	89	70	
	26	8125	762	422	270	188	138	105	84	68
	24	10750	962	562	359	250	183	140	101	90

1 1/2" Hy-Rib (7-Rib)

Thickness of slabs above base of Hy-Rib	Gage	Moment of resistance per ft. of width	Span in feet								
			3	4	5	6	7	8	9	10	11
2" thick slab, weight 24 lbs. per sq. ft.	28	3533	327	185	117	82					
	26	4241	392	221	141	97					
	24	5647	522	294	188	132					
2 1/2" thick slab, weight 30 lbs. per sq. ft.	28	4590	424	239	153	106	78	59			
	26	5513	510	287	183	127	93	71			
	24	7346	681	383	245	171	125	95			
3" thick slab, weight 36 lbs. per sq. ft.	28	5648	522	294	187	131	96	73			
	26	6773	627	353	225	158	115	87	69		
	24	9023	835	469	300	209	153	117	91		
3 1/2" thick slab, weight 42 lbs. per sq. ft.	28	6705	620	349	220	155	113	87			
	26	8044	742	417	268	186	137	104	82		
	24	10721	992	558	356	249	182	140	110	89	
4" thick slab, weight 48 lbs. per sq. ft.	28	7763	718	403	259	180	132	101	80		
	26	9304	864	485	310	216	158	121	97	77	
	24	12409	1140	644	413	288	212	162	128	103	86

1 1/2" Hy-Rib (DEEP-RIB)

Thickness of slabs above base of Hy-Rib	Gage	Moment of resistance per ft. of width	Span in feet									
			3	4	5	6	7	8	9	10	11	12
2 1/2" thick slab, weight 30 lbs. per sq. ft.	26	5479	507	286	182	127	93	71				
	24	7313	676	380	243	169	124	96				
	22	9141	845	475	304	211	155	120				
3" thick slab, weight 36 lbs. per sq. ft.	26	6851	633	357	228	159	117	89	71			
	24	9135	845	476	304	213	155	119	95			
	22	11418	1055	594	380	265	194	148	119			
3 1/2" thick slab, weight 42 lbs. per sq. ft.	26	8224	761	428	273	190	140	108	84			
	24	10958	915	546	356	243	179	141	113	91		
	22	13697	1115	694	456	316	233	179	141	113		
4" thick slab, weight 48 lbs. per sq. ft.	26	9596	887	498	320	222	163	125	99	80		
	24	12791	1066	626	426	296	218	167	132	107	87	
	22	15989	1332	832	532	370	272	209	165	134	108	
4 1/2" thick slab, weight 54 lbs. per sq. ft.	26	10958		572	365	253	186	142	113	91		
	24	14614		763	487	339	249	191	151	121	100	84
	22	18267		960	609	424	311	239	188	151	125	105
5" thick slab, weight 60 lbs. per sq. ft.	26	12330		641	411	286	209	160	127	102		
	24	16448		856	548	380	279	214	171	137	113	95
	22	20560		1085	685	475	348	267	213	171	139	119
5 1/2" thick slab, weight 66 lbs. per sq. ft.	26	13703		711	457	316	233	177	131	114		
	24	18270		951	609	423	311	237	188	150	126	105
	22	22837		1206	760	529	387	296	235	187	157	131

3/8-In. Hy-Rib Lath.

3/8-in. Hy-Rib lath is a self-furring lath, permits wide spacing of studs and saves channels and wiring.

DATA, 3/8-INCH HY-RIB LATH (SIX-RIB)

Gage	Wt. per sq. yd., lbs.	Stud spac. walls and partitions, in.	Spac. supports for ceilings, in.
28	3.57	24 to 30	23 to 26
26	4.28	32 to 36	30 to 33
24	5.71	36 to 42	33 to 35

Width of sheets, 20 in. Standard lengths, 6, 8, 10 and 12 ft.

Rib Lath.

Rib Lath for plastering and stucco is a stiffened steel lath permitting wide spacing of studs. Furnished in three types and various gages; also in open hearth or copper bearing steel; all painted.

NO. 1-A HY-RIB LATH

Size of sheets—15% by 96 in.			
Grade	Wt. per sq. yd., lbs.	Stud spac. for walls, in.	Joist spac. for ceilings, in.
No. 1A	3.66	18 to 28	16 to 24

STANDARD RIB LATH

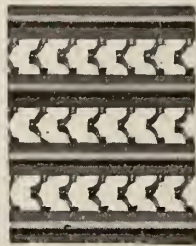
Size of sheets—21 by 96 in.			
Grade	Wt. per sq. yd., lbs.	Stud spac. for walls, in.	Joist spac. for ceilings, in.
No. 1	2.74	14 to 16	12 to 14
No. 2	3.42	16 to 20	14 to 18
No. 4	4.10	18 to 24	16 to 23

DETROIT DIAMOND LATH

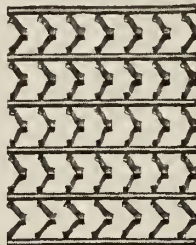
Size of sheets—24 by 96 in.				
Gage	Sheets per bundle	Yds. per bundle	Wt. per sq. yd., lbs., painted	Wt. per sq. yd., lbs., galvanized
No. 27	15	26 2/3	2.33	2.73
No. 26	15	26 2/3	2.55	2.95
No. 25	15	26 2/3	3.00	3.40
No. 24	15	26 2/3	3.40	3.80
No. 22	15	26 2/3	4.10	4.50

UNIVERSAL DIAMOND LATH

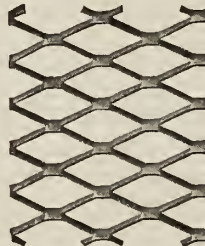
Size of sheets—29 by 96 in.				
Gage	Sheets per bundle	Yds. per bundle	Wt. per sq. yd., lbs., painted	Wt. per sq. yd., lbs., galvanized
No. 26	14	29	2.20	2.60
No. 24	14	29	2.90	3.30



1-A HY-RIB LATH



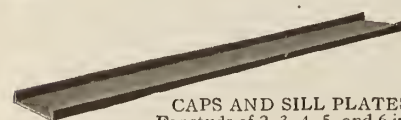
STANDARD RIB LATH



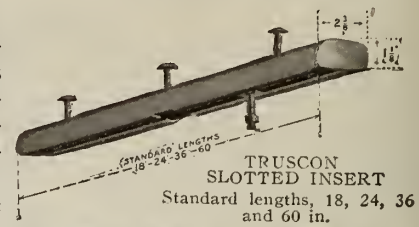
DETROIT AND UNIVERSAL DIAMOND LATH

Truscon Structural Pressed Steel.

A light weight, fire resisting construction consisting of pressed steel beams and studs combined with Hy-Rib metal lath for floors and walls. Ideal for light occupancy buildings such as stores, apartments, hotels, hospitals, institutions, residences, etc. Simple to erect, soundproof, verminproof and economical in cost. Sections furnished in a large variety of shapes, sizes, and gages. Prongs on flanges for attaching Hy-Rib.

I-BEAM
3, 4, 5, 6, 7, 8, 9, 10 and 12 in.CHANNELS
3, 4, 5 and 6 in.CAPS AND SILL PLATES
For studs of 2, 3, 4, 5, and 6 in.H STUD
3, 4, 5 and 6 in.CHANNEL STUD
2, 3, 4, 5 and 6 in.CHANNELS
3/4, 1, 1 1/2 and 2 in.HOLLOW STUD
2, 3 and 4 in.**Truscon Inserts.**

Used in concrete slabs, beams or columns for attaching shaft hangers, fixtures, sprinkler systems, etc. Obviate expensive drilling into concrete in finished building. Built into concrete during process of construction by merely fastening them to wood centering. The concrete thoroughly embeds insert and holds it rigidly in place. Only narrow slot flush with concrete is seen in completed work.

TRUSCON SLOTTED INSERT
Standard lengths, 18, 24, 36 and 60 in.TRUSCON ADJUSTABLE INSERT
1/2, 5/8 and 3/4 in.TRUSCON TAPPED INSERT
1/2, 5/8 and 3/4 in.**Rib Metal.**

A unit reinforcement, equivalent to a large number of separate bars. Provides perfect cross reinforcement against temperature and shrinkage strains.



RIB METAL

PROPERTIES OF RIB METAL

Size, No.	2	3	4	5	6	7	8	12
Width of sheet, in.	16	24	32	40	48	56	64	96
Area per ft. of width (sq. in.)	.450	.300	.225	.180	.150	.128	.113	.075

Truscon Expanded Metal.

All types and weights of diamond mesh reinforcement for concrete roads, floors, walls, roofs, pavements, etc.



TRUSCON EXPANDED METAL

Truscon Wire Mesh.

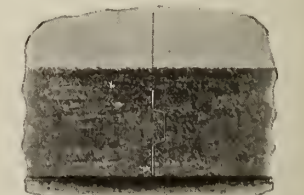
A superior reinforcement for concrete roads; furnished either in rolls with 18-in. core or in flat sheets cut to length; various weights.



TRUSCON WIRE MESH

Truscon Contraction Joint.

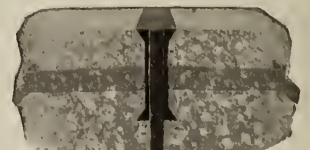
Used in concrete roads to form a plane of weakness for joint. Plates beveled to crown of road and doweled to provide stiffness.



TRUSCON CONTRACTION JOINT

Truscon Armor Plate.

Protects the expansion joints in concrete pavements.



TRUSCON ARMOR PLATE

Truscon Curb Bars and Edge Protectors.

Protects corners of concrete construction. Unit of protecting plate and positive anchorage. Furnished in 2 sizes, either straight or curved.



TRUSCON CURB BAR

WITHEROW STEEL COMPANY

Concrete Reinforcement

ROLLING MILLS, WAREHOUSE AND OFFICES
PITTSBURGH, PA.

NEW YORK OFFICE, 120 Broadway
BOSTON OFFICE, 73 Tremont Street

DETROIT OFFICE, 400 Penobscot Building
PHILADELPHIA OFFICE, 417 Widener Building

Products.

CONCRETE REINFORCING BARS: Witherow Deformed Bars (Patented); Plain Round, Plain Square, Square Twisted Bars.

COLLAPSIBLE SPIRALS.

Engineering Co-operation.

This company maintains a large engineering organization devoted entirely to furnishing assistance to architects, engineers and contractors.

Lump sum quotations are given, including reinforcing bars, Wiscoforms and ceiling materials, together with detailed working drawings, showing location of all Witherow materials in the structure.

Quick Shipments.

Large stocks are constantly on hand ready to ship from warehouses in Pittsburgh and New York.

An efficient traffic department insures speediest possible delivery.

Inquiries are sought and promptly answered.

Fabrication.

The WITHEROW STEEL COMPANY is equipped with the most modern labor and cost saving machinery for bending.

Spirals are shipped fabricated and collapsed.

Witherow Deformed Bars.

Superior points are:

(1) Round corners which prevent cracking of concrete.



WITHEROW DEFORMED BAR

- (2) Uniform cross section.
- (3) Maximum bond.

Plain Round, Square and Square Twisted Bars.

These bars are rolled in sizes from 3/8 to 1 1/4 in., according to standard specifications of the American Society for Testing Materials for concrete reinforcing bars.



WITHEROW SQUARE TWISTED BAR



WITHEROW PLAIN ROUND BAR



WITHEROW PLAIN SQUARE BAR

AREAS AND WEIGHTS OF REINFORCEMENT BARS

Size, in.	PLAIN SQUARE, SQUARE TWISTED AND WITHEROW DEFORMED		ROUND	
	Area, in.	Weight per foot, lbs.	Area, in.	Weight per foot, lbs.
3/8	.1406	.478	.1104	.376
1/2	.2500	.850	.1963	.668
5/8	.3906	1.328	.3068	1.043
3/4	.5625	1.913	.4418	1.502
7/8	.7656	2.603	.6013	2.044
1	1.0000	3.400	.7854	2.670
1 1/8	1.2656	4.303	.9940	3.379
1 1/4	1.5625	5.312	1.2272	4.173

THE YOUNGSTOWN PRESSED STEEL COMPANY

Manufacturers of Metal Lath, Expanded Metal and Channels

YOUNGSTOWN, OHIO

Products.

METAL LATH; EXPANDED METAL REINFORCING;
COLD FORMED CHANNELS.

Also, Corner Bead; Prong Lock Studding; Crimped Furring; Pressed Metal Stampings.

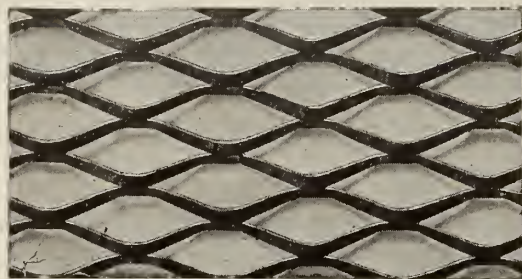
Ideal Metal Lath.

The highest grade of metal lath manufactured. Exceedingly rigid, has a wide strand, meets United States Government specifications and affords a firm and solid base for plastering.

Owing to the peculiar formation of the mesh, it does not shear the plaster and is therefore an economical lath to use.

Furnished in steel painted, iron alloy or galvanized, in the following weights and gages:

Gage	Size of sheet	Weight per sq. yd.	Sheets per bundle	Yards per bundle
No. 22	21" x 97"	5.00 lbs.	9	14
No. 24	21" x 97"	4.00 lbs.	9	14
No. 25	21" x 97"	3.50 lbs.	9	14
No. 26	21" x 97"	3.00 lbs.	9	14



IDEAL METAL LATH

Youngstown Metal Lath.

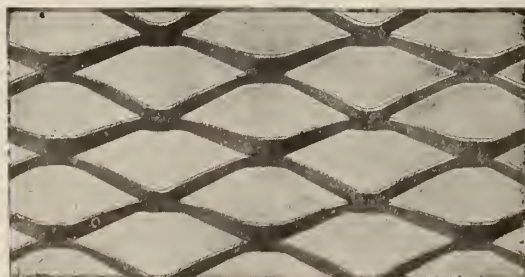
Particularly recommended for exterior stucco work.

A corrugated lath manufactured from the best grade of open hearth sheets.

The transverse corrugation, together with the extra wide strand, makes this material exceedingly rigid.

Furnished in the following weights and gages:

Gage	Size of sheet	Weight per sq. yd.	Sheets per bundle	Yards per bundle
No. 24	21" x 97"	4.00 lbs.	9	14
No. 26	21" x 97"	3.00 lbs.	9	14



YOUNGSTOWN METAL LATH

Mahoning Metal Lath.

Mahoning lath as shown in the illustration has a small mesh. This insures the use of a minimum of plaster and complete embedding of steel in plaster.

The formation of the mesh is perfect and provides an excellent key, every strand becoming thoroughly embedded in the plaster.

Furnished in steel painted, iron alloy or galvanized, in the following weights and gages:

Gage	Size of sheet	Weight per sq. yd.	Sheets per bundle	Yards per bundle
No. 22	21" x 97"	3.40 lbs.	9	14
No. 22½	21" x 97"	3.33 lbs.	9	14
No. 23	21" x 97"	3.10 lbs.	9	14
No. 24	21" x 97"	2.75 lbs.	9	14
No. 25	21" x 97"	2.40 lbs.	9	14
No. 26	21" x 97"	2.10 lbs.	9	14



MAHONING METAL LATH

Sharon Cold Formed Channel.

Formed cold of best quality open hearth steel, producing an exceptionally straight and very rigid channel. Can be bent into the most difficult shapes for furring without the steel fracturing.

Manufactured in the following sizes:

Gage	Size	Weight per 1000 lin. ft.	Size of flange
16	¾"	276 lbs.	¾"
16	⅝"	304 lbs.	⅝"
16	1"	332 lbs.	1"
16	1¼"	381 lbs.	1¼"
16	1½"	456 lbs.	1½"
16	1¾"	539 lbs.	1¾"
18	1¾"	458 lbs.	1½"
16	2"	580 lbs.	2"
16	2"	635 lbs.	1½"



SHARON COLD FORMED CHANNEL

Sharon channels have been accepted by the best architects.

Copy will be furnished of Robert W. Hunt & Company's test on ¾-in. channel for furring and 1-in. channel for carrying bars in suspended ceiling construction.

Stock lengths, 12, 14, 16, 18 and 20 ft.; 22-ft. lengths can be furnished on special orders.

Sharon Perforated Cold Formed Channels.

Perforation 4-in. on centers. A very substantial, as well as economical, hollow metal lath partition can be erected with Sharon perforated channels. Much lower in price than a double row of 3/4-in. channels, and can be erected for half the cost.

Perforations permit the erector to tie metal lath on either side with ease.

Manufactured in the following sizes:

Gage	Size	Weight per 1000 lin. ft.	Size of flange
16	1 1/2"	456 lbs.	3/4"
18	1 7/8"	458 lbs.	1/2"
18	2"	479 lbs.	1/2"
18	2 1/4"	521 lbs.	1/2"
18	2 1/2"	562 lbs.	1/2"
18	3"	626 lbs.	1/2"
18	3 1/2"	729 lbs.	1/2"



SHARON PERFORATED COLD FORMED CHANNELS

For wall and column furrings, thin partitions, carrying bars and furring strips for suspended ceiling.

Stock lengths, 12, 14, 16, 18 and 20 ft.; 22-ft. lengths can be furnished on special orders.

Shipped in bundles of convenient size.

The Youngstown Pressed Steel Company's Expanded Metal.

Expanded metal made by THE YOUNGSTOWN PRESSED STEEL COMPANY is a product of the very highest grade. This material, unlike other expanded metal, is formed at a single operation, without waste, the process lending strength and tenacity to the finished product. Particular attention is called to the "tie" of the diamonds (that part where meshes join one another) as shown in the illustration. In Youngstown expanded metal the "tie" is exceptionally wide, is not "scored"



YOUNGSTOWN EXPANDED METAL

and the material can not be broken at this point. The size of diamond, together with the thicknesses and widths of strands, can be varied to fit the purposes for which the expanded metal is intended.

The table shows the standard, most called for styles and sizes:

Style			Compa-rative gage	Standard sizes	
Diamond	Sectional area	Weight per sq. ft.		Widths	Lengths
3	.059	.20 lbs.	16	3', 5', 6'	6', 8', 10'
3	.082	.28 lbs.	12	3', 5', 6'	6', 8', 10'
3	.115	.39 lbs.	12	3', 5', 6'	6', 8', 10'
3	.130	.44 lbs.	12	3', 5', 6'	6', 8', 10'
3	.147	.50 lbs.	10	3', 5', 6'	6', 8', 10'
3	.162	.55 lbs.	10	3', 5', 6'	6', 8', 10'
3	.179	.61 lbs.	10	3', 4', 5', 6'	6', 8', 10'
3	.251	.85 lbs.	10	3', 5', 6'	6', 8', 10'
3	.274	.93 lbs.	10	3', 4', 5', 6'	6', 8', 10'
3	.324	1.10 lbs.	10	3', 5', 6'	6', 8', 10'
3	.377	1.28 lbs.	10	3', 4', 5', 6'	6', 8', 10'
2 1/4	.089	.30 lbs.	16	5'-4"	6', 8', 10'
2 1/4	.155	.52 lbs.	12	4'-4"	6', 8', 10'
1 1/2	.108	.36 lbs.	16	5'-3"	6', 8', 10'
1 1/2	.179	.61 lbs.	12	3', 4', 5', 5'-3", 6'	6', 8', 10'
1	.084	.29 lbs.	18	3', 6'	6', 8', 10'
1	.162	.55 lbs.	16	5'-3"	6', 8', 10'
1	.206	.70 lbs.	12	5'-3"	6', 8', 10'
1/2	.226	.76 lbs.	18	3'-6"	6', 8'

There are many construction jobs which require expanded metal of a desired sectional area in square inches per lineal foot of width of finished product, or a desired weight per square foot of finished product different from the standard styles above listed.

THE YOUNGSTOWN PRESSED STEEL COMPANY has special facilities for making expanded metal in 3 by 7-in., 2 1/4 by 5-in., 1 1/2 by 3-in., 1 by 2 1/8-in. and 1/2 by 1 3/16-in. meshes in practically any sectional area or weight per square foot desired for some specific purpose. The facilities are such that a minimum amount of delay is caused by such special orders, as mill connections permit the securing of steel, from which this material is expanded, on very short notice. The company will cheerfully cater to the architect's or engineer's desire for a special expanded metal for a special purpose.

Estimates of cost for the finished product will be gladly furnished; the only information necessary is the size of diamond desired, and the sectional area or weight per square foot, or both.

It may be pertinent to say that the steel used in the manufacture of Youngstown expanded metal is a special analysis soft steel of high tensile strength which enables the raw material to be expanded into the desired diamonds or meshes without danger of fracturing the strands, thus giving perfect material of full relative strength.

Youngstown expanded metal is especially adapted for reinforcing floors in buildings or bridges designed to carry heavy loads, and is largely used in reinforcing conduits, tanks, reservoirs, retaining walls, roofs, sidewalks, roads, etc.

THE DONLEY BROTHERS COMPANY

Manufacturers of Concrete Inserts

7337 Aetna Road
CLEVELAND, OHIO

Products.

The DONLEY INSERT for anchorage in concrete ceilings and walls.

Donley Devices and other building specialties of interest to engineers, architects and contractors.

Description.

The Donley insert is a malleable iron casting with 2 diverging roots, capped with flat lugs. Lower part contains a cavity. A slot in the exposed under surface communicates with this cavity. One end of the slot is enlarged to admit a bolt head.

Uses.

The Donley insert is suitable for the support of shafting, trolley and conveyor tracks, sprinkler systems, steam and plumbing pipes, machinery, racks or whatever equipment is to be suspended by bolts.

Its superior quality is recommended to users not merely with view to immediate needs, but they are urged to consider the unforeseen future uses to which the insert installation of any building may be subjected. In calculating the strength of floors to be equipped with inserts, the safe load of the inserts should be added to the estimated floor load.



DONLEY INSERT			
No.....	34	58	12
Size bolt...	$\frac{3}{4}$ "	$\frac{5}{8}$ "	$\frac{1}{2}$ "
Safe load, lbs.....	4900	3300	2300
Height over all.....	6"	5"	4"
Length....	$2\frac{7}{8}$ "	$2\frac{5}{8}$ "	$2\frac{1}{8}$ "
Shipping weight per 100.	185 lbs.	135 lbs.	85 lbs.

Factors of Strength.

In designing the Donley insert, three factors of strength were recognized: (a) strength of the concrete, (b) strength and tenacity of the insert, (c) tensile strength of the bolt. Of these three, the bolt strength is best known. The object in view, therefore, was to produce an insert which would always provide a resistance in proportion to the tensile strength of a steel bolt of appropriate size.

Result of Tests.

To reach this result, a large number of tests were conducted, both of existing inserts and of experimental models. Inserts embedded in cubes of concrete were loaded to failure, and compilation made of the breaking strains and the nature of the failure.

The Donley insert, as finally perfected and shown herewith, withstood a stress in excess of the ultimate strength of the appropriate bolt. Safe loads, noted in

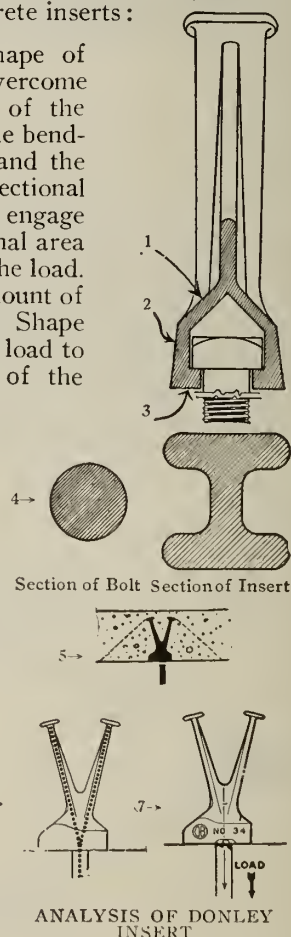
the accompanying table, represent bolt strength subjected to a safety factor of 4.

Analysis for Comparison.

Analysis of the Donley insert is here given and illustrated, which is useful as a basis of judging this in comparison with other concrete inserts:

(1) The section and shape of the top of the socket to overcome bending. (2) The thickness of the side walls, which must resist the bending of the supporting ledges and the tension of the load. (3) The sectional strength of the ledges which engage the bolt head. (4) The sectional area of the leg or legs that support the load. (5) The length of legs; the amount of concrete they make use of. (6) Shape of legs, straight from center of load to the ends. (7) The location of the legs in relation to the load.

NOTE—The tensile strength of steel being three-quarters greater than that of malleable iron, the size of the leg or legs of malleable iron upon which a load is applied should be at least three-quarters larger in sectional area than the steel bolt. The diagrams show the relative sectional areas of the insert and the bolt for which it is made. The sectional area of the Donley insert is two and one-half times as large as the net bolt area.



Complete in Itself.

The Donley insert has the advantage of being complete in itself, in contrast with inserts which have a loop or ring, through which a bar is to be passed for the better engagement of the concrete.

This is an element of economy, but chief claim of the Donley insert for preference is based on superior quality; the insurance that it provides against collapse of overhead fixtures, such as not infrequently occurs where inserts of unascertained strength are used.

Suggested Specifications for Installations.

The Donley inserts No. 12 (or size desired) shall be placed in rows spaced 4 ft. on centers—not to exceed 4 ft. apart in rows. Rows to start 1 ft. from wall or from beams which project below ceiling. They shall be placed on the concrete forms with the insert slot at right angles to the lines of shafting or other equipment to be supported, then nailed securely in position.

KOHLER DIE & SPECIALTY CO.

Concrete Inserts and Metal Specialties

DEKALB, ILL.

Products.

KOHLER THREADED CONCRETE INSERTS: Pressed Steel and Cast.

COLLINGS SLOTTED OR ADJUSTABLE CONCRETE INSERTS.

Kohler Threaded Concrete Inserts.

Combine all the advantages of strength and economy with the greatest possible utility. Used in industrial plants, public buildings, warehouses, elevators, garages, tunnels and docks.



PRESSED STEEL INSERT

Construction of $\frac{3}{8}$ " and $\frac{1}{2}$ " sizes

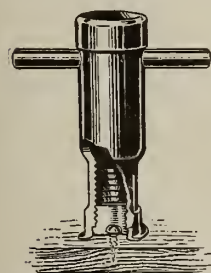


INSERT WITHOUT SCREW

ADAPTABILITY—The only inserts adapted for use with either wood or steel forms. Afford the safest and most secure method for supporting shafting, sprinkler systems, radiation, machinery, elevator guides and all appliances attached to either the walls, ceilings, floors or columns of concrete structures.

ADVANTAGES—Kohler threaded inserts are the easiest and quickest inserts on the market to set in the forms. No nails or pins required for their use. The screw point, shown clearly in the illustration, does the work. A blow with the hammer and a couple of turns with the hand sets this screw down so that the insert is held securely in a vertical position ready for the concrete to be poured.

The bottoms of these inserts are squared accurately with the thread, as illustrated, so that the inserts must stand upright when the screw is firmly turned down. After work is finished, forms are easily pulled away from the screws which are then quickly removed, leaving the insert free for the threaded bolt.



STEEL INSERT IN FORM, WITH SCREW POINT IN PLACE

Construction of $\frac{5}{8}$ ", $\frac{3}{4}$ " and $\frac{7}{8}$ " sizes



ENLARGED VIEW OF SCREW



CAST INSERT

ECONOMY—These inserts, regularly spaced in the ceilings, floors or walls of reinforced concrete buildings mean a saving of time and heavy expense in attaching or rearranging shafting, piping or other interior equipment. A necessity in concrete construction.

STRENGTH—Careful tests show that both the

pressed steel and cast threaded inserts have an ample margin of safety over the working load of bolts to be used. At the University of Illinois the $\frac{1}{2}$ -in. steel inserts, constructed as shown in the small illustration to the left, supported an average load on five tests of 6070 lbs. Similar tests of $\frac{5}{8}$ -in. cast inserts showed a supporting strength of 9600 lbs.

How SHIPPED—With both the pressed steel and cast threaded inserts the screw points as illustrated are used. These are put in place at the factory so that insert as shipped is ready for use. Notice it is possible to set these inserts in the forms almost instantly and with the same accuracy as driving a nail.

SIZES, WEIGHTS AND PRICES, KOHLER INSERTS

Size bolt	Height	Weight per 100	List price
PRESSED STEEL THREADED INSERTS			
$\frac{3}{8}$ in.	2 $\frac{1}{2}$ in.	8 lbs.	10¢ each
$\frac{1}{2}$ in.	3 in.	13 $\frac{1}{2}$ lbs.	12¢ each
$\frac{5}{8}$ in.	3 $\frac{1}{4}$ in.	42 lbs.	15¢ each
$\frac{3}{4}$ in.	3 $\frac{1}{2}$ in.	50 lbs.	18¢ each
$\frac{7}{8}$ in.	3 $\frac{3}{4}$ in.	63 lbs.	25¢ each
CAST THREADED INSERTS			
$\frac{1}{2}$ in.	3 $\frac{1}{4}$ in.	45 lbs.	13¢ each
$\frac{5}{8}$ in.	3 $\frac{1}{2}$ in.	75 lbs.	16¢ each
$\frac{3}{4}$ in.	3 $\frac{3}{4}$ in.	85 lbs.	20¢ each

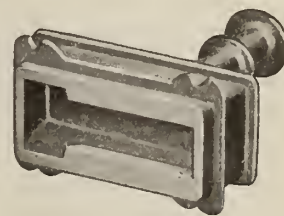
List prices are subject to discount which will be quoted on application.

Collings Adjustable or Slotted Insert.

Made with a corrugated stem that extends up into the compression area of the concrete, the correct place to hang the load; the tapering corrugated base is so shaped that it makes the concrete member stronger. In this insert the fullest strength of the concrete is developed. The greater the load on the Collings insert the tighter the concrete grips and holds.



Note Corrugated Stem and Corrugated Tapering Base



View of Chamber for Bolt

COLLINGS INSERT
(Patented March 26, 1918)

The Collings insert when placed in the form is never in the way of the reinforcing and is so designed that the concrete flows freely around it. There are no sharp corners and with the Collings insert less surface is exposed in the ceiling after the forms are removed than with any other—a very desirable feature.

The Collings insert may be used upside down in the floor for fastening chairs, machinery or permanent fixtures but its greater field is in the ceiling for supporting shaft hangers, sprinkler systems, electric lights, piping and overhead rails. Either the head of the bolt or the nut may be used in the socket. The Collings is the only insert in which the bonding value of the corrugated bar is secured.

SIZES, WEIGHTS AND PRICES, COLLINGS INSERTS

Size bolt	Height	Weight per 100	List price
$\frac{5}{8}$ in.	3 $\frac{3}{4}$ in.	81 lbs.	18¢ each
$\frac{3}{4}$ in.	4 in.	100 lbs.	23¢ each
$\frac{7}{8}$ in.	4 $\frac{1}{4}$ in.	120 lbs.	30¢ each

Discounts will be quoted on application.

RICHMOND SCREW ANCHOR CO.

TELEPHONE:
BECKMAN 4000

Pulitzer Building
NEW YORK, N. Y.

CABLE ADDRESS, "JURICH, NEW YORK"
A. B. C. Code, 5th Edition

AGENCIES

PHILADELPHIA, GILES & RANSOME, Commonwealth Building
BALTIMORE, HENRY H. MEYER Co., 110 S. Howard Street
CHICAGO, GEO. G. TUCKER Co., 1533 Monadnock Block

SEATTLE, F. T. CROWE & Co., 1103 First Avenue
MONTREAL, CANADA, J. A. MASTERS & Co., Shaughnessy Building
PARIS, FRANCE, JEAN THIOILLIER, 92 Boulevard Haussmann

Products.

RICHMOND SCREW ANCHORS for fastening all styles of screws into masonry or composition materials; "TYSCRU" FORM TIES.

Also, Expansion, Anchor, Form and Centering Bolts; Wall Plugs; Expansion Shields; Concrete Pole Steps, and Concrete Inserts.

Richmond Screw Anchors.

These anchors are made in two types, and can be set before concrete is poured, by affixing to forms; or, later on, by drilling a hole into masonry and setting screw anchor and screw together into it, in portland cement.



SCREW AND DOUBLE COIL ANCHOR

For use in plaster



BOLT AND FLAT COIL ANCHOR

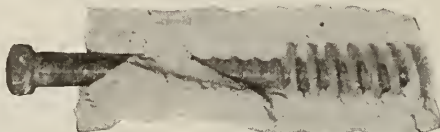
For use in concrete

STRENGTH—Made of steel, a minimum of metal provides a maximum of strength; all stresses are transmitted to surrounding masonry.

Tests show that bolt breaks before anchor loosens.

Placed in concrete it becomes integral with the work, and can not vibrate or loosen without destruction of entire surrounding medium.

Government tests indicate freedom from adhesion for bolts, even in largest sizes, after a lapse of 28 days. Non-adhesion is guaranteed.



RICHMOND SCREW ANCHOR, SHOWING ITS STRENGTH

PRICE LIST PER 100 (SUBJECT TO DISCOUNT)
SQUARE HEAD BOLTS AND FLAT COIL STEEL ANCHORS

Length under head, in.	Diameter of bolt in inches							
	1/4 and 3/8	1/2	3/4	7/8	1	1 1/4	1 1/2	
4	\$9.00	\$12.60	\$17.00	\$24.30	.....	.....	.....
5	9.50	13.30	18.00	25.70	\$36.00	\$47.90	.....
6	10.00	14.00	19.00	27.10	38.00	50.50	.....
8	.....	15.40	21.00	29.90	42.00	55.70	.....
10	.....	16.80	23.00	32.70	46.00	60.90	.....
12	.....	18.20	25.00	35.50	50.00	66.10	\$160.00	\$225.00
18	180.00	275.00	

FLAT COIL ANCHORS ONLY

.....	\$6.00	\$8.00	\$12.00	\$16.00	\$21.00	\$26.00	\$60.00	\$100.00
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Bolts of other lengths at proportionate prices.

PRICE LIST PER 100 (SUBJECT TO DISCOUNT)

FLAT HEAD IRON WOOD SCREWS AND DOUBLE COIL GALVANIZED STEEL ANCHORS

Length over all, in.	Trade No. and diameter of screw in decimals of an inch					
	No. 8 .1631	No. 12 .2158	No. 16 .2684	No. 20 .3210	No. 24 .3737	No. 30 .4526
2	\$3.70	\$4.75	\$5.55	.....	.....	.....
3	4.40	5.40	6.20	\$8.30	\$10.10	.....
4	.....	6.25	7.00	9.35	11.40	\$17.00
5	7.95	10.60	12.95	19.00
6	9.10	11.95	14.70	21.00

DOUBLE COIL ANCHORS ONLY

.....	\$3.00	\$4.00	\$5.00	\$6.50	\$8.00	\$11.00
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Screws of other lengths at proportionate prices.

Form Tie—"Tyscru" (Patented August 28, 1917).

"Tyscru" is good for a working load of 5000 lbs.

"Tyscru" is a fast form tie, saving more than half the time of any other method.



The TIE that holds forms APART.

"Tyscru" costs less than annealed wire alone required for any operation, and is four times as fast.

"Tyscru" is tie, spreader, and gauge up to 18 in.

"Tyscru" costs less than rods, clamps and spreaders because it is more than twice as fast.

"Tyscru" gives a handy attachment for reinforcing rods holding them firm and true.

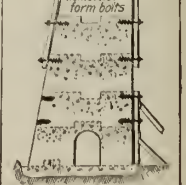
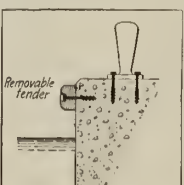
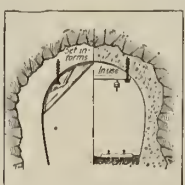
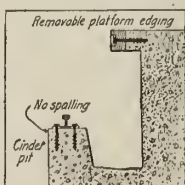
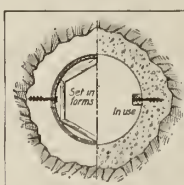
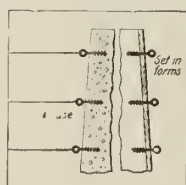
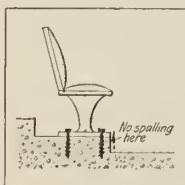
"Tyscru" affords a convenient anchorage for succeeding set-ups in wall construction.

"Tyscru" leaves in the walls anchorages at frequent intervals for work benches, shelving, shafting, steam pipes, starting boxes, etc.

DETAILS OF "TYSCRU" CONSTRUCTION

Price List		Spacing		
Length in.	Per 100	Height of wet unset concrete, ft.	Spacing of Tyscru vertically, ft.	Spacing of Tyscru horizontally, ft.
4	\$19.50	2-0	6-0	18-0
6	20.50	3-0	5-0	12-0
8	22.00	4-0	4-0	6-0
10	23.50	5-0	4-0	4-0
12	25.50	6-0	4-0	3-6
14	28.00	7-0	4-0	3-0
16	29.50	8-0	4-0	2-0
18	31.00	9-0	2-0	2-6
20	32.00	10-0	2-0	2-3
22	33.00			
24	34.00			
26	35.50			
28	37.00			
30	38.50			

Longer lengths on application.



TYPICAL USES OF RICHMOND SCREW ANCHORS

Grandstands: Yale Bowl; University of Chicago; University of Michigan; McGill University, etc.

Posts and poles: Removable screws permit stripping vertical forms. N. Y. Barge Canal, Catskill Aqueduct

Mine shafts: Removable screws permit stripping vertical forms; cage guides. Catskill Aqueduct, Vulcan Iron Mines

Railroads: Rails to concrete ties; platform edgings, etc. N. Y. N. H. & H. R.R., B. R. T. R.R., D., L. & W. R.R., etc.

Tunnels: Removable screws permit stripping forms. Overhead transmission. C. P. R. in Mt. Royal tunnel

Docks: Used by N. Y. State Barge Canal, U. S. Army and Navy engineers, Montreal, Philadelphia, New York, Baltimore

Cantilever forms: Walls and dams. The anchor only remains in the work; light to handle, easy to set

SECURITY INSERT COMPANY

Ceiling Sockets for Concrete Work

2 South 15th Street
PHILADELPHIA, PA.

Product.

SECURITY INSERTS, or CEILING SOCKETS, for Concrete Work.

Security Inserts.

The Security insert solves the problem of the hanging of machinery or fixtures to be suspended from ceiling or wall in factories, warehouses and other buildings of concrete construction.

The Security insert was designed by engineers who made a careful study of this problem, and produced a socket overcoming all objectionable features inherent in others. The ease of installation, the absence of any fixed thread, the strength and many other commendable features of this socket, are shown in the illustrations.



INSERT NAILED TO FORM

Features.

The Security insert embodies the following valuable features:

(1) The design, distribution of metal, and anchorage in the concrete enable it to carry a greater load than either bolt or concrete.

(2) It has no fixed thread to become rusty or damaged.

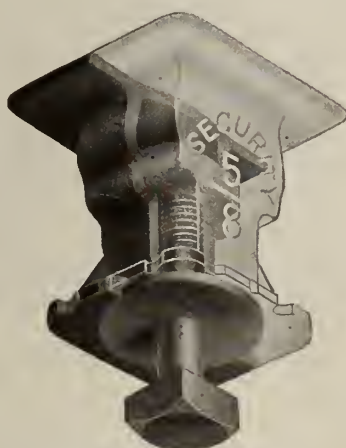
(3) In place of fixed thread a standard steel nut (the strongest thread possible) is placed in the insert when ready to use.

(4) This nut is renewable at any time.

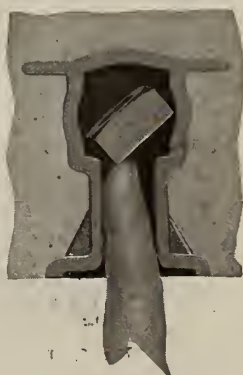
(5) A stud or a bolt may be used, whichever is more convenient for the work.

(6) The Security insert permits play of stud or bolt while hanging machinery or other fixtures; but when washer is slipped into recess, the stud or bolt is held rigidly central.

(7) The Security insert has a large flat base, insuring upright position in the form, to which it is securely nailed, thus avoiding waste of time and lumber.



PHANTOM SHOWING INTERNAL CHAMBER WITH BOLT, NUT AND WASHER IN POSITION



INTRODUCING OR REMOVING NUT

(8) It is desirable to place inserts in all parts of concrete buildings, such as offices, store-rooms, etc., as well as in those portions where machinery is to be installed.

(9) The Security insert is the only insert provided with a means for concealing the hole in wall or ceiling. This may be accomplished by use of a cardboard disk, which fits the washer recess and can be painted to harmonize with surroundings.

(10) There is absolutely nothing to get out of order or deteriorate in the Security.

(11) The Security insert is correct in principle, simple in construction, and so designed as to insure safe, permanent anchorage for anything, from the lightest partition to the heaviest crane.

(12) Once placed, Security inserts are always ready for use.



BOLT AND NUT IN POSITION

Strength.

Security inserts will carry with a factor of safety the safe load of the bolt for which they are designed.

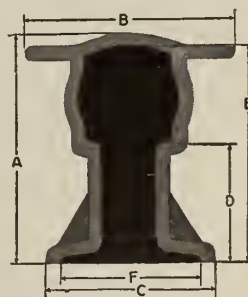
STRENGTH OF BOLTS

Assumed Tensile Strength 60,000 lbs. per Sq. In.

Size	Ultimate strength	Safe load factor 5
$\frac{3}{8}$ -in. bolt.....	4,100 lbs.	820 lbs.
$\frac{1}{2}$ -in. bolt.....	7,600 lbs.	1,520 lbs.
$\frac{5}{8}$ -in. bolt.....	12,100 lbs.	2,420 lbs.
$\frac{3}{4}$ -in. bolt.....	18,100 lbs.	3,620 lbs.
$\frac{7}{8}$ -in. bolt.....	25,200 lbs.	5,040 lbs.

TABLE OF MEASUREMENTS

Size of bolt, in.	A in.	B in.	C in.	D in.	E in.	F in.
$\frac{3}{8}$	2 $\frac{3}{4}$	1 $\frac{3}{4}$	1 $\frac{1}{8}$	1 $\frac{3}{8}$	2 $\frac{5}{32}$	1 $\frac{3}{4}$
$\frac{1}{2}$	2 $\frac{3}{4}$	2	1 $\frac{7}{8}$	1 $\frac{3}{8}$	2 $\frac{5}{8}$	1 $\frac{7}{8}$
$\frac{5}{8}$	3	2 $\frac{3}{4}$	2 $\frac{3}{4}$	1 $\frac{3}{4}$	2 $\frac{7}{8}$	2 $\frac{1}{2}$
$\frac{3}{4}$	3	3	2 $\frac{1}{2}$	1 $\frac{7}{8}$	2 $\frac{7}{8}$	2 $\frac{1}{2}$
$\frac{3}{4}$	4	3	2 $\frac{1}{2}$	2 $\frac{1}{8}$	3 $\frac{7}{8}$	2 $\frac{1}{2}$
$\frac{7}{8}$	4	3	2 $\frac{3}{4}$	2 $\frac{3}{8}$	3 $\frac{1}{2}$	2 $\frac{1}{2}$



DIMENSION DIAGRAM SECURITY INSERT

PRICE LIST

Security Inserts Made for the Following Sizes of Bolts:

Diam. of bolts	Each
$\frac{3}{8}$ -in.....	11 cents
$\frac{1}{2}$ -in.....	13 cents
$\frac{5}{8}$ -in.....	17 cents
$\frac{3}{4}$ by 3 in.....	21 cents
$\frac{3}{4}$ by 4 in.....	25 cents
$\frac{7}{8}$ -in.....	30 cents

The company furnishes the insert only.

WRIGHT & ALEXANDER COMPANY

Manufacturers of Concrete Inserts

ROCHESTER, N. Y.

Products.

"WRIALCO," a patented CONCRETE INSERT.

Description.

The most practical and reasonably priced hanger yet devised for automatic sprinkler, shafting and general piping work in connection with concrete building construction.

Made of an exceptionally high grade malleable iron and in strength designed to break the bolt throughout the different sizes. Owing to the design of the "Wrialco" insert, its position in the concrete becomes as a wedge, insuring permanency; its removal can only be accomplished by the destruction of the holding concrete. Of the several pulling strength tests made of the "Wrialco" and its use throughout the country, we do not know of an instance where they have been pulled from their concrete anchorage.

Method of Attaching Inserts to the False Work.

We suggest and recommend, that either coated nails or small wood screws be used in the fastening of inserts to the false work, preferably the wood screws. The inserts will then be securely fastened and in a position to use when wanted for anchorage purposes.

Distinctive Features of the "Wrialco" Malleable Concrete Inserts.

- (1) Strength, due to the wedge construction—its complete embedded surface a resisting force against dislodging from the concrete anchorage.
- (2) Compactness.
- (3) Adjustment, horizontal and vertical. Can be made rigid at any point of adjustment desired.
- (4) Adjustment the full length of slot.
- (5) Nailing feature. Nails are driven through the lugs provided on either end into the false work or form at a 45° angle slant. This slant nailing feature serves as a wedge, preventing the insert from lifting up in working the concrete.
- (6) Security of nut in the adjustment chamber.

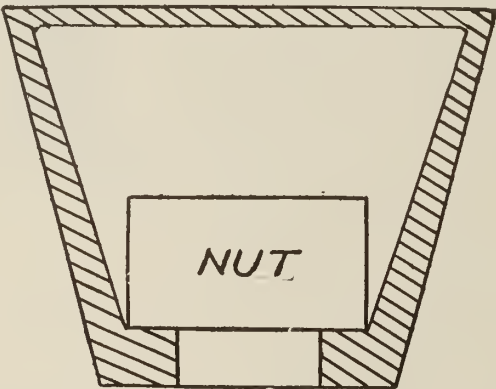


FIG. 1. CROSS SECTION

Showing arrangement of the adjustment chamber, making it possible to place nut in the chamber or to remove it after insert has been embedded in the concrete.
U. S. Standard or machine bolt nuts may be used

No chance of the nut tilting. An even pulling pressure throughout the entire length of the adjustment slot.

"Wrialco," an insert of exceptional merit, incomparable, the dependable insert for buildings of concrete construction.

Strength.

The Wrialco inserts are made of a high grade malleable iron. They are designed to carry a load fully in keeping with the rated strength of the bolt or nut employed in the different sizes.

MEASUREMENTS AND WEIGHTS

Size of bolt	Height	Length at top	Length at bottom	Width at top	Width at bottom	Length of adjustment slot	Weight per 100
3/8"	1 1/2"	3 1/4"	2 3/8"	1 1/2"	1 5/8"	1 3/4"	56 lbs.
7/8"	1 1/2"	3 1/2"	2 3/8"	1 1/2"	1 5/8"	1 3/4"	56 lbs.
1 1/8"	1 1/2"	3 3/4"	2 3/8"	1 1/2"	1 5/8"	1 3/4"	69 lbs.
1 1/2"	2 1/4"	4"	2 7/8"	2 1/4"	1 5/8"	2"	112 lbs.
1 3/4"	2 1/4"	4"	2 7/8"	2 1/4"	1 5/8"	2 1/8"	130 lbs.
2"	2 1/4"	4 1/8"	2 7/8"	2 5/8"	1 5/8"	2 1/8"	138 lbs.



FIG. 2. WRIALCO INSERT EMBEDDED IN CONCRETE
For 3/8-, 7/8-, 1 1/8-, 1 1/2-, 1 3/4- and 2-in. nuts



FIG. 3. PERSPECTIVE VIEW OF INSERT

Showing nut to which rod or bolt is attached and the adjustment feature.
Rod or bolt can be made rigid at any point of adjustment desired

THE STINE SCREW HOLES CO.

Manufacturers of Screw Holes

WATERBURY, CONN.

CABLE ADDRESS: "SCREWHOLES, WATERBURY"—Private Code Used (sent on request)

Products.

SCREW HOLES.

Screw Holes.

The illustration shows a Stine screw hole. It is a brass device used to provide a permanent threaded hole for a screw. It is made, as shown in Figs. 1, 3 and 4, from brass rod, drilled and threaded on the inside so as to receive the screw, and knurled on the outside so as to allow for a certain amount of crushing of the brass when the screw hole is driven into a hard material. This insures proper and solid incorporation in the material where it is used.

It can be used in all cases where an ordinary screw is necessary, as well as in materials where the successful use of such a screw would be impossible. In rubber, cork, wood, fiber and other soft substances, the screw hole may be driven in with a hammer; but in brick, stone, marble, hard rubber, concrete, aluminum and steel, it is necessary to drill a hole slightly smaller than the screw hole before driving in the latter.

Because of their permanent character, screw holes can be used to advantage on such articles as switch boxes, screen doors, etc., where the screws have to be removed and replaced a number of times. A good firm fastening is always assured and the ease with which removal and replacement is accomplished saves valuable time.

Driving Head.

The illustration, Fig. 2, shows the driving head which is screwed into each screw hole before driving for the purpose of making the latter operation easy and quick; and also of preventing damage to the top of the screw hole. As can be seen by illustration 5, the driving head is in such a position that it may be quickly removed after the screw hole is in place.

Sizes.

Screw holes are made to fit the sizes of wood or machine screws listed in the tables given herewith. Each box contains 100 screw holes and one driving head.

Stock Shipment.

A large supply of screw holes is carried in stock from which we are able to make immediate shipments. The fact that the factory has excellent railroad facilities and is only about 100 miles from New York still further facilitates quick deliveries.

Advantages.

(1) They can be used without damage to receiving material. (2) They make possible the standardization of wood or machine screws in all materials. (3) They are made of brass and will not rust under atmospheric or moisture conditions. (4) They save more time value than the holes cost. (5) Special tools are not needed in using them in any material. (6) They can be used in any place a screw can be used. (7) By using screw holes, screws can be used in many places, and in many materials where it is impossible to use screws without them. (8) These are the only ready-made screw holes on the market. (9) No special screws are needed. These screw holes come in different sizes to fit any wood screw or machine screw now in stock. (10) They make the neatest possible job in any material. (11) Smaller and shorter screws can be used with screw holes than can be used without them, this making another saving to their credit.

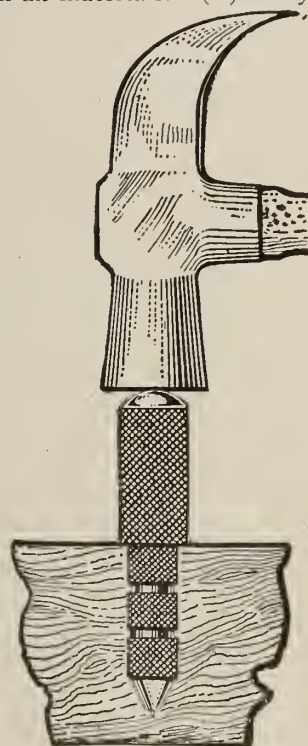


FIG. 5
SHOWING HOW DRIVING HEAD IS USED TO EMBED A SCREW HOLE

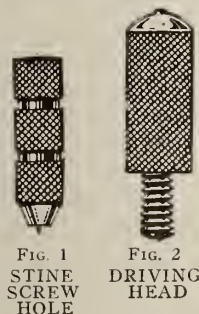


FIG. 1
STINE
SCREW
HOLE

FIG. 2
DRIVING
HEAD

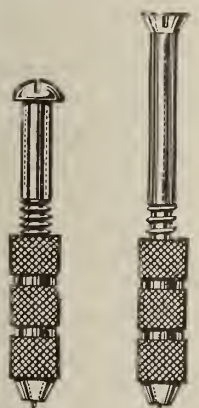


FIG. 3
SCREW HOLES
WITH SCREWS
INSERTED

FIG. 4

Dealers.

Stine screw holes are an attractive selling proposition for dealers. The universal use of screws offers a large possible market for screw holes and the economy and satisfaction to the customer which come from the use of the latter will make many permanent customers.

Write for color card which shows screw holes in various materials, samples, and prices to dealers.

SPECIFICATIONS AND PRICES*

Screw No.	Threads per in.		Diameter of body, in.	Length machine screws		Price per 100	Screw holes private code	
	Wood,** in.	Machine, in.		From in.	To in.		Wood, 1 box	Machine, 1 box
6	18 (1.38)	32 (0.79)	.1368 (3.47)	$\frac{3}{8}$ (5.8)	1 (25.4)	\$2.50	ACFW	ACFM
7	16 (1.50)	32 (0.79)	.1500 (3.81)	$\frac{3}{4}$ (6.4)	$1\frac{1}{8}$ (28.6)	2.75	ACGW	ACGM
8	15 (1.63)	32 (0.79)	.1631 (4.14)	$\frac{3}{4}$ (6.4)	$1\frac{1}{4}$ (31.8)	3.00	ACHW	ACHM
9	14 (1.8)	30 (0.85)	.1763 (4.49)	$\frac{3}{4}$ (6.4)	$1\frac{3}{8}$ (34.9)	3.50	ACIW	ACIM
10	13 (1.9)	24 (1.06)	.1894 (4.81)	$\frac{3}{4}$ (6.4)	$1\frac{1}{2}$ (38.1)	4.00	ACJW	ACJM
11	12 (2.1)	24 (1.06)	.203 (5.16)	—	—	4.50	ACKW	ACKM
12	11 (2.3)	24 (1.06)	.2158 (5.48)	$\frac{3}{8}$ (9.5)	$1\frac{3}{4}$ (44.5)	5.00	ACLW	ACLM

*Lengths of wood screws vary from $\frac{1}{4}$ in. to 6 in. increasing by $\frac{1}{8}$ in. up to 1 in., and by $\frac{1}{4}$ in. up to 3 in. All screws should enter the screw holes $\frac{1}{4}$ in. to $\frac{1}{2}$ in. The screw holes themselves enter the receiving material over $\frac{3}{4}$ in.
**A screw hole for any size wood or machine screw fits all lengths of that size screw.

AMERICAN CHEMICAL PAINT COMPANY

1118 South Eleventh Street
PHILADELPHIA, PA.

BRANCH OFFICES

NEW YORK, N. Y., 149 Broadway

DETROIT, MICH., 279 East Jefferson Avenue

Products.

Patented Processes, Appliances and Chemicals for Preparing Metals for Painting: LITHOFORM (Patented) for making paint hold to galvanized iron; DEOXIDINE (Patented Process) a Chemical Wash for preparing cold rolled steel for painting; DEOXYLYTE, a Non-rusting Pickle for iron and steel; RUBYLYTE, a Chemical Preparation to take rusting properties out of water.

Paint, for steel and galvanized iron; Paint Preservatives; Rustproofing Processes; Cleaners; Primers, for galvanized iron or steel.

Lithoform (Patented), for Galvanized Iron.

Lithoform means "I make stone," and is a non-metallic material for application to surfaces of galvanized iron, causing paint to adhere firmly thereto. It is a clear, thin, waterylike, non-volatile liquid or solution of certain chemical properties which, when applied, turns the outer surface of galvanized iron into a stony substance resembling pumicestone; the latter is a firm part of the metal and slightly absorbs (like absorbent stone) the first coat of paint, which on drying becomes inseparable from it—a knife is required to detach the paint from galvanized iron treated with Lithoform. The surface formed by Lithoform can be painted and repainted like wood.

CHEMICAL PROPERTIES—Lithoform contains no oil, varnishes, pigments or volatile solvents—it is not a paint. The chemistry of Lithoform and its action on zinc appear in this company's patents, copies of which will be furnished on request.

How APPLIED—By brushing, spraying or dipping. Full directions accompany each shipment. Old paint on galvanized iron must be removed before application.

COVERING CAPACITY—Exceeds that of paint or varnish. When applied with a brush, 1 gal. will cover 1500 to 2000 sq. ft., in less time than is necessary for paint.

GUARANTEE—When applied according to directions, the company guarantees that Lithoform will prevent paint from peeling or scaling off galvanized iron and zinc.

CAUTION—Under no circumstances use Lithoform on any metals except zinc and galvanized iron without first consulting this company.

Deoxidine Patented Process, for Steel.

A positive means of eliminating the development of defects in the finish of steel; it cleans steel and prevents rusting. Causes of rust, such as soldering fluids, non-drying oils, acid runs, hand marks, etc., are removed by this process and prevented from acting under the paint. Gasoline or turpentine has utterly failed to remove the oils; rust still lingers after careful sanding with emery cloth by hand; even the perspiring hands of the sanding operator have left invisible hand marks to show through the painted finish a few weeks later; and, finally, the sand blast, fairly successful in this preparatory course, was expensive to install and troublesome to operate, invariably leaving some grains of sand in the cracks or seams which would get into the paint at a later period.

The Deoxidine patented process now replaces the sand blast.

DESCRIPTION—Deoxidine is a wash, not a paint. This process, composed of ingredients mentioned in the Letters Patent, is a chemical one based on such patents owned by the company—the only process that will clean and prevent rust at same time. It destroys all rust forming substances and even rust itself; removes all traces of oil; produces a surface that slightly absorbs the first coat of paint, causing the latter to adhere firmly to the steel. The process has been on the market for a number of years, proving Deoxidine to be a positive method of preventing defects in the painted finish.

APPLICATION—Deoxidine may be applied by brushing, dipping or spraying, allowing sufficient time for it to act on the surface and then removing it by wiping with a cloth, washing with water or by other means, depending on the nature of the steel being treated.

SPECIFICATION DATA FOR PREPARING STEEL FOR PAINTING BY THE DEOXIDINE PROCESS—Complete directions for processing accompany each shipment.

Hot and Cold Rolled Steel, Interior Steel Finish, Automobile bodies, Structural Steel, etc.—When ready for painting, apply Deoxidine, allow it to act for about 5 minutes, wash off with water, dry with a rag or chamois and allow sufficient time to thoroughly air dry; then paint.

Work Covered With Grease or Heavy Oil—Before treating with Deoxidine remove grease or oil with a suitable solvent such as kerosene, gasoline, soda or lye.

Work Having a Heavy and Thick Covering of Rust—Before treating with Deoxidine remove loose scales of rust with a scratch brush and scrub with Deoxidine and emery cloth. Finally treat with Deoxidine and wash with water in the regular way.

Work That is Not to Be Painted—Treat with Deoxidine and wipe dry with a cloth, omitting the water.

Small Parts—First dip in a tank of Deoxidine; then into a tank of running water, and dry over heat.

GUARANTEE—The Deoxidine process, when used according to directions, is guaranteed to prevent the rusting of steel under the paint.

SHIPMENTS—Sold and shipped generally in barrel lots.

Deoxylyte.

A non-rusting pickle for iron and steel. Can be used cold or hot, in the form of a bath or a wash.

To remove rust with Deoxylyte, apply the Deoxylyte to the rusty work with a brush, allow it to remain on overnight, then wash the work with water.

Rubylyte.

A chemical preparation to take the rusting properties out of water. Recommended for use in hydraulic dies and in water for grinding.

APPLICATION—Use 1 lb. of Rubylyte to 200 gals. of water.

References.

Extensive lists of steel and iron works; foundries; motor, metal, car, welding, aeroplane, automobile and other industrial corporations; together with various other satisfied users of products of this company will be mailed to architects and other interested persons on request.

ANTI-HYDRO WATERPROOFING CO.

TELEPHONE:
WORTH 9184

299 Broadway
NEW YORK, N. Y.

LABORATORIES, NEWARK, N. J.—Telephone, Market 5069

Products and Services.

"ANTI-HYDRO," a Liquid Compound to be used with portland cement for waterproofing, dampproofing, hardening, and other purposes.

CONSULTING WATERPROOFING ENGINEERS. The consulting engineers are ready at all times to advise concerning difficult waterproofing problems. Correspondence is invited.

Description.

"Anti-Hydro's" function may be expressed as waterproofing cement with cement; that is, filling the voids with a cement solution, which crystallizes at the same time as the cement, integrally forming a hard, insoluble silicate of greater tensile strength, density and activity. It enriches mortars so that cost of troweling, mixing and supervision is reduced to a minimum. In fact, it more than pays its cost in labor saving. It hardens wearing surfaces to a degree that makes them dustless and adamant.

"Anti-Hydro" is a liquid compound, neutral to cement. When added, in certain percentage to the water used in gaging portland cement mixtures in the usual way, it has the effect, without retarding setting, of rendering cement in all kinds of masonry impervious to water, moisture, frost, gas, oils, odors, sugar solutions, alkalis and most acids. It excites and brings into service all the cohesive or colloidal possibilities of portland cements, which in themselves are most efficient waterproofing mediums. There are no alums, hydrate of lime, greases, oils, stearic acid, or decomposable ingredients used; neither are there any iron admixtures—all of which disintegrate concrete in time.

Uses.

Because of its remarkable properties "Anti-Hydro" is used for hardening cement floors, for waterproofing concrete in mass and in surface coating, for dampproofing and for waterproofing mortar in brickwork.

Quantity Required.

For coatings, 1 gal. "Anti-Hydro" for each 80 to 100 sq. ft. 1 in. thick; for mass concrete, 1½ to 2 gals. for each cu. yd.

Specifications.

FLOOR HARDENER—Upon fill shall be laid a 1-in. topping of 1 part portland cement and 2 parts clean sand. This shall be gaged by addition of "Anti-Hydro" to all water used in tempering dry mixture, in proportion of 1 gal. of "Anti-Hydro" to 10 gals. of water. The proper consistency will be obtained if, for each barrel of cement, 1 gal. of "Anti-Hydro" and 10 gals. of water be used.

WATERPROOFING IN MASS—To water used in gaging mixture add 1 gal. of "Anti-Hydro" for every 10 gals. water. Proper consistency will be obtained if, for each barrel cement, 1 gal. "Anti-Hydro" and 10 gals. water be used.

WATERPROOFING IN COATINGS—All interior surfaces of all exterior walls, upper surface of concrete floor slab of basement or cellar, all pits, piers, etc., as shown on plans, shall be water-



TRADE-MARK

proofed by the addition of "Anti-Hydro" Liquid Waterproofing Compound to all water used in tempering dry mixture of 1 part cement and 2 sand, in proportion of 1 gal. "Anti-Hydro" to 10 gals. water.

To assure perfect bond to underlying masonry, all surfaces, before application of waterproofing, shall be thoroughly roughed, cleaned and dampened. Coatings shall be applied not later than 24 hours after surfaces have been prepared. A slush or grout of neat cement, using 1 part "Anti-Hydro" to 3 parts water, is first applied, then followed by a 1 cement: 2 sand mixture.

Floor work shall be 1 in. in thickness, and shall serve the double purpose of a waterproofing agent and dustless wearing surface.

Wall coatings shall be ⅝ in. in thickness from floor level, where they shall be properly coved and bonded to floor, and carried up to at least 1 ft. above grade level.

DAMP-PROOFING—To a mixture of 1 gal. "Anti-Hydro" and 3 gals. water gradually stir about ½ bag of portland cement to a creamy consistency. Apply in 3 coats with a brush or spray.

The first coat is a penetrating one, the mixture for which should be as thick as the brush will carry and well rubbed in, taking particular care to fill all joints and cracks. The second is a further filler. The third is the finish coat, to which any color or effect can be given.

BRICKWORK—Brickwork to be laid in mortar of 1 part portland cement and 2 parts clean sand. This to be gaged or tempered with water having the addition of "Anti-Hydro." in the proportion of 1 gal. "Anti-Hydro" to 10 gals. water. Each course of brick to be carefully grouted, filling all joints with a liquid mixture as above, carrying the same percentage of "Anti-Hydro" to the water used in gaging it, 1 to 10.

STUCCO ON SOLID MASONRY—The stucco shall be applied in 2 coats. The straightening coat shall consist of 1 part portland cement and 3 parts sand. This shall be gaged with a solution of 1 part "Anti-Hydro" to each 10 parts of water. The wall shall first be thoroughly wetted and the straightening coat applied ¾ in. thick. The finish coat shall consist of 1 part portland cement and 2½ parts clean sand, which shall be gaged with the same strength solution of "Anti-Hydro" and water as the straightening coat and applied ¼ in. thick. Surface to be stippled. No lime should be used.

STUCCO ON METAL LATH—The stucco shall be applied in 3 coats. The first and second coats shall consist of 1 part portland cement and 3 parts clean sand, and shall be gaged with a solution of 1 part "Anti-Hydro" to each 10 parts water. The first coat shall be applied ⅞ in. thick and ⅝ in. over the face of the lath. The second coat shall be ¾ in. thick. The finish coat shall consist of 1 part portland cement and 2½ parts clean sand, which shall be gaged with the same strength solution of "Anti-Hydro" as the first and second coats and shall be applied ¼ in. thick. Surface to be stippled. No lime should be used.

ACID RESISTING—Write for special specifications.

Approval.

The superiority of "Anti-Hydro" for waterproofing and concrete hardening is demonstrated by the permanency of work completed as long as sixteen years ago, and by the comparative tests of the United States Bureau of Standards. In these tests, reported in their Technologic Paper No. 3, they designate "Anti-Hydro" as Compound No. 40, and state "It is most impermeable of any of the Mortars."

Shipment.

"Anti-Hydro" is shipped in standard containers of 5, 10, 20 and 30 gals., f. o. b. Newark, N. J.

ESTABLISHED 1883

THE BILLINGS-CHAPIN CO.

Factory Paints, Cement Coatings, Varnishes and Japans

438 Pearl Street
NEW YORK
TELEPHONE, WORTH 1354

1163 East 40th Street
CLEVELAND, OHIO
TELEPHONE, ROSEDALE 4675

146 High Street
BOSTON, MASS.
TELEPHONE, MAIN 4137

Products.

Manufacturers of COATINGS, Transparent and Opaque, covering all departments of exterior and interior treatment of surfaces—wood, metal, cement, stucco, brick, plaster.

CEMENT COATINGS, "DRIWAL" (Waterproofing), "BILCHACO" CEMENT FLOOR COATING, "RUSTNAUGHT" (Antirust and Insulator for Structural Steel).

House Paints, Shingle Stains, Roof Paints, "Flexo-Flint Finish," "Rubeffect" (a flat finish varnish), "Artone" (for wall decoration and plaster, wood or metal ceilings), "Flo-rite" (the perfect white enamel).

"Driwal" for Concrete and Brick.

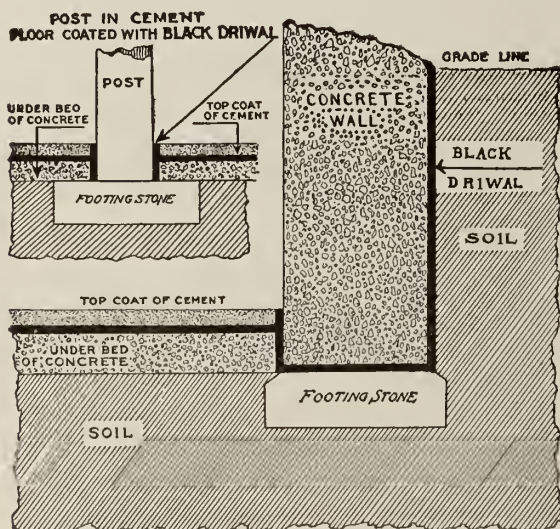
A waterproof and decorative coating for cement, stucco and brick surfaces.

"Driwal" prevents dampness, efflorescence and staining. Made in 14 colors, including greens, browns, reds, yellows and stone colors; white and black; also, transparent.

Driwal will not blister nor peel if properly applied. It penetrates, stains, preserves and waterproofs the texture of the surface; has no disagreeable odor.

Waterproofing for Heavy Pressure.

Black "Driwal" will not become brittle like tar, and may be applied without heating. Made in 3 forms: No. 1, Standard Body; No. 2, Extra Heavy, especially desirable on rough work; and No. 3, Paste, for filling cracks and crevices.



APPLICATION OF "DRIWAL"

Showing where Black "Driwal" should be used in waterproofing cement floors and foundation walls in damp locations, and also proper treatment of posts setting in cement floor



TRADE-MARK

"Bilchaco" Cement Floor Coating.

"Bilchaco" Cement Floor Coating hardens the surface; prevents cement dust, stains and injury from lubricating oils; improves sanitary value and appearance. Suitable for use in office buildings, hos-

pitals, schools, church basements, factories, breweries, packing houses, canneries, garages, laundries, etc.

Made in 6 shades.

BILCHACO

TRADE-MARK

"Rustnaught."

"Rustnaught" is a protective coating for steel, iron and other metals against rust. This coating is made along the lines indicated as best by the results of the investigation of the Cushman Laboratories as to the best protective coatings for structural iron, bridges, etc. It contains ingredients best calculated to act as insulators. It contains no asphaltum nor tar. It will successfully resist sulphuric acid fumes, brine and lubricating oil.

"Rustnaught" is also especially suitable for metal roofs and other metal surfaces exposed to severe weather conditions, as it is an antirust coating of greatest durability.

"Rustnaught" gives protection against rust and electrolysis. It will remain elastic, thus responding to the expansion and contraction of the metal in changing temperatures.

"Rustnaught" is made in 8 appropriate colors and black.

RUSTNAUGHT

TRADE-MARK

References.

The following is a list of a few of the many prominent buildings where "Bilchaco" paints, varnishes, and kindred products have been used.

BUILDING	LOCATION
Yale University	New Haven, Conn.
West Baden Springs Hotel	West Baden, Ind.
War Department	Fortress Monroe, Va.
Lincoln Memorial Hall	Hodgenville, Ky.
Fort William Henry Hotel	Lake George, N. Y.
Cuyahoga County Court House	Cleveland, Ohio
The Alling & Cory Co.	Pittsburgh, Pa.
The New Greenbrier Hotel	White Sulphur Springs, W. Va.
Mount Washington Hotel	Bretton Woods, N. H.
University of Michigan	Ann Arbor, Mich.
Hotel Wentworth	Portsmouth, N. H.
Eastman Kodak Co.	Rochester, N. Y.
Oak Ridge Abbey	Springfield, Ill.
Randolph Macon Academy	Front Royal, Va.
St. Benedict's College	Atchison, Kans.
Hotel Champlain	Bluff Point, N. Y.
Hotel Dempsey	Macon, Ga.
State Insane Asylum	Trenton, N. J.
Hotel Chamberlin	Old Point Comfort, Va.
American Optical Co.	Southbridge, Mass.
Atlantic Hotel	Chicago, Ill.

CLINTON METALLIC PAINT CO.

Manufacturers of Paints, Refractory Cements, Roof Cements, Mortar Colors and Cement Colors

HOME OFFICE
CLINTON, N. Y.

Products.

PROTECTIVE PAINT for Metals; REFRACTORY CEMENT; ROOF CEMENT; MORTAR COLORS.
Also, Cement Colors.

orders testify to the extent to which manufacturers have been able to reduce the cost of maintaining refractory structures through the use of "Clinton Super-Heat Cement."

Protective Paints for Metals.

Made in three forms: dry, paste, and ready-mixed.

DRY—"Clinton Metallic Paint," a natural red-brown oxide of iron reduced to the last degree of fineness (99% through 200-mesh).

Analysis of typical sample made at the Massachusetts Institute of Technology, Boston, Mass., October 2, 1919, follows:

Ferric oxide	68.0%	Magnesium carbonate	5.0%
Silica	15.0%	Alumina	2.7%
Calcium phosphate	3.0%	Sulphur	0.25%
Calcium carbonate	5.2%		

One large corporation of national reputation (name on request) has used approximately 150 tons of this dry pigment annually for many years in the manufacture of paint for the protection of its buildings and certain products which it sells.

Full instructions for mixing are gladly furnished.

PASTE—"Clinton Metallic Paste Paint," sometimes called "Clinton Metallic Ground In Oil."

Dry "Clinton Metallic Paint" thoroughly incorporated with pure linseed oil to the consistency of a thin paste; convenient in that it may be readily reduced by stirring in linseed or other suitable paint oil. This should not be confused with paste paint made thick or stiff. Such paste may be made with very little oil, and therefore at low cost. It is difficult to reduce such paste without mechanical mixing.

READY-MIXED—"Clinton Metallic Paint Mixed Ready for Use" contains only "Clinton Metallic Paint," pure, raw linseed oil, and best grade japan dryer. It is the opinion of this company that this is the best protective paint for metals manufactured. 1 gal. covers practically a sq. ft. on metal.

Refractory Cement for Bonding Fire Brick.

A plastic cement used for bonding fire brick, for lining crucibles, and for patching wherever refractory material is required.

Fire clay mortar serves merely as filler to impede the passage of air through the minute openings between the brick. It quickly jars or dusts out, leaving the brick readily susceptible to displacement by vibration and shock. "Clinton Super-Heat" Fire Brick Cement sets hard as rock in a few hours—even before heat is applied. It adheres permanently to the brick, substantially welding them together and seals the wall against infiltration of air.

Constantly increasing sales and numerous repeat



U. S. TRANSPORT LEVIATHAN
Brickwork cemented with "Clinton Super-Heat Cement"

As its part in the Great War, "Clinton Super-Heat" cemented the brickwork of the U. S. Transport Leviathan. It is invaluable in the presence of extreme vibration.

Full information, working sample, and miniature fire brick cemented with "Super-Heat" gladly sent on request. Distributors for this product are in all large cities.

Roof Cement.

"Clinton Silk Fibre Elastic Roof Cement" is made in red, brown, slate, black, green and gray colors.

This is a plastic material designed for bedding slate and tile, for sealing openings around chimneys, etc., and for patching and repairing roofs of every description. It adheres firmly to any surface. It never cracks, it never crumbles, it never lets go. It acts as a perfect and permanent seal against the weather.

"Clinton Silk Fibre Elastic Roof Cement" expands and contracts with changes of temperature. It will not run in the hottest weather.

Mortar Colors.

"Clinton Mortar Colors."

Mortar color is a familiar term to the architect, the dealer in building materials, and the mason contractor. Each knows from experience and observation how greatly the investment of a small sum in coloring material for the mortar enhances the appearance of a brick structure. The business man of today insists that his business be housed in presentable buildings with attractive surroundings. It is generally admitted that a building faced with common red brick with white or gray mortar joints, is unattractive. Such a building with red mortar joints blending with the brick, or with black joints affording contrast, is an ornament to any community in which it may be placed. The cost for coloring material should never exceed \$2.00 per 1000 facing brick and will ordinarily be much less. Good mortar colors are permanent. Unlike paint, they need never be renewed. Like paint, they beautify the structure. Their use is increasing daily, particularly in connection with rough texture brick.

Clinton "Super-Heat" Cement
TRADE-MARK

CHEESMAN-ELLIOT CO.

INCORPORATED

OWNERS OF NATIONAL PAINT WORKS

Manufacturers of Technical Paints

MAIN OFFICE

TELEPHONE CONNECTION

23 Flatbush Avenue
BROOKLYN, N. Y.

WORKS

WILLIAMSPORT, PA.
BROOKLYN, N. Y.**Products.**

TECHNICAL PAINTS for all purposes, including special formula and specification paints.

METAL PRESERVATIVE PAINTS: Bridge and Structural Paints of every kind including No. 31 Imported Red Oxide of Iron; No. 16 Carbon Black; No. 32 Graphite; No. 300 Suspended Red Lead; No. 250 Blue Lead; Lead and Zinc Paints; No. 450 Black Magnetic Oxide of Iron. Also Special Paints for severe and unusual conditions, including Fume Resisting Paints; Dampproof and Sweatproof Paints; Heat Resisting Paints; No. 755 Subway Black for Painting Steel Incased in Concrete.

MILL WHITE or LIGHT REFLECTING PAINTS: "Newlite" for coating walls and ceilings with durable pure white, washable finish. Made in flat, eggshell, semigloss and high gloss.

PAINT for CONCRETE, CEMENT or STUCCO: "Newlite" for interior and Kent Concrete Primer and Kent Concrete Finish for exterior or interior use; CE-Co Cement Floor Paint, a high grade durable floor coating.

Also Brick Paints: CE-Co Brick Paint in all colors; House and Building Paints: CE-Co Prepared House Paint, the highest grade paint for finest work, and N. W. P. Standard Prepared Paint for houses and factory buildings; Marine Paints: N. P. W. Marine Paints; Gas Holder Paints: No. 31 Williamsport Red Gas Holder Paint, Blue Lead, and Lead and Zinc Holder Paints.

Enamels: CE-Co White Enamel for finest work, and Keep White Enamel, both made in eggshell and semigloss, as well as high gloss finishes; Machinery Paints and Enamels: Oilproof Paints and Enamels for engines and machinery, in flat, semigloss and high gloss finishes.

Metal Preservative Paints.

CHEESMAN-ELLIOT Co.'s technical paints for the preservation of steel and iron are known for their uniform reliability as protective coatings. The longest service and best protection for the metal on practically all classes of work can be obtained from the use of No. 31 Red Oxide and No. 16 Carbon Black.

The following specifications provide coatings of lasting qualities and give the most protection:

PRIMING or SHOP COAT—No. 31 Imported Red Oxide or No. 300 Suspended Red Lead.

FINISH or FIELD COATS—No. 16 Carbon Black or, Graphite Paint in color selected or, Lead and Zinc in color selected or, No. 755 Subway Black.

No. 31 Imported Red Oxide Paint.

Made from a specially treated bright oxide of iron as the principal pigment. The principal vehicle is lin-

seed oil, combined with special waterproofing oils and gums on formulas developed by our long experience. It is made for both metal and wood and is particularly recommended for use in industrial plants as well as general iron and steel structures. It is suitable for both priming and finishing coats.

The spreading power of No. 31 is about 650 sq. ft. per gal., 1 coat, on metal.

REFERENCES—No. 31 is on more railroad bridges in the United States than any other iron oxide paint. It is extensively used in large industrial plants, including the American Cyanamid Co.; West Virginia Pulp and Paper Co.; New York and Pennsylvania Co.; Ontario Power Co.; Canadian Niagara Power Co.; Niagara Falls Power Co.; Turners Falls Power Co.; Anaconda Copper Mining Co.; Garfield Smelting Co.; New York Edison Co.; American Locomotive Co.; Eastern Mfg. Co.; Celluloid Co., etc.

Over 12,000 gals. of No. 31 were specified by the Air Nitrates Corporation, with the approval of the government engineers, and used as the shop and field coats on the steel of the U. S. Nitrate Plant No. 2 and the large power house at Muscle Shoals, Ala.

No. 16 Carbon Black Bridge and Structural Steel Paint.

One of the oldest and best known coatings. Composed of high grade pure carbon black with magnetic black oxide of iron and a percentage of inert pigments, combined with pure linseed oil and special driers and binders.

No. 16 dries jet black, with a bright luster. Its spreading power is about 850 sq. ft. per gal., 1 coat. No. 16 over No. 31 withstands tropical conditions better than any other paint.

No. 16 Carbon Black is a well-known bridge paint and is the standard bridge finishing paint of many large railroad companies after more than 25 years' use of it.

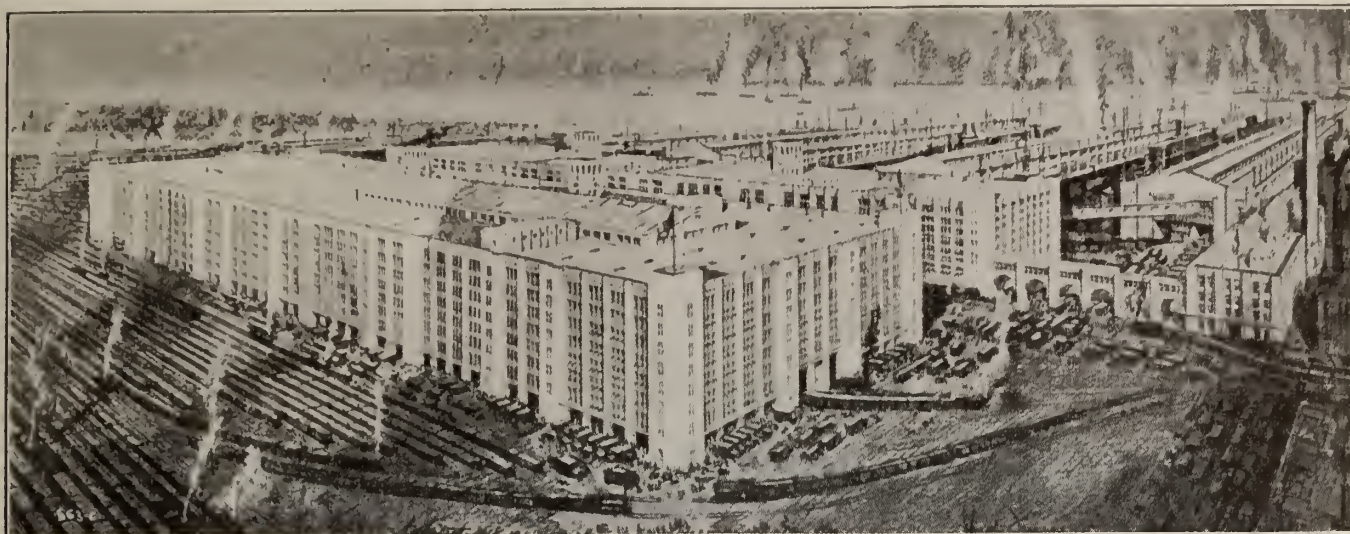
Graphite Paints.

Line comprises our No. 32 Natural Color Graphite and a full line of colors, including brown, gray and black. Our graphite paints are the highest quality and are purchased in large quantities by railroads, structural steel fabricators, and manufacturing plants.

No. 625 Galvanized Iron Paint.

No. 625 Galvanized Iron Paint is especially for use on new galvanized iron, and is extremely durable, adhering firmly to the metal. This paint works well under the brush, and will spread about 650 sq. ft. per gal., 1 coat. The special vehicles of No. 625 Galvanized Iron Paint are acidproof, and obtain a firm hold on the smooth, greasy surface of galvanized iron. After applying a coat of No. 625, any of CHEESMAN-ELLIOT Co.'s paints can be used over it without fear of peeling, or No. 625 can be used for the finishing coats.

This paint has been used on galvanized iron pier sheds for many years with entirely satisfactory results.



UNITED STATES ARMY SUPPLY BASE, BROOKLYN, N. Y.

This plant covers an area of 57 acres. The buildings and 4 double deck piers cost \$40,000,000.00 and constituted the largest concrete contract ever executed, the work being done by the Turner Construction Co.
10,500 gals of CHEESMAN-ELLIOTT Co.'s paints, including inside white, were used on this work

No. 250 Sublimed Blue Lead.

Especially suitable for use as a metal preservative against sulphurous fumes and other deleterious gases. Extensively used by copper smelting plants, gas companies, etc. It is very effective as a priming coat in repainting bridges, and other steel structures which, through neglect, have become badly pitted with corrosion. It is also recommended as a shop coat on structural steel to be used in mills and factories when it is desired to have the steel finished with white paints. Its blue gray color facilitates covering by the white paint and blue lead has proved itself to be one of the best preservative paints for metal.

Suspended Red Lead Paint.

We manufacture red lead paint in ready mixed form, with guaranteed qualities of suspension, containing as high as 80% pure red lead. Our No. 300 Suspended Red Lead represents the best that can be made in this class of material.

Light Colored Structural Paints.

Preservative paints in light colors, grays, white and miscellaneous colors.

"NEWLITE" PAINT, FOR LIGHT REFLECTION—Intended for interior use on walls, ceilings, columns, etc., to increase illumination by reflecting light. "Newlite" forms a solid pure white coating with flat, eggshell gloss, semigloss or high gloss surface, as desired. It is washable and extremely durable.

Although "Newlite" is an oil paint, the oils used in "Newlite" do not turn yellow. There is likewise no lead in any form used in "Newlite." Lead has a tendency to turn dark on interior use where it is kept away from good light. The basic pigment of "Newlite" is lithopone, the whitest and one of the best covering pigments known. There is therefore nothing in "Newlite" that is liable to discoloration, which accounts for its remarkable permanence of whiteness, and consequently its efficiency as a light reflector.

"Newlite" has been used in plants with severe conditions, such as sulphite pulp and paper mills, dye and rubber factories, bleacheries, etc., as well as factories with only ordinary conditions, and has universally given satisfactory results.

"Newlite" is suitable for application to concrete, brick, wood, plaster or metal.

Two coats of "Newlite" flat white, or 1 coat of "Newlite" primer and 2 coats of "Newlite" eggshell gloss, "Newlite" semigloss or "Newlite" high gloss, are sufficient to produce a first class pure white finish on any unpainted surface. On surfaces of slight porosity 1 coat of "Newlite" primer and 1 coat of any of the gloss finishes produces satisfactory results.

"Newlite" is also furnished in all colors, or can be readily tinted by the addition of oil colors.

REFERENCES—The Endicott Johnson Co.; American Woolen Co.; Burgess Sulphite Fibre Co.; National Aniline & Chemical Co.; Garner Print Works and Bleachery; Shepherd Electric Crane & Hoist Co.; Stokes Rubber Co.; Henrietta Mills; Norfolk & Western R. R., and others are among users of "Newlite."

Kent Concrete Paint, for Exterior Concrete or Stucco.

Forms a waterproof, frostproof coating of great durability. It is made in practically all colors. Kent concrete paint serves the double purpose of keeping out moisture and beautifying the building with one operation.

The principle of Kent Concrete Paint is a 2-coat combination to resist free lime and the weather. Kent Concrete Primer is neutral to the free lime in concrete and prevents "burning" through. Over the neutral primer is applied the weatherproof Kent Concrete Finish, which is also to a considerable degree neutral to alkalis.

Kent Concrete Paint has been used on many important concrete structures. It covers well and costs no more than common lead and oil paints.

Information Required in Ordering.

When writing this company relative to an order, give all possible information, indicating:

- (1) Character of surface to be painted.
- (2) Number of coats to be used.
- (3) Time to be allowed for drying between coats.
- (4) Whether painted before; is so, condition of old paint.
- (5) Kind of exposure (sun, water, gases, etc.).
- (6) How is paint to be applied (brushed, dipped or sprayed.)

Free Booklets and Color Cards.

Our booklets, "Practical Paint & Painting Specifications," "Technical Paints for Industrial Plants," and "Review of Technical Paints," as well as color cards, will be sent free on request.

DETROIT GRAPHITE COMPANY

Makers of Paints in all Colors for all Purposes

DETROIT, MICH.

BRANCH OFFICES

NEW YORK, N. Y.	CHICAGO, ILL.	BOSTON, MASS.	SPRINGFIELD, MASS.	CLEVELAND, OHIO
BUFFALO, N. Y.	ST. LOUIS, MO.	KANSAS CITY, MO.	SAN FRANCISCO, CAL.	GREENVILLE, S. C.
HOUSTON, TEX.	CHARLOTTE, N. C.	PHILADELPHIA, PA.	CINCINNATI, OHIO	EL PASO, TEX.

Products.

SUPERIOR GRAPHITE PAINT for structural steel and metal surfaces; ANTI-AQUA, a Danpproof Coating for stone, concrete or brick walls and foundations; STA-WHITE, a pure White Oil Paint for industrial interiors.

Degraco-Lite, a White Enamel for interior and exterior; Degraco-Tone, a Flat Washable Finish for interior use on plaster, metal, wood, cement, beaver board, etc.; Degraco Concrete Wall and Floor Paint; Degraco Colors for exterior and interior use.

Superior Graphite Paint.

The base of Superior Graphite Paint is Lake Superior amorphous graphite ore. This ore is a natural combination of graphitic carbon and silica, carrying as well percentages of oxides of aluminum and iron.

Extreme fineness is secured in the preparation of the ore, which is thoroughly ground and mixed with refined and treated linseed oil of highest grade.

Lake Superior graphite ore has a greater affinity for linseed oil than many of the commercial graphites on the market. Proved methods of machine grinding and manufacture make for unusual uniformity of mixture and proper drying qualities. The inert nature of the ore prevents chemical action between pigment and vehicle, and the paint film therefore retains its elasticity and durability over a long period.

Superior Graphite Paint prevents rust action on structural steel, fire escapes, steel window sash, frames and all metal surfaces. Unusual and severe conditions of exposure are met by this paint.

Elasticity to expand and contract with surface on which it is applied prevents cracking and checking of the film.

Large covering capacity, opacity, and ease of application make for initial economy in materials and labor.

Durability (proven in service) results in low ultimate cost.

Superior Graphite Paint has established its reputation as a leader among metal protective paints through service records covering a period of 30 years.

Manufactured in the following colors:

No. 30 Natural	No. 35 Red
No. 32 Brown	No. 36 Stack Black
No. 34 Black	No. 59 Olive Green

Standard packages: barrels, half-barrels, 5-gals. and 1-gal.

NOTE—No. 32 Brown is generally used as a shop coat, No. 30 Natural field coat, and No. 59 Olive Green, final finish coat. This combination of colors facilitates inspection and insures complete coats being applied.

Other colors or combinations desired may be used with equal success.

SPECIFICATION—All scale, dirt and foreign matter shall be removed from structural steel before any painting is done in the shop.

Covered surfaces, surfaces in contact, and surfaces enclosed, of all parts of riveted members, shall receive 1 coat of Superior Graphite Paint No. 32 Brown after pieces are punched and before assembled.

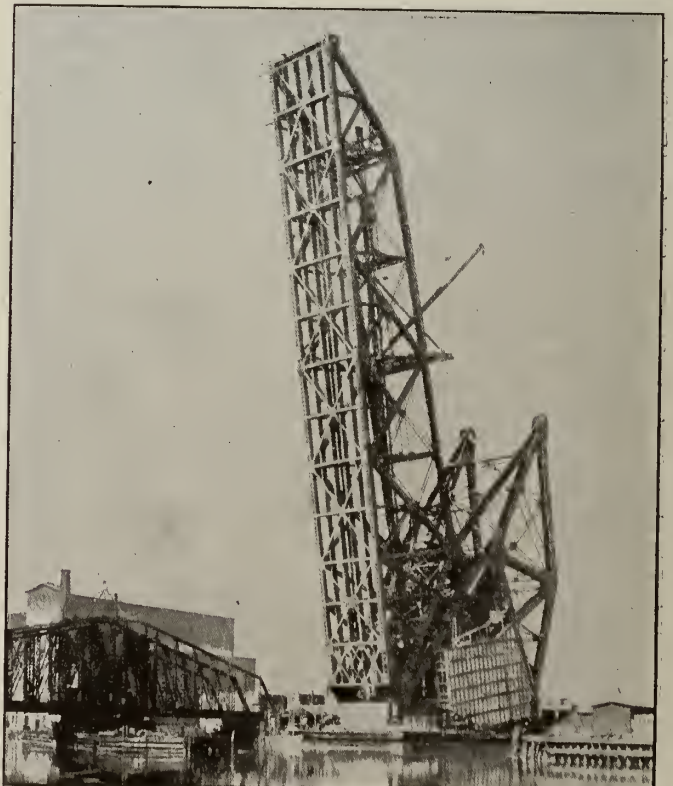
All finished members shall receive 1 complete coat of Superior Graphite No. 32 Brown before taken from shops or exposed to weather. Foundation beams and connections shall receive 1 coat in shop. All bolts used in erection and remaining permanently in structure shall be dipped in Superior Graphite Paint.

All pins and bored pinholes or other planed surfaces shall be coated with white lead and tallow before leaving shop.

All surfaces accessible after erection shall receive 2 coats of Superior Graphite Paint No. 30 Natural and 59 Olive Green, respectively; after being placed in position.

All painting shall be done on dry and preferably warm surfaces.

Paint used shall be Superior Graphite Paint manufactured by DETROIT GRAPHITE COMPANY, Detroit, Mich.



DOUBLE TRACK STRAUSS BASCULE BRIDGE, ST. CHARLES, AIR LINE, ILLINOIS CENTRAL R. R.
260 ft. high. 1750 tons of steel protected with Superior Graphite Paint

All paint shall be delivered to shop and to erection site in unbroken packages, subject to inspection and approval of architect and engineer.

REPAINTING SPECIFICATION—All metal work and other exposed surfaces to be painted shall be thoroughly cleaned with steel brushes, and where necessary all loose scale shall be removed with three cornered steel scrapers and hammer. No paint shall be applied until all dust, mud and grease have been carefully removed, nor shall any paint be applied during wet or foggy weather, or upon a wet surface.

First coat shall be Superior Graphite Paint No. 30 Natural applied as soon as parts are cleaned. Any parts of structure liable to hold moisture shall be cleaned and slushed with this paint.

When first coat has dried sufficiently, a period of at least 1 week being allowed to elapse, second coat shall be applied using Superior Graphite Paint No. 59 Olive Green.

All paint used shall be that manufactured by DETROIT GRAPHITE COMPANY, Detroit, Mich., and shall be delivered in unbroken packages.

Anti-Aqua Dampproof Coating.

Anti-Aqua is a waterproofing and dampproofing paint especially recommended for the following uses:

As a coating on the exterior of stone, brick and concrete foundations to prevent seepage of water.

As a coating on the interior of stone, brick and concrete walls to exclude dampness.

As a coating for the unexposed surfaces of marble, granite or other fine stone used in buildings to prevent seepage and staining.

As a coating between concrete walls and exterior tile or face brick of buildings.

As a plaster bond.

Anti-Aqua is a liquid bituminous paint of ordinary brushing consistency which dries within a few hours and when applied to stone, brick or concrete surfaces, enters into and seals up the pores, and on account of its penetration, the coating can not be destroyed by abrasion during backfilling of foundations.

Two coats of Anti-Aqua may be applied on concrete or brick walls and then followed by a coat of rough plaster. When used in this way, Anti-Aqua acts as a waterproofing paint and at the same time eliminates the use of furring and lathing.

The use of Anti-Aqua as a plaster bond on ceilings is not recommended.

The covering capacity will depend on the porosity

of the surface, but under normal conditions it will be from 80 to 100 sq. ft. per gal.

Anti-Aqua is supplied in the proper consistency for application, but if for any reason thinning is necessary, only special Anti-Aqua thinner should be used. Gasoline, benzine, petroleum solvents, turpentine or its substitutes will not mix with Anti-Aqua and should not be used for thinning this paint.

Sta-White.

Sta-White is a pure white oil paint for industrial interiors with unusual light-reflecting qualities.



TRADE-MARK

It contains no lead, glue or other harmful or easily affected ingredients, bleached oil or pigments, and consequently shows no tendency to turn yellow.

Sta-White will not chip, flake or peel.

It is recommended for interior painting of mills, factories, offices, public buildings, schools, hospitals, theaters, hotels, restaurants, etc.

Sta-White may be used on wood, metal, concrete, plaster, brick, and other surfaces. When, after a period of years, Sta-White becomes soiled, covered with dust or other settlements, the original whiteness and reflecting qualities are easily restored by brushing or washing without injury to the finish.

Sta-White will give maximum service that is expected of highest grade interior whites, both as to light reflecting qualities and durability.

Sta-White is made in high gloss enamel finish, although semigloss and flat finishes are also furnished.



AMERICAN HARD RUBBER CO. BUILDING

Painted with Sta-White. Note how the high gloss finish reflects the light

SPECIFICATIONS FOR CONCRETE, BRICK, PLASTER, WOOD OR METAL—The surfaces shall be dry, and free from dust or loosely attached matter such as old paint, rust, scale, etc. All oil spots shall first receive a coat of shellac.

The first or priming coat shall be Sta-White Primer applied with a full brush.

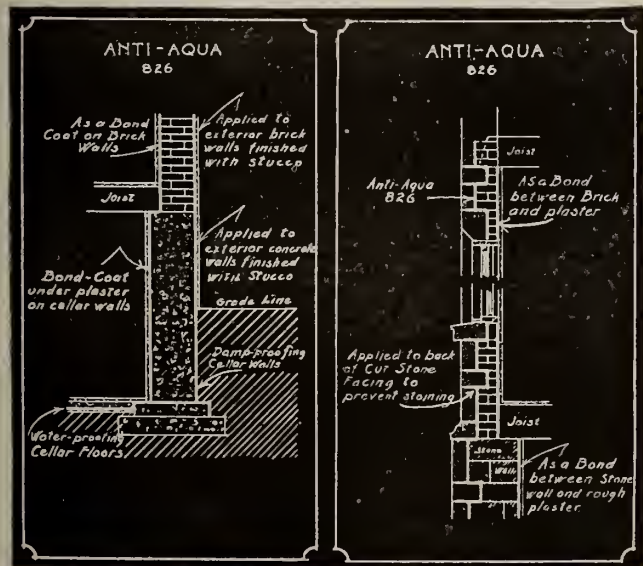
The final coat shall be Sta-White Gloss (semigloss or flat as desired) brushed in the manner varnish is applied, i.e., flowed on rather than brushed out. Care should be taken to see that the paint does not sag.

Drying Time—At least 48 hours shall be allowed between coats.

Thinning—For brick, concrete, plaster or wood surfaces, Sta-White Primer may be thinned with turpentine or turpentine substitute (petroleum spirits), not to exceed 1 qt. to 1 gal. of paint.

For steel, the primer shall be thinned with not to exceed 1 pt. to 1 gal. Sta-White Gloss (semigloss or flat) shall not be thinned under any circumstances.

All paint used shall be that manufactured by the DETROIT GRAPHITE COMPANY, Detroit, Mich., and shall be delivered in unbroken packages. All work shall be subject to inspection and approval of the architect or engineer.



DETAILS SHOWING METHOD OF APPLYING ANTI-AQUA DAMP-PROOF COATING

E. I. DU PONT DE NEMOURS & CO., INC.

Sales Department, Paint and Varnish Division

WILMINGTON, DEL.

PHILADELPHIA

CHICAGO

BRANCH OFFICES

BOSTON

NEW YORK

MINNEAPOLIS

COLUMBUS

Products.

DU-LITE (Mill White), ANTIOXIDE (Rust-inhibitive), OXIDE PAINT, CONCRETE PAINT, FLOOR & DECK PAINT, TOWN & COUNTRY PAINT, ELASTIC WALL PRIMER.

Flat Wall Paints, Machinery Enamels, Acid Resisting Black Paint, Graphite Paint, Smokestack Paint.

Also a complete line of Paints and Varnishes for all types of construction.

For Explosives, see page 40.

Quality.

The all important factor in the manufacture of the above products is the maintenance of a quality standard, attained through the use of highest grade raw materials, scientifically formulated and tested, and incorporated by modern machinery. The result of this careful formulation and production speaks for itself in the durability of the products, their covering or hiding power and the perfect protection they afford to the various types of material to which they are applied.

Service.

The Du Pont Architectural Service Bureau, Paint and Varnish Division, has been of valuable assistance to architects and engineers in solving difficult paint problems, through detailed advices, information, literature, color cards and specifications. This service is entirely unobligative, and performs a necessary function in bringing to a successful conclusion any project where paints and varnishes are used.

Du-Lite (Mill White).

An intensely white, solid covering paint for factory, mill, hospital and public building interiors. This is an oil paint, with non-poisonous pigments, greatly superior to calcimine or cold water paints, both from the standpoints of appearance and durability. Du-Lite may be used on wood, metal, concrete or brick surfaces equally well, producing a tough, elastic finish that will not chip or flake off. It retains its color exceptionally well, and is not affected by steam or fumes.

FINISH—Supplied in flat, eggshell or gloss finish.

COVERING CAPACITY—Will cover approximately 500 sq. ft. per gal., 1 coat.

SPECIFICATIONS

For Cement, Concrete, Brick and Plaster—All surfaces when thoroughly dry, shall be wire brushed to remove loose particles of cement, and then dusted. Cement and plaster should age for at least 30 days before painting.

First Coat: Du Pont Elastic Wall Primer.

Second Coat: Du Pont Du-Lite Flat.

Third Coat: Du Pont Du-Lite Gloss, Eggshell or Flat.



TRADE-MARK

For Wood and Wall board—Surfaces shall be reasonably smooth, dry and free from grease and dirt. Knots and sappy places in wood shall be shellacked before painting, and all nail holes puttied after first coat.

First Coat: Du Pont Du-Lite Flat, reduced to priming consistency with equal parts of pure raw linseed oil and pure spirits

of turpentine.

Second Coat: Du Pont Du-Lite Flat of package consistency.

Third Coat: Du Pont Du-Lite Gloss, Eggshell or Flat.

Structural Steel and All Other Metal Work Primed or Unprimed (Exception: Galvanized iron)—Wire brush metal surfaces to remove rust, scale or loose particles. Remove oil or grease with turpentine or benzine.

First Coat: Du Pont Ferro-Keep Gray.

Second Coat: Du Pont Du-Lite Flat.

Third Coat: Du Pont Du-Lite Gloss, Eggshell or Flat.

Galvanized Iron—Surface shall be thoroughly clean; oil and grease to be removed with turpentine or benzine. New galvanized iron shall be washed with a solution of 8-oz. copper sulphate to gal. of water. Allow to dry 4 hours before painting. Where galvanized surfaces have weathered for a month or longer this treatment is not necessary.

First Coat: Du Pont Galvanized Iron Primer.

Second Coat: Du Pont Du-Lite Flat.

Third Coat: Du Pont Du-Lite Gloss, Eggshell or Flat.

Antioxide (Rust-Inhibitive).

The highest grade of rust-inhibitive paint, made with a varnishlike vehicle which prevents moisture from attacking the metal and causing rust. It curbs progressive oxidation where it has begun and withstands acid fumes and conditions to an unusual degree.

COLORS—Supplied in red, bronze, green, maroon and black.

COVERING CAPACITY—Will cover approximately 750 sq. ft. per gal., 1 coat.

SPECIFICATIONS

Structural Metals for Buildings, Bridges, Fire Escapes, Tanks, Fences, Railings, etc.—All steel work shall be thoroughly freed of mill scale, rust, dirt and grease, by cleaning with wire brushes, scrapers, benzine, etc.

Priming Coat: After cleaning, the work shall not be allowed to stand, but shall immediately be given a priming coat of Antioxide Red. All abrasions of the priming coat due to handling in shipment and in erection shall be carefully recoated, and let stand 4 days before applying second coat.

Field Coats: After erection, the metal work shall

be given 2 field coats of Antoxide. Each coat shall be allowed to stand until perfectly dry, at least 4 days before subsequent coats are supplied.

Ferro-Keep.

An excellent metal protective paint-prepared with special rust inhibitive pigments. Dries with a full oil gloss.

COLORS—Supplied in black, green, red and gray.

COVERING CAPACITY—Will cover approximately 600 sq. ft. per gal., 1 coat.

SPECIFICATIONS

See Antoxide.

Oxide Paint.

A good covering, durable paint for exterior use, on outbuildings, fences, roofs, and similar work. May be used on wood or metal surfaces.

COLOR—Supplied in bright red only.

COVERING CAPACITY—Will cover approximately 500 sq. ft. per gal., 1 coat.

SPECIFICATIONS

Coats—1 or 2 coats in accordance with surface conditions.

Concrete Paint.

A protective and decorative coating for cement, concrete, stucco, plaster and brick surfaces, interior or exterior. It preserves the texture and individuality of concrete and its composition includes a special vehicle unaffected by lime or alkalis.

COVERING CAPACITY—Will cover approximately 300 to 350 sq. ft. per gal., 1 coat.

SPECIFICATIONS

Concrete should age for at least 30 days before painting. When thoroughly dry, wire brush to remove loose particles of cement and then dust.

First Coat: Harrisons Concrete Paint thinned with 20% pure raw linseed oil and 5% turpentine.

Second Coat: Harrisons Concrete Paint of package consistency.

Floor & Deck Paint.

For interior and exterior wood and concrete floors. Makes a tough and elastic coating and one that is impervious to moisture. Prevents the gradual wearing away and "dusting" of concrete floors, due to abrasion or heavy traffic.

When treating concrete floors a coat of Du Pont Concrete Floor First Coater is applied as a foundation over which the Du Pont Floor & Deck Paint is applied.

COLORS—Supplied in spruce, dark spruce, buff, light stone, dark stone, dust color, brownstone, maroon and light brown.

COVERING CAPACITY—Will cover approximately 275 sq. ft. per gal., 2 coats.

SPECIFICATIONS

All floor surfaces shall be dry, clean, free from grease and dirt, and reasonably smooth.

Concrete surfaces should age for at least 30 days

before painting. Wire brush to remove scale or loose particles.

Wood Floors—**First Coat**: Du Pont Floor & Deck Paint thinned at the rate of 1 pt. of pure turpentine to 1 gal. of paint.

Second Coat: Du Pont Floor & Deck Paint of package consistency.

Concrete Floors—**First Coat**: Du Pont Concrete Floor First Coater.

Second Coat: Du Pont Floor & Deck Paint of package consistency.

Third Coat: Du Pont Floor & Deck Paint of package consistency.

Concrete Floor First Coater.

A product of varnishlike consistency for the treatment of concrete floors before painting. Stops the suction and prevents lime and alkali from affecting subsequent coatings.

COVERING CAPACITY—Will cover approximately 400 sq. ft. per gal., 1 coat.

SPECIFICATIONS

See Floor & Deck Paint.

Elastic Wall Primer.

A sealing coat for concrete, cement, brick or plaster surfaces. Stops suction and is not affected by lime or alkalis. Forms a perfect foundation for all paint coatings when used on surfaces mentioned.

COVERING CAPACITY—Will cover approximately 300 sq. ft. per gal., 1 coat.

SPECIFICATIONS

See Du Pont Du-Lite.

Harrisons Town & Country Paint.

The highest grade of prepared paint, for all general exterior woodwork wherever a coating of exceptional durability is required.

One hundred and twenty-five years of paint making experience is back of this product, together with every facility to maintain its quality and uniformity.

COLORS—Supplied in 30 shades, black and whites.

COVERING CAPACITY—Will cover approximately 350 to 400 sq. ft. per gal., 2 coats.

SPECIFICATIONS

All surfaces shall be dry, clean and smooth. Grease and stains to be removed with benzine.

Putty all nail holes and surface imperfections after priming coat.

COATS—**Priming Coat**: For close grained, non-absorbent woods, thin with equal parts pure raw linseed oil and pure turpentine. For soft woods, like white pine or poplar, thin with 3 parts pure raw linseed oil and 1 part pure turpentine. For hard or yellow pine, cypress, Norway pine and other resinous woods, thin with 1 part raw linseed oil and 3 parts pure turpentine.

Second Coat: Thin with 2 parts pure raw linseed oil and 1 part pure turpentine.

Third Coat: Thin each gallon of paint with from 1 pt. to 1 qt. of raw linseed oil, depending on surface conditions and color used.

THE GENERAL FIREPROOFING COMPANY

Waterproofing and Dampproofing Products and Technical Paints

YOUNGSTOWN, OHIO

BRANCH OFFICES

BUFFALO, 40 Builders' Exchange
WASHINGTON, 711 Woodward Bldg.
ATLANTA, Third National Bank Bldg.
MINNEAPOLIS, 754 Builders Exchange

PHILADELPHIA, 512 Bulletin Bldg.
BOSTON, 125 Federal Street
MILWAUKEE, 1201 First National Bank Bldg.

CHICAGO, 325 West Madison St.
KANSAS CITY, 1009 Waldheim Bldg.
OMAHA, 213 Kennedy Bldg.
SAN FRANCISCO, 444 Market St.

EXPORT DEPARTMENT: 395 Broadway, NEW YORK

Products.

INTEGRAL WATERPROOFING, PASTE and POWDER; TROWEL COATING; FOUNDATION BRUSH COATING; MOP COATING; WATERPROOFING FELT; SATURATED FABRIC; ACIDPROOFING; COLORLESS WATERPROOFING; CEMENT and MASONRY COATINGS; FLOOR HARDENER; FLOOR PRIMER; FLOOR ENAMEL; DAMPPROOFING COATING; STAINPROOF STONE BACKING; MASTIC CEMENT; STEEL COATING; PROTECTIVE COATING (for steel); GALVANIZED IRON COATING; WOOD PRESERVATIVE.

Bonding Compound, GF No. 400.

For Metal Lath Reinforcement, see pages 174-76.

Service.

A Waterproofing Service Department is maintained, in which are practical engineers who have had wide experience on waterproofing jobs. Their time is devoted to studying actual conditions and recommending the right method along with the most suitable material for the job.

This department will give complete specifications if informed regarding nature of the work.

GF No. 10 Integral Waterproofing Paste.

A smooth white paste mixed with the gauging water for concrete and cement. It effectively lines all pores, rendering the mass permanently watertight. The small quantity required, and ease of using GF No. 10 make it an effective and inexpensive waterproofing.

USES—For waterproofing concrete foundations, floors, tanks, silos, etc., as an integral part of the mix; for waterproof coating when mixed with cement plaster; for waterproofing stucco exteriors over masonry, metal lath, hollow tile, etc.

GF No. 11 Integral Waterproofing Powder.

For the same work as GF No. 10 Paste. The only difference is the form and method of application.

GF No. 15 Trowel Coating and No. 16 Foundation Brush Coating.

The former a thick pastelike compound, the latter a heavy bitumen which can be swabbed on with a brush.

USES—For dampproofing substructures on the outer surface before refilling with soil.

GF No. 17 Mop Coating, GF No. 18 Waterproofing Felt and GF No. 21 Saturated Fabric.

For membrane waterproofing courses.

USES—Nos. 17 and 18 used for waterproofing basements, floors, roofs, etc.; Nos. 17 and 21, for swimming pools, steel and concrete bridge decks, etc.

GF No. 99 Acidproofing.

A thin transparent liquid which effectively resists dilute acids and acid gases.

GF No. 100 Colorless Waterproofing for Exteriors.

A permanent pore-filling liquid, which in no way changes appearance of walls but waterproofs them.

USES—For waterproofing exterior walls of brick,

stone or stucco; for copings, parapets, cornices; for cisterns, water tanks and pools.

GF No. 101 Cement and Masonry Coating.

For uses similar to GF No. 100, except that it imparts a lasting color to the surface. Furnished in colors—white, old ivory, buff, Bedford gray, Portland gray, concrete gray, tile red and brownstone.

GF No. 145 Floor Hardener.

A concentrated liquid for hardening and dustproofing concrete floors, both new and old. Also used to prevent streaking and staining on the face of granite and limestone. Proof against water, oil and dilute acids. Especially suitable for factories, warehouses, etc.

GF No. 155 Floor Enamel.

A decorative, protective coating for concrete floors, extremely long in vehicle, thereby insuring deeper penetration and greater wearing surface. Consequently, while not giving as dense a color, makes a better dustproofing. With No. 155 no priming coat is required. Supplied in red, brown, gray, green and colorless. Especially suitable for office buildings, hospitals, hotels and public buildings.

GF No. 200 Dampproofing Coating.

A heavy bitumen which is applied cold to rough brick or masonry walls. The strong "tack" aids in bonding the plaster; also forms an insulator.

USES—As a dampproofing on walls to which plaster is applied directly, or over lath and furring.

GF No. 220 Stainproof Stone Backing.

Applied on the back and joint surfaces of limestone, marble, etc., before erection to prevent staining and efflorescence.

GF No. 250 Mastic Cement.

A thick cementlike waterproofing for concrete roofs and pointing up joints, window and door casings, etc. In black and colors.

GF No. 300 and No. 325 Structural Steel Coatings.

For structural steel, either permanently exposed or to be incased in masonry or concrete.

GF No. 350 Galvanized Iron Coating.

A thin, transparent compound in liquid form. One coat applied with a brush to any galvanized surface will neutralize and cover up the oily film, preparing the surface for ordinary oil or graphite paint. GF No. 101, in colors, can be used over this priming coat.

GF No. 550 Wood Preservative.

Makes wood impervious to water; protects it from rotting due to dampness; prevents formation of fungi, and discourages wood-boring insects. Applied by brush, spray or immersion. Nut brown color, leaves no film.

Handbook.

The Waterproofing Handbook containing complete specifications furnished on request.

ESTABLISHED 1888

THE GOHEEN CORPORATION

Paint Engineers

FACTORY AND GENERAL OFFICES
WARREN, OHIO

BRANCH OFFICES

NEW YORK, N. Y., Postal Telegraph Building
PHILADELPHIA, PA., Land Title Building
PITTSBURGH, PA., Park Building
FAIRMONT, W. VA., Professional Building

CINCINNATI, OHIO, First National Bank Building

CHICAGO, ILL., City Hall Square Building
BOSTON, MASS., Winthrop Building
ST. LOUIS, MO., Railway Exchange Building
DALLAS, TEX., Slaughter Building

Products.

GOHEEN'S PRODUCTS include Protective Coatings for iron and steel; Interior and Exterior Wood Paints, Enamels; Dampproofings and Waterproofings for concrete and masonry surfaces; Concrete Floor Paints and Hardeners; Canvas Waterproofings, Wood Floor Preservatives and Shingle Stains.



Goheen's Highway Red.

A chemically combined red lead paint. This product has been developed to overcome the faults of the commonly used mixture of red lead and oil on iron and steel. Can be used as a shop coat or field coat. Does not harden or settle in the package.

Covering capacity is 800 sq. ft. per gal. Two coats properly applied will give absolute protection from 7 to 10 years.

Co-operation.

Our Engineers are always glad to correspond and co-operate with the trade. Our Engineers' Handbook, color cards and folders will be furnished on request.

Goheen's Carbonizing Coating.

An inhibitive and protective coating for iron and steel. Wearing qualities unexcelled. Recommended for use on all structural steel work, bridges, steel tipples, gas holders, standpipes, etc.

Covering capacity, 1000 sq. ft. per gal.

Has protected Inter-City Viaduct, Kansas City, for 14 years and good for several years more.

Goheen's Concrewaltum.

A paint for dampproofing and beautifying masonry surfaces. Prevents efflorescence and the staining of the walls. To be used where positive and permanent results are desired.

Made in all colors.

Covering capacity, 400 sq. ft. per gal.

Goheen's Galvanum.

The only paint that adheres permanently to galvanized iron. Can be applied without treating galvanized iron with an acid wash. Dries firm and hard, producing a film which is impervious to acids and to various alkalis found in water. Will not crack when subjected to heat or cold.

Covering capacity, 600 sq. ft. per gal. for light colors, and 800 sq. ft. per gal. for dark colors.

Goheen's Old Honesty.

Where the highest grade paint for exterior and interior wood surfaces is desired, Goheen's Old Honesty is recommended. This product is a combination of lead, zinc and linseed oil.

Made in all colors.

It has a covering capacity of 600 to 700 sq. ft. per gal. under normal conditions.

Other Products.

GOHEEN'S ASBESTOS ORE PAINT—A fire retardant and wood preservative coating for wooden tipples, trestles, fences, shaft houses, etc. Made in reds, browns, greens, black and special colors. Covers 400 sq. ft. per gal.

GOHEEN'S ROCKOTE—For hardening concrete floors. Converts granulating, dusting concrete floors into hard, flintlike surfaces.

GOHEEN'S HYDROLITE—A concentrated liquid for waterproofing concrete. Readily miscible with the gauging water. Can be thrown directly into the mixer—no skill required. One gal. waterproofs 1 cu. yd. of mass concrete. Costs less than any other good waterproofing on the market.

GOHEEN'S FLAT WALL FINISH—A sanitary washable flat paint which dries with a rich velvet effect. Covers 600 sq. ft. per gal. Hides in one coat.

GOHEEN'S PUBLIC SERVICE WHITE—A high grade mill white for factories, public buildings, schools, hospitals, dairies, etc. Increases lighting efficiency. Retains its gloss and whiteness indefinitely.

GOHEEN'S ENAMELETTE—A white enamel that stays white. Absolutely sanitary. Can be washed without harm. Equal to highest grades of imported enamels and more economical.

GOHEEN'S ROOF CEMENT—An asbestos fiber cement for renewing old composition, tin, paper, felt and wood roofs. Made in liquid and paste form.

GOHEEN'S SPECIAL ACID AND HEAT RESISTING PAINT—Resists combined effect of chemical fumes, heat and steam on exterior exposure. Ideal for smokestacks. For interior conditions, use Goheen's Oxidized Carbon Cement R No. 1.

ESTABLISHED 1852

HAMPDEN PAINT & CHEMICAL CO.

SPRINGFIELD, MASS.

BOSTON, MASS.

BRANCH OFFICES

NEW YORK, N. Y.

Address all correspondence to main office

Products.

- "HAMPDEN" MILL WHITE, for mill and factory walls and ceilings.
- "HAMPDEN" STRUCTURAL PAINT, for the protection of structural iron and steel.
- "HAMPDEN" CEMENT FLOOR COATING.
- "HAMPDEN" CONCRETE FLOOR HARDENER, for concrete floors.
- "HAMPDEN" PIPE ENAMEL, for hot and cold interior piping systems.
- "Hampden" Interior Flat Finish, for hospitals, offices and public buildings; "Hampden" Mill Enamel, for interior mill trim; "Regal" Wall Coating, a cold water paint; "Hampden" Exterior Concrete Coatings, for exterior brick and concrete surfaces; "Rubercoat" Elastic Carbon Paint, for waterproofing roofs, and all walls below grade; "Hampden" Varnishes, for all classes of work—exterior and interior; "Hampden" Ready Mixed Paint, for exterior work; "Hampden" Permanent Green, for all exterior work; "Almandine" Reds, for exterior use.

"Hampden" Mill White.

This paint is particularly adapted for brightening interiors of mills, factories and industrial plants, and may be applied to walls and ceilings of wood, brick and concrete. Possesses great light reflecting qualities. It will not chip or scale, is permanent and washable, and is supplied in 3 finishes.

MILL WHITE GLOSS—For use in rooms free from moisture. Insures permanent high gloss. Exceptional ease of spread and covering capacity.

MILL WHITE EGGSHELL—A pleasing finish between that of flat and gloss. Great covering capacity, and opaqueness combined with ease of spread.

MILL WHITE FLAT—For interior use where moisture and steamy conditions exist. A permanent, velvety finish, pleasing to the eye.

SPECIFICATION DATA

For New Surfaces—Surfaces must be dry and free of all loose particles. All knots and sappy places in woodwork should be coated with shellac of good body.

For Old Surfaces—Surfaces must be dry, and cleaned of loose particles.

Previous applications of whitewash or similar coatings removed and surface left clean.

Grease and oil stains removed and surface coated with shellac.

First Coat—Concrete, brickwork, and plastered surfaces given 1 coat "Hampden" Concrete Primer brushed well into pores. Allow at least 24 hours for drying.

Unpainted galvanized surfaces given 1 coat "Hampden" Galvanized Iron Primer. Woodwork given 1 coat "Hampden" Mill White Flat. Allow at least 48 hours for drying.

Second Coat—1 coat "Hampden" Mill White Flat. Allow at least 48 hours for drying.

Third Coat—1 coat "Hampden" Mill White—Flat, Egg-shell or Gloss, as desired.

All paints, when necessary, to be made workable by addition of "Hampden" Mill White Thinners in proportion not greater than 10%.

"Hampden" paints may be obtained from HAMPDEN PAINT & CHEMICAL Co., Springfield, Mass., or authorized agents.



TRADE-MARK

NOTE—The second coat of "Hampden" Mill White Flat may be omitted for 2-coat work; it is not advised, unless surface has been previously painted and old paint is in good condition.

CONSERVATIVE COVERING CAPACITY,
OVER PRIMED SURFACES—On wood, 50 sq. yds. per gal.; on brick and concrete, 30 sq.

yds. per gal.

"Hampden" Cement Floor Coating.

This is a sanitary finishing paint for cement floors in hospitals, schools, office buildings, halls, etc. It hardens the surface and prevents cement dust, thus lengthening the life of even the best concrete floors. Easily kept clean. It is oilproof, therefore very valuable for use in garages, factories and engine rooms. Not intended for wet basement floors.

"Hampden" Concrete Floor Hardener.

For hardening, waterproofing, and dustproofing concrete floors. Chemically transforms the concrete—colorless.

"Hampden" Structural Paint.

This paint forms a permanent coating to protect structural iron and steel, and is a most efficient rust inhibitor. Made in 5 colors, and in special shades when quantity warrants.

SPECIFICATION DATA

Shop Work—All metal surfaces must be thoroughly scraped and cleaned of all rust, mill scale, dirt, and dust. All grease removed, and surfaces dusted. Apply 1 heavy coat "Hampden" Structural Gray No. 502; thinned, if necessary, by addition of pure turpentine in proportion not greater than 10%. All surfaces inaccessible when assembled to receive 2 coats before assembling.

Erection—After erection, all rust spots and places where paint is off to be thoroughly cleaned. All edges, rivets, nuts and bolt heads to receive an extra coating of above paint. Dip all bolts before placing.

Finishing—2 coats "Hampden" Structural Paint (of shade selected). Allow from 3 to 5 days' drying time for previous coat. Nothing but strictly pure settled linseed oil shall be used in reducing, and in proportion not greater than 15%.

"Hampden" paints may be obtained from HAMPDEN PAINT & CHEMICAL Co., Springfield, Mass., or authorized agents.

"Hampden" Pipe Enamel.

These enamels are adapted for hot and cold interior piping, and form permanent coatings for the preservation of metal pipe. Made in shades adopted by the American Society of Mechanical Engineers.

Packages.

Paints packed in 1-bbl., ½-bbl., 5-gal. and 1-gal. containers. When packed in barrels, same are equipped with mechanical agitators.

Publications.

Bulletins and pamphlets covering the different paints will be sent on request. A book of specifications for painting is offered with the idea that it may prove of assistance to the busy architect and engineer, and may be had on application.

THE HYDREX FELT & ENGINEERING CO.

Specialists in Structural Waterproofing, Insulation and Soundproofing

120 Liberty Street
NEW YORK, N. Y.

FACTORIES
RAHWAY, N. J.

BRANCH OFFICES
CHICAGO, ILL.

PHILADELPHIA, PA.

Products.

HYDREX WATERPROOFING FELT
HYDREX PRIMER and HYDREX (BITUMEN) COMPOUND

HYDREX-"SANIFLOR" DEADENING FELT
HYDREX-"NOVENTO" WATERPROOF SHEATHING PAPER

HYDREX WATERPROOFED BURLAP
HYDREX PRESERVATIVE PAINT
HYDREX-"BIKOTA" SHEATHING PAPER
HYDREX WATERPROOF CLOTH
HYDREX WATERPROOF CANVAS
HYDREX-"PLUVINOX" READY ROOFING

Hydrex Expansion Joint (strips); Technical, Roofing and Asphalt Paints; Cold Storage Insulation, Damp Course, Asphalts, Cloth-backed Case Lining, etc.

Hydrex Waterproofing Felt ("The Membrane Method").

This well-known waterproofing felt is an absolutely impervious leatherlike sheet, first saturated and then given a *glazed coating* on both surfaces. Used in two or more layers with hot Hydrex Compound (as the conditions may require) for waterproofing foundations, tunnels, subways, reservoirs, swimming pools, dry docks, fortifications, battery room floors, etc.

SPECIFICATIONS.—For general waterproofing work, specify 4 layers of the felt, cemented together with hot Hydrex Compound (*The Membrane Method of Waterproofing*), which has been successfully used in the most difficult water pressure work throughout the world.

For waterproofing upper floors in mills, warehouses, etc., specify 2 layers of Hydrex Felt "*Penna. Special*" grade, cemented together with hot Hydrex Compound.

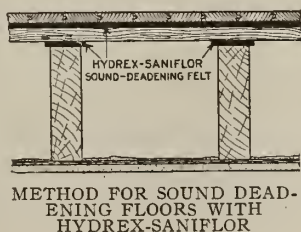
Detailed specifications, suited to particular needs and conditions, will be promptly supplied, on request. As engineers and experts in structural waterproofing, this company will furnish estimates, plans and specifications for waterproofing any kind of construction.

Hydrex-"Saniflor" Sound Deadenening Felt (Insulation).

A thick, soft felt *coated* on both surfaces so as to hermetically seal in the felt and render it non-absorbent, clean, sanitary and absolutely verminproof. Moths, mice and other vermin will *not* and can *not* eat the coating, because gnawing causes the teeth to stick. The well-known sound deadening quality of Hydrex-"SANIFLOR," together with its verminproof features, makes it unequalled for use in hospitals, residences, apartment houses, schools, etc.

Also widely used under machinery to prevent vibration and as a warmth giving, blanketlike lining under clapboards and roofs, and for cold storage, ice-houses and refrigerator car insulation.

Hydrex-"SANIFLOR" is put up in rolls 36 ins. wide, containing 300 sq. ft.



TRADE-MARK
Reg. U. S. Pat. Off.

Hydrex Primer and Hydrex (Bitumen) Compound.

Used for coating walls, floors, electrical work, etc. Hydrex Compound is a standard for junction boxes, mastic acid resisting floors, etc.

SPECIFICATIONS.—When surfaces are dry, brush on a thorough coating of Hydrex Waterproofing Primer, and when dry, mop over it a heavy coating of hot Hydrex Compound.

Hydrex Dampproofing and Preservative Paint.

A heavy bodied black paint for dampproofing the interior or exterior surfaces of walls, and also for hollow terra cotta tile walls to be stuccoed. It excels in *acid resisting qualities*, especially against sulphuric acid, and is therefore standard for use in electric storage boxes and battery rooms, for coating walls and all exposed metal.

This paint forms a heavy, tenacious, impervious coating to which plaster and stucco tightly bond. For the best results, 2 coats should be used. Covering capacity, 1 gal. for about 100 sq. ft. of brick surface.

Hydrex-"Novento" Waterproof Sheathing Paper.

An extra heavy *felt paper*, first waterproofed through and through and then given a *glazed coating* on both sides. *Is further improved by a coating of powdered soapstone* on the weather side, the soapstone being a great water repellant and preservative. Used under clapboards, slate, tile, stucco, tin, etc., the gray or soapstoned surface is turned outward towards the weather; under floors, the soapstone surface is turned upward.

Hydrex-"NOVENTO" contains no *coal tar or acids* to corrode tin, nails or other metal. Being alkali resisting, it is largely used under stucco. Made in 1-ply, 2-ply, 3-ply. Put up in rolls of 500 sq. ft.

Hydrex-"Bikota" Waterproof Sheathing Paper.

A low priced, waterproof sheathing paper, coated on both sides, but *not* saturated. Widely used under floors and parquet flooring. Made in 1-ply, 2-ply, 3-ply. Put up in rolls of 500 sq. ft.

Hydrex Waterproof Canvas.

A heavy, strong canvas, impregnated and coated with an elastic waterproof compound. Used on porch roofs, boat decks, piazza floors, etc., where there is considerable walking. Shipped in rolls 29 ins. wide, containing 216 sq. ft.

Hydrex Burlap, "New York Subway Brand."

A saturated and coated burlap accepted and used for waterproofing New York Subways. Put up in rolls of 400 sq. ft.

Hydrex Waterproof Cloth.

A waterproofed woven fabric used for waterproofing in connection with (hot) Hydrex Compound. Shipped in rolls 36 ins. wide, containing 500 sq. ft.

Hydrex-"Pluvinox" Ready Roofing.

A high grade, smooth surfaced, durable roofing. Made in 1-ply, 2-ply, 3-ply. Rolls contain 216 sq. ft.

THE HYDROLITHIC WATERPROOFING CO., INC.

Engineers and Contractors for Waterproofing

TELEPHONES:
GREELEY 2264, 2265

1328 Broadway
NEW YORK, N. Y.

Services and Products.

Engineers and Specialists for WINSLOW'S HYDROLITHIC SYSTEM OF WATERPROOFING.

HYDRO-CRETE, a Protective Concrete.

This company takes and executes contracts for the WATERPROOFING of all kinds of SUBSTRUCTURES, such as Subways, Tunnels, Reservoirs, Vaults, Swimming Pools, Boiler Rooms, Cellars, etc., giving a guarantee against any percolation, whether structures are of concrete, brick or stone.

Winslow's Hydrolithic System.

All work is executed in the well-known Winslow's hydrolithic system, using either hydrolithic cement or hydrolite as the conditions may require. Hydrolithic coatings contain all the good points of a first class true Portland cement mortar, with the addition of their water repellent and waterproofing qualities.

APPLICATION—Hydrolithic waterproofing is applied on the interior of exterior walls and floor forming one monolithic shell, and the adhesive qualities are such that it will withstand any water pressure, and will last just as long as the structures waterproofed will last. Hy-

HYDROLITHIC

TRADE-MARK



Before applying Waterproofing



After being Waterproofed

42ND STREET (NEW YORK) STATION, QUEENSBORO SUBWAY

hydrolithic waterproof coatings, $\frac{5}{8}$ in. thick on brick, have withstood a laboratory test of 1200 lbs. per sq. in.; and actual successful work has been done 162 ft. below grade, representing a hydrostatic pressure of over 70 lbs. per sq. in.

ADVANTAGES—The advantages of Winslow's hydrolithic system over the old membranous method are many: Repairs of any defects can be made easily, as the work is always in sight; it gains floor space, taken up in the membranous method of protecting brick walls, not necessary under the hydrolithic system; the waterproof coat constitutes the finish of the walls and floors, and, being impervious, is absolutely sanitary. Hydrolithic coatings are perfectly bonded to waterproofed structures, forming a part of such and thereby add strength to walls, and especially to floors.

RECORD—Winslow's hydrolithic system has been used for more than 20 years; has stood the test of time, and the company can truly say there is nothing superior to it on the market to-day.

ESTIMATES—If architects will write their requirements, specifications and estimates will be gladly furnished, no matter how large or small the job may be.

REFERENCES—A few of the buildings where Hydrolithic Waterproofing was used:

Delaware & Hudson Office Building, Albany, N. Y., M. T. Reynolds, Architect
Third National Bank, Springfield, Mass., Starrett & Van Vleck, Architects; Hoggson Bros., Engineers
Peoples National Bank, Jackson, Mich., Rocker & Vattet, Architects; Hoggson Bros., Engineers
Michigan City Trust & Savings Bank, Michigan City, Ind., T. C. Visscher, Architect; Hoggson Bros., Engineers
Wm. Penn Hotel, Pittsburgh, Pa., Janssen & Abbott, Architects
St. Paul's Cathedral, Pittsburgh, Pa.
Union Arcade Building, Pittsburgh, Pa.
Goodyear Rubber Tire Co., Long Island City, N. Y., A. H. Bowditch, Architect
Royal Bank of Canada, Liverpool, N. S., Purdy & Henderson, Engineers
Bridgeport Trust Co., Bridgeport, Conn., G. A. Freeman, Architect
Residence of Jas. Gamble Rogers, Architect, New York, N. Y.

Hydro-Crete.

A concrete especially adapted in the construction of bank vaults, producing the highest degree of protection against fire, water, intense heat, riots and burglary.

Hydro-Crete received the indorsement of experts after thorough tests had been made, representing as near as possible actual conditions of destruction by fire, drilling, cutting and smashing.

REFERENCES—Hydro-Crete has been used lately in the construction of the following bank vaults:

Federal Reserve Bank, Equitable Building, New York, N. Y.
Guaranty Trust Co., 43rd Street and Fifth Avenue, New York, N. Y.
Guaranty Trust Co., 140 Broadway, New York, N. Y.
Metropolitan Life Insurance Co., New York, N. Y.
Rhode Island Hospital Trust Co., Providence, R. I.
Italian Discount & Trust Co., New York, N. Y.

HYDRO-CRETE
TRADE MARK

THE LOWE BROTHERS COMPANY

Paints for Iron and Steel

450-452 East Third Street

DAYTON, OHIO

BRANCH OFFICES

BOSTON, MASS.
ATLANTA, GA.

NEW YORK, N. Y.
KANSAS CITY, MO.

JERSEY CITY, N. J.
MINNEAPOLIS, MINN.

CHICAGO, ILL.
TORONTO, CAN.

Products.

METAL PROTECTIVE and PRESERVATIVE PAINTS: RED LEAD LUTE, METALCOTE, GRAPHITE PAINT, GALVANIZED IRON PRIMER, MACHINE FILLER; SEALER COAT; OILPROOF MACHINE FINISHING PAINT.

DYEHOUSE ENAMELS.

MILL WHITE PAINT: Primer, Flat and Gloss.

Also other Metal Protective Paints; Carbon Paint; "High Standard" Liquid Paint, for interior or exterior use; Aluminum Paint; Mellotone, a flat oil, interior paint; Mello-Gloss, an interior gloss paint; Enamels; Stains; "Little Blue Flag" Varnishes.

Scope of Use.

These paints are made ready for use, and are adapted for structural and manufacturing purposes as follows:

Steel structures, bridges, railway equipment, public works of all kinds, metal roofs, metal covered buildings, factory buildings—exterior and interior—electric light, telephone and railway requirements; pipes, water, oil and gas tanks, machinery, viaducts, elevators, smokestacks, subways, ornamental ironwork.

Metal Protective Paints.

RED LEAD LUTE—A special treatment of red lead and linseed oil in combination with inert materials of durability and binding power. It is far superior to ordinary hand mixed red lead as a preservative paint for foundation coats on structural iron and steel.

Ordinary red lead and oil mixed by hand must be used immediately. With Red Lead Lute there is no waste. Lute has been known to remain in suspension in the container over 3 years. Every drop in the bucket will be taken up by the brush, leaving no sediment whatever.

METALCOTE—Used over Red Lead Lute or for all coats. Dries quickly with a good gloss without tack. Best possible protection against all sorts of injurious gases and moisture.

GRAPHITE PAINT—Selected graphite in combination with a binder that insures adhesion and durability.

GALVANIZED IRON PRIMER—Adheres to galvanized iron and presents a suitable surface for recoating.

Machinery Paints.

MACHINE FILLER—For painting and filling iron castings and machinery of all kinds. Does not crack or check and sands readily to a smooth surface.

SEALER COAT—A gloss varnish paint used over sanded out machine filler to seal the pores and prepare the surface for the finishing coat.



TRADE-MARK

OILPROOF MACHINE FINISHING PAINT—Made in light, medium and dark gray shades and black. When used over sealer coat, dries with a beautiful semigloss finish.

MACHINERY FINISHING PAINT—A high grade flat finish for fine machinery.

Dyehouse, Rubber Factory and Chemical Plant Paints.

Designed to meet the severe conditions prevalent in dyehouses, rubber factories, and chemical plants. They are acid and fume resisting, are not affected by moisture, and do not turn yellow. They work easily under the brush, cover solid in 1 coat, and produce an elastic durable surface. Dry in 24 to 36 hours, according to the conditions. Furnished in brushing consistency, and may be thinned with benzine for spraying, if desired. It is not recommended that the Dyehouse Enamel White be sprayed on.

Lowe Brothers Mill White.

Mill White is a paint excelling in ease of working, spreading capacity, hiding power and durability. Made from pigments and liquids best adapted to the purpose with most careful attention to each detail of manufacture. May be used on wood, brick, concrete, plaster, steel ceilings, wallboard, or any other surface ordinarily fit to be painted, and in each case gives excellent results. Because of its superior hiding power, very few coats are necessary to cover blackest walls. Its easy working properties greatly lessen cost of applying.

MILL WHITE PRIMER—Designed only for first coat work where 2 or more coats are used. It is an oil paint that works freely under the brush. Covers 600 to 700 sq. ft. per gal., 1 coat, depending upon nature of surface. Adheres firmly to surface and puts it in proper condition for receiving finishing coats of Gloss or Flat.

MILL WHITE FLAT—Produces a beautiful, soft, velvety finish. Very easily applied with a good wall brush. Will cover from 600 to 700 sq. ft. per gal., 1 coat, depending upon condition of surface. Like all flat paints it has a tendency to settle; but it may be stirred up with ordinary effort, as it does not harden in can.

MILL WHITE GLOSS—A paint of high class, full body, excellent working properties and great serviceability. Covers from 400 to 500 sq. ft. per gal., 1 coat, depending upon condition of surface. This paint, on account of its great light reflecting properties, is a most satisfactory mill finish. To secure best results where surface is dirty, an undercoating of Mill White Primer is recommended.

Special Requirements.

Special finishes are made up for individual concerns to perform a particular service, as practical experience and up-to-date laboratories enable THE LOWE BROTHERS COMPANY to handle most difficult requirements.

THE MINWAX COMPANY, INC.

Waterproofing, Dampproofing and Protective Metal Coatings

18 East 41st Street
NEW YORK, N. Y.

327 South La Salle Street
CHICAGO, ILL.

AGENTS

BALTIMORE, MD., HUDSON CEMENT & SUPPLY Co., Whitmore and Westwood Avenue
COLUMBUS, OHIO, COLUMBUS BUILDERS' SUPPLY Co., 145 North Front Street
DETROIT, MICH., S. P. CONKLING, 68 Jefferson Street
KANSAS CITY, MO., HAVENS STRUCTURAL STEEL Co., 17th Street and Eastern Avenue
LOS ANGELES, CAL., F. W. FARRINGTON & Co., 339 Citizen's National Bank Building
MINNEAPOLIS, MINN., L. D. SISSON Co., 556 Builders' Exchange
NEW YORK, N. Y., NEW YORK FRENCH EXPORT BUREAU, 15 Park Row

NEW YORK, N. Y., SPRUILLE BRADEN, 19 W. 44th Street
OMAHA, NEBR., J. T. KELLEY, Wilkinson Building
PHILADELPHIA, PA., CHARLES G. COPE, 507 Shubert Building
PORTLAND, ORE., F. W. FARRINGTON Co., 304 Henry Building
SALT LAKE CITY, UTAH, ENGINEERING SALES Co., 17 Exchange Place
SEATTLE, WASH., F. W. FARRINGTON Co., 445 Henry Building
SIOUX CITY, IOWA, O. S. DEAN, 308 Davidson Building
SAN FRANCISCO, CAL., K. M. HAYDEN, 816 Postal Telegraph Building
SANTIAGO, CHILE, ERRAZURIZ SIMPSON & Co.
VANCOUVER, B. C., THE ENGINEERING CORP., LTD., 906 Rogers Building

Products.

MINWAX WATERPROOFING SYSTEM;
DAMP-PROOFING; CONCRETE FLOOR FINISH;
BRICK and CEMENT COATING; PROTECTIVE METAL COATINGS.

Also Expansion Joint Cement and Artistic Wood Finishes.

Minwax Waterproofing System.

For foundations, pits, basements, trenches, retaining walls, bridge floors, subways, and all sub-level purposes.

This is a membraneous system, using two plies or layers of Minwax saturated cloth laid in and cemented with Minwax hard waterproofing—the resultant blanket being made up of two layers of cloth and three swabbings of waterproofing.

MINWAX SATURATED CLOTH—A heavy, strong, elastic cotton fabric completely saturated with a highly refined natural asphalt. This complete saturation not only protects each fiber of the cotton from moisture, but also prevents the lateral transfer of moisture through the laminations of the waterproof blanket by capillary action.

MINWAX HARD WATERPROOFING—This waterproofing, with which the cloth is both saturated and applied, is a naturally occurring asphalt refined with the sole object of producing a material absolutely stable both chemically and physically—a material possessing maximum ductility, which will be extremely tough at all working temperatures without being brittle, and which shows a minimum susceptibility to temperature changes. Therefore, a structure waterproofed by the Minwax system is one which is enveloped in a rubbery skin over $\frac{1}{8}$ in. thick, of great strength, which will not rot or deteriorate, and which will exclude water permanently regardless of the pressure encountered.

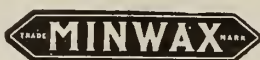
The cotton cloth system is the standard type of membraneous waterproofing, and the Minwax system is pioneer of all cloth systems and the only one with a proven record of satisfactory service.

Complete specifications furnished on request.

Minwax Protective Metal Coatings.

No. 500 BLACK—For metals exposed to heat. Minwax No. 500 black is intended for such heat exposures as stacks, boiler fronts, steam coils and steam piping—and it successfully resists temperatures up to 800° Fahr. without running or physical alteration.

Being a natural hydrocarbon with no pigments whatever, it dries entirely by evaporation into a tough, elastic coating with a smooth black, non-cracking enamel-



like surface. Its covering capacity is about 400 sq. ft. of smooth metal per gal.

No. 700 BLACK—For smoke exposures.

Train sheds, roundhouses and similar exposures, where the corrosive action of steam and smoke will be encountered, are the field of application for Minwax No. 700 Black. It dries by evaporation into a tough, tenacious, elastic film that is acidproof, alkaliproof, fumeproof and, of course, moistureproof. It resists all temperature changes without physical alteration, cracking, peeling or blistering. No pigment coating can be applied over Minwax No. 700 Black. Two-coat treatment is always recommended—its cost being little more than that of one ordinary oil paint coat. Covering capacity is about 400 sq. ft. per gal., first coat, and 500 sq. ft. per gal., second coat.

No. 150 BLACK—For exposed interior metal surfaces, Minwax No. 150 Black meets conditions where metals are not in direct sunlight, but are exposed to air, moisture, fumes, smoke, etc.—as in tunnels, factories, shops, mills, foundries and boiler plants. It forms a tough, elastic, non-cracking, impervious coating with the maximum of protection. Covering capacity is about 450 sq. ft. of smooth metal per gal.

No. 100 RED—A shop coat for iron or steel. This Minwax coating bonds firmly without peeling or blistering to any metal. The color is a bright Flemish tile red, of extreme permanency, produced by imported ferric oxide in a reinforced oil vehicle. Covering capacity is about 350 sq. ft. per gal., on metal.

No. 100 BLACK—A field coat for embedded iron or steel. Minwax No. 100 Black is a pure asphaltic hydrocarbon coating produced from a natural asphaltic mineral wax. It is designed as a protective coating, over Minwax No. 100 Red, for metal that is to be embedded in concrete or masonry. It is chemically inert, is acidproof and alkaliproof, dries by evaporation, is absolutely stable, and gives a tacky surface that bonds perfectly with the priming coat and also with the surrounding masonry or concrete. Minwax No. 100 Red and Black, in combination, give as perfect protection against corrosion as modern science can produce. The covering capacity of Minwax No. 100 Black is about 450 sq. ft.

Specifications on any of the above sent on request.

Publications.

Bulletin 21—Sub-Level Waterproofing. Bulletin 22—Waterproofing Exposed Walls. Bulletin 23—Concrete Floor Treatment. Bulletin 24—Protective Metal Coatings. Booklets on Artistic Wood Finishes and miscellaneous Minwax Protective Products.

MORENE PRODUCTS CO., INC.

Manufacturers of Cement in Liquid Form and Waterproofing Specialties

245-247 West 28th Street
NEW YORK, N. Y.

Products.

LIKWID CEMENT for Finishing Exterior and Interior Surfaces; MORENE PETROFLUID for Waterproofing Structures subject to water pressure; MORENE KEMISOL for Waterproofing Surfaces above ground.

Morene Likwid Sement.

Especially adapted for application on structural steel and galvanized iron in all factories, industrial plants, gas works, reservoirs, tanks, etc.

Can be applied on live steam pipes.

Morene Likwid Sement is portland cement in liquid form, produced by chemical process, carrying sand and asbestos in suspension, retaining the natural set, hardening and curing features of the original portland cement base. Is immune from injury by the elements.

Morene Likwid Sement is shipped ready for use. It should be used within 30 days from date of shipment.

The base color is white cement. It is applied with a brush in any color and texture on stone, brick, concrete or plastered surfaces. Any smooth, stipple or stucco effect can be produced.

Rough concrete or brick walls first given a surface application of Morene Kemisol (applied with a compressed air spray) and a heavy coat of Morene Likwid Sement will be absolutely waterproof and have a reasonably smooth appearance as the smaller voids and imperfections will be filled.

SPECIAL FEATURES—(1) Morene Likwid Sement is a perfect waterproof cement surface, will not scale, and fine hair checks will not appear as in ordinary cement plaster.

(2) It can be applied without injury when subjected to hot sun or wind and after being applied an hour, ordinary showers will not mar the surface.

(3) Will adhere and bond to painted surfaces. Old defective stone, brick and cement walls can be safely refinished.

(4) Morene Likwid Sement applied over brown coat cement plaster makes it unnecessary to apply the usual finish or dash coat plaster and to paint same for decorative color effect.

(5) It will also adhere to wood and metal, thus enabling wooden or metal cornices to be finished to match the adjacent stucco or stone work.

Morene Kemisol.

The scientific, practical and economical perfection of a colorless waterproofing and preservative for stone, brick, concrete and cement surfaces above ground.

APPLICATION—Use 1 gal. of Morene Kemisol for 10 to 15 sq. yds. Surface to be treated must be dry and absorptive to obtain proper results. If the structural material is covered with paint, grease or other foreign matter preventing direct contact, same must be removed before applying the waterproofing.

Morene Kemisol should be applied with a compressed air spray (orchard spray); a large brush will do. Every square inch of exposed surface must be treated. Crevices, cracks, voids and all low places must be thoroughly saturated.

Apply freely, not less than two applications, second

to follow immediately after first is absorbed, not over 10 minutes intervening. Once dry and set, no more can be absorbed. Any material remaining on the surface is useless. Smooth cut stone or pressed brick surfaces should be wiped off with cheese cloth before last application has thoroughly dried.

All dangerous crevices and voids on buildings must be pointed up with Morene Plastik Sement after being treated with Morene Kemisol to insure a watertight job.

SPECIAL FEATURES—(1) Morene Kemisol is a chemical solution, water base, ready for use.

(2) Is efficient only on absorptive surfaces.

(3) Leaves no coat, fills no pores, but makes the material itself non-absorptive.

(4) Is a preservative for stone, brick and cement; prevents discoloration and stains.

(5) Applied to the surface, prevents efflorescence or alkali from appearing on walls.

CAUTION—This material is ready for use. Do not dilute. In cold weather it will thicken. If too heavy, warm to about 100° Fahr. It should not be used at a temperature lower than 50° Fahr.

Morene Petrofluid.

An underground waterproofing material for basements, tunnels, tanks and reservoirs, or any concrete or brick construction to resist water pressure; to be used as an integral mixture in cement plaster or floor topping—prevents absorption and percolation, and will resist constant and severe water pressure.

APPLICATION—Surface to be plastered must be properly prepared to secure a perfect bond.

If the surface is smooth or has been painted, roughen by chipping about 70% of the surface. Dry parts of the wall must be thoroughly wetted with water or given a brush coat of equal parts of Morene Petrofluid and water before plastering to avoid quick drying of plaster and assuring a perfect bond.

For average conditions, mix 1 part cement and 2 parts fine sharp sand in the usual manner. Add 1 gal. of Morene Petrofluid to each bag of cement, then add sufficient water to make proper consistency. Apply and finish same as ordinary cement plaster.

For troweling or floating surface, use equal parts of Morene Petrofluid and water.

Estimate for this work: 1 bag of cement and 2 bags sand will plaster 6 to 7 sq. yds. $\frac{1}{2}$ in. thick. Minimum thickness of plaster should be $\frac{1}{2}$ in.

Where severe water pressure exists, increase the quantity of Morene Petrofluid about 50% or $1\frac{1}{2}$ gals. to each sack of cement. Also increase the thickness of plaster somewhat.

CAUTION—This material is ready for use. In cold weather it will thicken; if too heavy, warm to about 100° Fahr. Should not be used at a temperature lower than 50° Fahr.

Technical Service Department.

This company maintains a Technical Service Department. Experts are at your service for the solution of any problems pertaining to waterproofing, and to the conservation or protection of buildings.

NEW PROCESS CHEMICAL CO., INC.

Waterproofing and Acid Resisting Paints and Cements

39 Cortlandt Street

NEW YORK, N. Y.

Products.

PAINTS: Waterproofing; Acid Resisting; Anticorrosive; Insulating; Concrete; Marine.

CEMENTS: Waterproofing; Acid Resisting; Flashing; Seam; Elastic; Roof; Vault Light; Insulating.

Also Liquid Waterproof Glue.

INTRODUCED 1907



TRADE-MARK
Reg. U. S. Pat. Off.

XXX Nupro Cement (Maroon and Black), Elastic, Adhesive, Water and Acidproof.

Applied while hot with a trowel. For waterproofing structures. Will adhere to brick, concrete, steel, wood, tin, iron, slate, glass or felt. Retains its elasticity; will withstand vibration and climatic changes.

Especially adapted for waterproofing foundation walls; for lining steel, wood or concrete tanks; for coating exposed brick walls; for filling cracks and stopping leaks in concrete roofs, foundations, tanks, etc.; for waterproofing steel joints where they go through concrete; for coating steel girders lying in wet or damp places for prevention of electrolysis and corrosion; for uniting old and new concrete, making a perfect watertight joint; for tile and slate roof repairing; for vault lights; for waterproofing interstices of steel structures, etc.

COVERING CAPACITY—1 lb. XXX Nupro Cement covers 2 sq. ft. $\frac{1}{16}$ in. thick.

NOTE—Used on the Queensboro and Manhattan bridges in New York City for waterproofing expansion joints. In service since 1916, still qualifying.

X Nupro Cement (Maroon in Color).

X Nupro Cement is an especially high grade of flashing for dormer windows, skylights, chimneys, repairing leaks in tin roofs, etc.

It is ready for use. Adheres to wet or dry surfaces and forms a leatherlike impregnable coat that always remains elastic and adhesive and will not become brittle, peel off, crack due to vibration, nor is it affected by climatic changes.

COVERING CAPACITY—1 lb. covers 4 sq. ft. when applied as a flashing.

Nupro Solution and Enamel—Elastic and Adhesive, Anti-corrosive Coating for All Kinds of Tanks.

Nupro Solution is a primer to be used in steel or concrete water tanks or containers that are to hold cold acid solutions, alcohol or vinegars, after which a coating of Nupro Enamel, $\frac{1}{16}$ of an in. thick is applied.

100 lbs. of Nupro Enamel will coat 200 sq. ft. $\frac{1}{16}$ in. thick.

COVERING CAPACITY—1 gal. of Nupro Solution covers 400 sq. ft. of surface.

"Tri-Bitume" (Registered).

"Tri-Bitume" is a composition of bitumen mixed with non-oxidizing oils, is elastic, adhesive, waterproof and insulating.

For waterproofing foundation walls below grade, dampproofing walls above the grade level and staining limestone, granite and marble.

Manufactured in several consistencies.

NOTE—Nupro "Tri-Bitume" was used for waterproofing concrete car floats and barges built by the United States Navy and War Departments.

TRADE MARK
TRI-BITUME

"Tri-Bitume" No. 11 (Primer).

A primer to be used in conjunction with "Tri-Bitume" No. 22 and No. 33 as a first coat where structures are to receive 2 or more coats. Its purpose is penetration and to seal all pores.

COVERING CAPACITY—1 gal. covers 100 sq. ft.

Dampproofing Walls above Grade (Interior).

"Tri-Bitume" No. 22, a black, heavy, elastic, waterproof material that remains tacky, makes a perfect bond between plaster and main wall, eliminates furring and lathing.

COVERING CAPACITY—1 gal. covers 80 sq. ft.

Dampproofing Walls below Grade (Exterior).

"Tri-Bitume" No. 33, a heavy, semiplastic, water-repellent, elastic coating, is applied with a stiff brush or trowel to the outside of foundation walls, after the same have received a coating of "Tri-Bitume" primer No. 11. (Backfill should not be placed until after the coating has dried for at least 48 hours.)

COVERING CAPACITY—1 gal. "Tri-Bitume" No. 33 will cover 40 sq. ft.

Stainproofing Marble, Limestone, Granite, etc.

Apply 1 coat of "Tri-Bitume" No. 11 before stone is to be laid and 1 coat of "Tri-Bitume" No. 22 not more than 24 hours before the stone is laid. The above treatment will eliminate mortar stains and efflorescence.

Nupro Acid Resisting Paint No. 44 (Maroon, Black, Gray and Green).

For factories, foundries and industrial plants. Not being affected by acid fumes or gases, it is especially adapted for coating all steel or iron structural work in industrial plants, foundries, etc., for the prevention of disintegration due to corrosion caused by gases, acid fumes and climatic conditions. Possesses a proper degree of expansion and contraction, and will not crack, chip or peel off.

Maroon is recommended as a first coat.

COVERING CAPACITY—1 gal. covers about 400 sq. ft. of surface.

PERMANENT IRONITE WATERPROOFING CO.

Engineers and Contractors for Waterproofing

518 Peoples Gas Building
CHICAGO, ILL.

BRANCH OFFICES

PITTSBURGH, PA., 813-14 Union Bank Building
KANSAS CITY, MO., 232 Lathrop Building
ST. PAUL, MINN., Pioneer Building

MILWAUKEE, WIS., First National Bank Building
HOUSTON, TEX., 204 Beatty Building
FT. WORTH, TEX., 117 South Jennings Avenue

Products.

IRONITE WATERPROOFING; IRONITE CEMENT FLOOR HARDENER; IRONITE OILPROOFING.

Ironite Waterproofing.

Made in the form of a very fine metallic powder. It is mixed with water, and on application to a porous masonry surface will penetrate where moisture will.

The Ironite oxidizes and expands, becoming an integral part of the material to which it is applied, both strengthening and waterproofing same.

Ironite is an insulator against electricity, steam, heat and cold. It is non-magnetic, prevents electrolysis, and withstands a high degree of heat. Tests have proved it to withstand higher degrees of heat than concrete, steel and fire brick. Protects against the action of gases, fats, oils, brines, syrups, etc.

WHERE USED—Ironite is used on subways, basements, scale pits, coaling stations, powerhouses, cinder pits, tanks, tunnels, etc.; also on porous building products, such as brick, concrete and stone, applied on wet or dry surfaces.

APPLICATION—It is applied either to the interior or exterior surfaces of walls or floors, as conditions require.

By applying to the interior surfaces no outside excavation is necessary, consequently old work can be waterproofed as readily as new construction. Further, for inside treatment, the most opportune time can be selected to treat the surfaces, no interior lining wall being

required to hold the waterproofing in place; consequently, in case of fractures in the structure, repairs can be easily made.

PRESSURE—Ironite waterproofing is guaranteed to prevent leaks, providing structure stands where pressure does not exceed 4320 lbs. per sq. ft.

FINISHING OF WALLS—Walls may be plastered or decorated after waterproofing has been applied.

LIFE—Ironite will last as long as the structure to which it is applied, and in most instances lengthens the life of the structure.

SPECIFICATIONS—Specify that all surfaces to be treated shall be taken care of by the Ironite method, by the PERMANENT IRONITE WATERPROOFING CO.

Detailed specifications furnished on request.

Ironite Cement Floor Hardener.

A metallic hardener, used as an added aggregate, which, when mixed with cement, expands to such an extent as to close the pores in the cement finish. The result is a solid floor with a wearing surface of maximum density, adding strength to the concrete.

Specifications and information furnished on request.

Ironite Oilproofing.

This material is applied similar to the Ironite waterproofing, and will make the concrete both waterproof and oilproof. The Ironite method has been used for over 2 years to treat the inside surface of concrete oil storage tanks in various sections of the country, and has been used for different kinds of oil products.



BASEMENT AND SUB-BASEMENT OF PENNSYLVANIA FREIGHT TERMINAL, CHICAGO, ILL.
Waterproofed from the inside with Ironite method

THE SHERWIN-WILLIAMS CO.

Paints, Varnishes, Enamels, Stains, Wood Preservatives

601 Canal Road, N. W.
CLEVELAND, OHIO

FACTORIES

CLEVELAND

CHICAGO

NEWARK

MONTREAL

LONDON, ENGLAND

SALES OFFICES AND WAREHOUSES IN PRINCIPAL CITIES

Products.

Manufacturers of a complete line of PAINTS; VARNISHES; ENAMELS; STAINS; ROOF CEMENTS; WOOD PRESERVATIVES; CONCRETE and CEMENT HARDENERS; WATERPROOFING COMPOUNDS.

Facilities and Quality of Products.

To meet the paint requirements of mine owners and operators, THE SHERWIN-WILLIAMS Co. has thoroughly investigated the conditions surrounding the industry and as a result has developed a line of materials particularly adapted to meet the severe and widely differing destructive influences to which such paints are subjected.

Sherwin-Williams' facilities for producing just the right product for each specific purpose are unequalled in the paint and varnish field. The sources of supply of many of the most important raw materials are controlled by THE SHERWIN-WILLIAMS Co., who operate 5 factories for the production of paints and varnishes—tin can factory, box factory, mines and smelters, and other essential raw material producing units.

Each product is designed for the particular use specified and will economically and effectively produce the best results.

S-W Mine, Mill and Factory Colors.

Sherwin-Williams Mine, Mill and Factory Colors are recommended for decorating and preserving exterior surfaces where a durable oil paint is required at moderate cost.

Used largely where operators desire to maintain standard uniform colors at various plants, employees' houses, etc. (see plant standardization plan on next page).

S-W Metalastic (Liquid).

Metalastic is a combination of carbon black, graphite and specially treated pure linseed oil, producing a film that is very elastic and durable. The drying is so regulated by special dryers that it is an ideal paint for shop coats on structural steel. It is also recommended as a fabricating coat. Furnished in four colors—black, brown, green and dark gray—ready for use.

Put up in 1-qt., 1-gal. and 5-gal. cans, also barrels.

S-W Non-corrodible, Acid Resisting Paint.

A splendid antirust paint with graphite for its pigment base. It will be found very durable and economical for metal surfaces. It is a scientifically prepared coating for use on metal surfaces subjected to the action of gases, acids or their fumes, salt water, ammonia, and other disintegrating agents. Especially adapted for use



on smelters or buildings adjacent, which are subjected to sulphuric acid fumes, and similarly exposed locations.

Put up in 1-gal. pails, 5-gal. square tin cans and barrels.

S-W Galvanized Iron Primer.

Prepared ready for use. This is a paint for priming or first coating galvanized iron and sheet metal surfaces; metal sash and trim, cornices, finials, leaders and in fact any galvanized iron surface. [It is a perfect undercoating and can be successfully applied to galvanized iron and sheet metal surfaces.] It is made especially for high class work and subsequent coats of S-W Metal Protective and Oil Paints must be applied not longer than 4 days later. Made in gray only.

Put up in 1-qt., 1-gal. round cans, 5-gal. square cans and barrels.

S-W Roof and Bridge Paint.

An economical paint for roofs, bridges, barns, fences, etc., of metal or rough lumber.

S-W Carbon Paint, Red Diamond Brand.

Absolutely the best chemically inert carbon metal protective paint possible to manufacture. Produces a homogeneous film which insures maximum protection.

S-W Salamander Smoke-stack Black.

Especially made for boilers, smokestacks and surfaces subjected to great heat. Elastic and very durable.

S-W Gas Engine Enamels.

Especially adapted for finishing machinery, engines, and all metal work, etc., where a rich gloss elastic finish is desired. Does not become brittle nor mar easily.

S-W Graphite Pipe Joint and Gasket Compound.

A practical advantageous material indicated by its name. It makes a perfectly tight joint with less labor and cost than red lead and other materials, and in addition allows the various fittings on which it has been used to be uncoupled without the loss or breakage characteristic of red lead, cement or rust-set joints. Does not become hard in the package.

S-W Lustral Enamels.

Designed particularly for use on wood and metal surfaces, where an elastic high gloss enamel finish is desired. Constructed to withstand severe usage to a maximum degree. Made in a number of attractive shades.

S-W Eggshell Mill White.

(Undercoat and finishing).

For use on building interiors, etc. The intense whiteness makes it particularly adaptable for use in dark corners for reproducing refractory light. It will be found an invaluable agent for efficient lighting in building interiors.

Put up in 1-gal. and 5-gal. containers, also in barrels.

S-W Ajax Insulating Varnishes and Compounds.

In Ajax insulating materials THE SHERWIN-WILLIAMS Co. offers a complete line of insulating varnishes, both air drying and baking compounds, acid resisting paints, spirit varnishes, etc. The same care that is used in the manufacture of the entire line of Sherwin-Williams paint and varnishes is used in the production of insulating materials. The raw materials are selected with the greatest of care by experts in this line and are combined in a way that only long experience, careful research and a full knowledge of the business can teach.

Every batch is carefully tested in THE SHERWIN-WILLIAMS Co.'s well equipped laboratories (before shipment is made) for heat resistance, oilproof and moistureproof qualities, as well as dielectric strength.

This painstaking care that is used both in the manufacturing as well as the testing of S-W insulating materials, assures a product that at all times will meet the exacting requirements of users of electrical equipment of all kinds.

S-W Preservative Shingle Stain.

An exceptional line of shingle stains made on a creosote basis for use on shingle roofs and all shingle parts. Is also well adapted for stables and outbuildings, as it is an excellent wood preservative, as well as a strong disinfectant.

S-W Ebonol.

An economical black elastic paint for use on paper, composition, felt and canvas roofing and on exterior equipment of any sort where an economical paint is desired. Can be used on tin roofing, as it absolutely contains no acids harmful to the metal. Is also adapted for use on rain water tanks, standard pipe, sluice boxes, water troughs, gutters, copings, fences, etc.

Ebonol has excellent covering capacity, works well under the brush and will stand outdoor exposure.

S-W Elastic Roof Cement.

Without doubt the most durable and economical roof cement on the market today. For use in repairing all leaky roofs, can either be used for patching or can be spread over the entire roof, making practically a new roof at a very small cost. Cracks and holes in brick, stone, concrete, chimneys and other exposed surfaces can be sealed up with comparatively little trouble by using this material. It is made on a pine tar basis with long asbestos fiber as its pigment, which makes it fireproof.

S-W Elastic Roof Cement will remain plastic in all temperatures, will not run in the hot summer sun or crack in freezing temperatures.

Put up ready for use in 1-, 5-, 25- and 100-lb. containers and barrels.

100 sq. ft. of roofing will require from 25 to 50 lbs.

S-W Carbolic-Oil (A Wood Preservative.)

Carbolic-Oil is a pure anthracene oil derived from the distillation of pure coal tar, or in other words, the heaviest oil produced from the distillation of coal tar and what is known as a high boiling point oil. The distinction between an anthracene and creosote oil is that the latter distills at a low temperature, consequently is lighter in gravity, more volatile, and generally recognized as not being efficient for the types of work for which Carbolic-Oil is recommended.

Particularly recommended for use on poles, shaft timbers, trestles, flumes, tipples, air shafts, sheds, etc.

Carbolic-Oil can be sprayed, dipped or brushed and where possible, dipping is preferable, heating the material about 200° Fahr. It is always preferable to heat a wood preservative before applying, as this greatly assists the impregnation of the wood.

S-W Concrete and Cement Hardener.




An effective preparation for hardening and waterproofing cement. The value of using a preparation for hardening and waterproofing cement can not be overestimated. Cement, the same as all other materials, is subject to wear and decay from the elements unless properly protected. By filling up the open pores or voids with S-W concrete and cement hardener, the cement may be greatly strengthened or hardened, thus giving it much better wearing properties. The elements have no effect on S-W Concrete and Cement Hardener, as, after the pores of the cement are filled with this material, the cement becomes permanently and thoroughly waterproof.

S-W Petriloid.

An excellent waterproof, alkaliproof, acidproof and dampresisting glossy black composition, used for hermetically sealing concrete and stone surfaces against the detrimental agents mentioned.

S-W Plant Standardization Plan.

THE SHERWIN-WILLIAMS Co. has a plant standardization plan of special interest to mine operators (see sample below). Complete information of this plan, together with a system worked out for general use will be submitted on request.

STANDARDIZATION CHART OF PAINTS AND VARNISHES LEHIGH & WILKES-BARRE COAL COMPANY WILKES-BARRE, PA.				
NUMBER	COLOR	USE	HOW USED	PER GALLON COVERING CAPACITY
52 Semi-Flat Black No. 52		Breaker and Hoisting Engines, Fan Engines, Compressors and Pumps, Interior Only.	One coat over filler	400-500 sq. ft. one coat
67 Semi-Flat Black No. 67		Fan Draft Engines, Conveyor Fan Housing, Chain Hoist and Shop Engines, Hot Water Heaters, Hoisting Engines, Inside Pumps, Exterior and Interior	One coat over filler	400-500 sq. ft. one coat
84 Intermediate Coat No. 84		Plates chipped down to filler	One or more coats as needed	400-500 sq. ft.

STANDARDIZATION CHART

Special Paints.

It is of course impossible to describe the entire line of Sherwin-Williams products in these columns—only a small percentage being mentioned here. However, this company makes a special paint for every surface and is prepared to furnish at once and in any quantity just the right product for any purpose. THE SHERWIN-WILLIAMS Co. will be glad to solve specifically any paint problem.

THE STANDARD PAINT COMPANY

NEW YORK

BOSTON

CHICAGO

SAN FRANCISCO

MONTREAL

Products.

IMPERVITE CEMENT WATERPROOFING COMPOUND.

Also, Ru-ber-oid and SPC Roofings, Shingles, Felts, Papers, Deck Cloth; P&B Technical Paints, Liquid Insulating Materials and Asphalt Specialties.

Advantages of Impervite Waterproofing.

A $\frac{3}{4}$ -in. facing of Impervite mortar, plastered on the inside of a structure according to Specification A, by THE STANDARD PAINT COMPANY or under its supervision, is guaranteed to make and maintain the job watertight.

Due to the efficiency of Impervite, a *leaner* mortar than ever before specified may be used. This eliminates cracking.

Impervite differs from other waterproofing compounds, because it contains no calcium stearate or other soap. Unlike soap compounds it does not reduce the strength or delay the set, therefore larger amounts can be used and greater safety attained, although even for equal weights, it is guaranteed to be twice as efficient as any soap compound. See Test G.

Impervite is a white paste having a paraffin base, emulsified so as to be mixable with water. The value of paraffin has long been known, and Impervite now adapts it to concrete. Impervite is shipped in 25-lb. and 100-lb. cans and 450-lb. barrels.

Impervite mortar is permanent. It will resist brine, hot water, steam, fuel oil and other oils; distillates, acid fumes and most chemicals.

As compared to a membrane of tar and felt, the Impervite system is applied to the inside and does not require any protecting wall or double floor construction. This saves in excavation, construction, and useful space.

The experts of this company discuss cost and design with clients and maintain an effective co-operation with the job. Apply for a Question Blank, fill out, and receive suggestions.

Tests.

A—SAN FRANCISCO EXPOSITION—As the result of comparative tests, Impervite received the Gold Medal, highest award.

B—PERMEABILITY TEST—Impervite mortar, $\frac{3}{4}$ in. thick, has been tested to 150 lbs. pressure per sq. in. without any percolation taking place.

Note—(A very efficient permeameter designed by this company will be loaned.)

C—BONDING TEST—Impervite facing bonded to old concrete shows an adhesion of 290 lbs. per sq. in., equal to about 600-ft. head of water.

D—"ENGINEERING RECORD"—See Oct. 10, 1914, for description of an Impervite job withstanding 200-ft. head.

E—U. S. BUREAU OF STANDARDS—Technologic Paper No. 18 reports that compound No. 11 was the only one warranting further investigation. (No. 11 is Impervite.)

F—U. S. DEPARTMENT OF AGRICULTURE

CRUSHING STRENGTH		LEAKAGE IN 5 HOURS	
Plain	.....1350 lbs. per sq. in.	Plain	.....17 cubic centimeters
Impervite	..1470 lbs. per sq. in.	Impervite	.....No leakage

G—DR. SEGER'S CERAMIC LABORATORY

LEAKAGE IN 24 HOURS	
Plain 1:3 mortar	.....384 cc.
2% Soap compound C	...240 cc.
2% Soap compound B	...216 cc.
2% Impervite	.....56 cc.
5% Impervite	.....5 cc.
10% Impervite	.....0 cc.



Remarks on Design.

FLOORS—It is important that floors be reinforced strongly enough to resist the upward pressure of the ground water. This is $62\frac{1}{2}$ lbs. per sq. ft. of floor for each 1 ft. of head. Clay or rock foundation does *not* permanently reduce this. A floor 20 by 50 ft. subject to 5-ft. head has a total upward pressure of 312,500 lbs. Determine the maximum head of water before starting construction. Special data on request.

All floors should have some reinforcement to prevent cracking due to temperature stresses and the shrinkage of concrete on setting. A safe rule for small floors subject to not over 2-ft. head of water is a 5-in. base of 1:2:4 concrete, reinforced with $\frac{3}{8}$ -in. deformed steel bars, 1 in. from top of floor and spaced 1 ft. apart in both directions across floor.

Protect floor from cracking by heat of boilers or ashes. Domestic furnaces should rest on a layer of plain brick, extending out 4 ft. in front. Large boilers should rest on 2 in. of sand, covered with brick and extending out 8 ft. in front.

WALLS—To prevent shrinkage cracks in concrete walls, use 0.5% of reinforcing steel in horizontal direction: that is for every 100 sq. in. cross section of wall, use $\frac{1}{2}$ sq. in. of horizontal steel. For example, a wall 10 in. thick and 10 ft. high has a cross section of 1200 sq. in. and requires 6 sq. in. of horizontal steel. This may be secured by 6 rods 1 in. square, or better by 24 rods $\frac{1}{2}$ in. square.

A plain circular or straight wall is less likely to crack than one with offsets. Strengthen corners by bending the reinforcement around and using extra bars and fillets.

Ask for this company's suggestions on expansion joints.

For Safety, Use Specification A.

Specification A has been compiled at the urgent request of engineers desiring a high safety factor. It is original and contains the most advanced practice.

Without interfering with the strength of the mortar, it takes more compound than competitors are able to use and gives 12 times the security. See Tests F and G. It specially avoids rich mortars which might crack. The total cost of labor, cement, sand and compound for a waterproof facing is 20¢. to 50¢. per sq. ft., the cost of compound being 2¢. to 6¢. *Therefore if the extra safety is worth 4¢. a sq. ft., use Specification A.*

Abridged Specification A.

Walls and floors, where indicated on plans and specifications, are to be waterproofed with Impervite Cement Mortar, according to Specification A of THE STANDARD PAINT COMPANY, New York, N. Y., whose instructions shall be secured by contractor before starting work. No substitution will be permitted.

Specification A—1:3 Mortar Facing.

ESTIMATING—For 100 sq. ft. of surface, 1 in. thick, figure 3 bags of cement, 9 cu. ft. of sand and 36 lbs. of Impervite.

MIXING—Mix equal parts of Impervite and water and take a 12-qt. pail of this solution for each bag of cement. Use 1 bag cement to 3 cu. ft. sand. Mix on a tight floor until the mortar is perfectly uniform.

MATERIALS—Cement shall be approved brand, but sand is of greater importance, as it is impossible to secure results with sand which is dirty or too fine. Sand must be washed free from loam or clay. It must have a large proportion of coarse grains, and on test must equal Standard Ottawa Sand.

WORKMANSHIP—The work shall be done by experienced cement masons or sidewalk finishers, not by lime plasterers. Go over finished job with a light hammer; cut out any hollow place, roughen well, apply grout and replaster. Any cavity or scratch indicates faulty workmanship.

ROUGHENING—The roughness left by board forms is not sufficient for perfect bonding. Chip new concrete every 1 to 1½ in. immediately after removing forms, as part of the concreting contract; the waterproofing may be done later (a convenient tool is a T shape 3-lb. hammer with 4-in. points). Chip old concrete and wash with 1 part muriatic acid to 5 parts water (mixed in a wooden pail) and flush off thoroughly. Deeply rake joints of new brick; old brick should have entire surface removed with an axe. On new floors remove dirt and chalky material; thoroughly chip old or smooth floors.

BONDING—Wet down at intervals or soak for 24 hours so as to saturate the surface with water and prevent too quick drying of the mortar, which would make it weak. Then brush a grout of cement and water on to a small portion and follow within 10 minutes with mortar, for if the grout dries it is worse than useless. (The grout penetrates the fine pores where mortar is too stiff to enter.)

PLASTERING—Wall facings shall be ¾ in. thick in 2 coats. Floor facings 1 in. in 1 coat. Walls are plastered first; floors last.

Prevent mortar from sagging. Allow to harden 1 to 2 hours, then work with wooden float to compact thoroughly and remove holes. This is most important. Scratch lightly with ½-in. wire mesh. Apply finish coat, stopping 6 in. above floor. Allow to harden, then float again with great care and trowel smooth. (The use of dry cement in finishing is prohibited.) Apply floor, sweeping 6 in. up wall in a rounded cove; float and trowel.

When joining to any facing that has stood 12 hours or more, break off the edge to expose a clean fresh surface, and brush on a cement grout.

After getting first set, cover floor for 1 week with moist sand or water 1 in. deep. If room is heated, keep walls covered for 1 week with wet burlaps.

PUMPING—Dig a hole or sump 3 ft. below floor level and keep this pumped dry night and day until the mortar has set sufficiently to withstand the pressure of water. (Instructions for closing sump sent on request.)

NOTE—For oilproofing, acidproofing, or if necessary to combat running water, get special directions.

Specification B—1:2 Mortar Facing.

ESTIMATING—For 100 sq. ft. of surface 1 in. thick, figure 8 lbs. Impervite, 4 bags cement and 8 cu. ft. sand.

MIXING—Use 1 bag cement to 2 bags clean, coarse sand. Mix equal parts Impervite and water and take ½ gal. of this solution to each bag of cement.

Specification C—Mass Concrete.

ESTIMATING—For each cubic yard of concrete, figure roughly, on small jobs, ½ yd. of sand, 1 yd. of stone and cement as follows: (7 bags for 1:1½:3), (6 bags for 1:2:4), (5 bags for 1:2½:5), (4 bags for 1:3:6). For each bag of cement, take 1 lb. of Impervite (1 pt., dipperful). On special work more may be used.

MIXING—Impervite gives a smooth flowing mixture with a reduced amount of water; this results in stronger concrete. Throw right into the mixer, giving fully 1 to 2 minutes in the machine.

CONCRETING—Spade well to the face of the work. Work continuously if possible; but if stops at night are necessary, roughen the surface with a rake. Before starting again, pour a 2-in. bonding layer of 1:3 waterproof mortar without stone.

NOTE—Under ideal conditions, concrete can be made waterproof without any compound. Under practical conditions, it is easy to slip up on any of the following details:

(1) Rigid and watertight formwork. (2) Well graded aggregates that run uniform from day to day. (3) Uniform proportioning and adequate mixing of every batch. (4) Preventing the use of an excess of water. (5) Depositing the concrete without segregation in chutes or forms. (6) Conscientious spading. (7) Either continuous night or day work, or very careful attention to the bonding planes. (8) Preventing the infiltration of water, before concrete is hard. (9) Curing to prevent freezing, or too rapid drying.

The addition of Impervite is very useful, but even a 3-ft. thickness of mass concrete is not as safe as a ¾-in. Impervite mortar facing according to Specification A.

Specification D—1:4 Non-cracking Stucco.

ESTIMATING—For 100 sq. ft. of surface 1 in. thick, figure 2½ bags cement, 10 cu. ft. sand and 10 lbs. of White Impervite. (1-in. stucco is twice as strong as ¾-in.) Hair is unnecessary. Lime (whether hydrated on the job or at the mill) will not be permitted, as it contracts on drying, thereby increasing the tendency of stucco to crack.

MIXING—Measure and mix carefully to get uniform color. To each bag of cement, use 4 cu. ft. clean, coarse sand, measured in a frame 4 ft. by 2 ft. by 6 in. high. Mix equal parts Impervite and water, and take 1 gal. of this solution for each bag of cement.

APPLICATION—Saturate tile or masonry walls with water before stuccoing. The painting of tile is *not* recommended. Keep stucco from drying till at least 1 week old; cover with tarpaulins or spray frequently. To prevent diagonal cracks at the corners of door and window openings, place an extra strip of expanded metal 1 ft. square.

NOTE—The pamphlet, "Inside Facts about Stucco," will be sent on request. This was the first literature showing that rich mortar is the main cause of hair cracking. Impervite is recommended by leading architects and manufacturers of tile, lath and cement. For valuable data on Impervite stucco, see Technologic Paper No. 70 of the U. S. Bureau of Standards.

An old client reports, "The Impervite stucco is the best job in the county; not a hair crack in the whole structure."

Testimonials.

MCDONALD & JOSLIN, BOSTON, MASS.—"We have had a great deal of trouble with waterproofing different basements and elevator pits, and it seems a godsend to find something so simple and satisfactory as Impervite."

RUBBER REGENERATING CO., NAUGATUCK, CONN.—"We used Impervite in a pit with 9-ft head to fight against. This water was strong with dilute acid. A ¾-in. facing of Impervite mortar was placed on the walls and a 1-in. facing on the floor and, since then, this pit has been absolutely dry."

BELL BROTHERS MUSIC CO., TOPEKA, KANS.—"We tried everything that was mentioned in order to overcome water seeping through the wall. We are now using the room for pianos and there is no sign of dampness."

THE SANDUSKY CEMENT CO.

Manufacturers of Concrete Waterproofing and Waterproofed Cement
CLEVELAND, OHIO

BAY BRIDGE, OHIO

• FACTORIES
SYRACUSE, IND.

DIXON, ILL.

YORK, PA.

Products.

MEDUSA WATERPROOFING, in either Paste or Powder form—the original *integral* concrete waterproofing.

MEDUSA PORTLAND CEMENTS: Gray and White Portland Cements; Waterproofed Gray and Waterproofed White Portland Cements.

Also, Medusa Stone Backing.

Medusa Waterproofing.

MEDUSA PASTE—A white emulsion which can be dissolved in the gauging water for mortar or concrete. Especially recommended for machine mixed concrete.

The correct quantity to be used is 1 gal. to a barrel of portland cement.

MEDUSA POWDER—A water-repellent compound of fatty acids chemically combined with lime, to be mixed with dry cement before sand and water are added.

From 1½% to 2% of weight of cement (6 to 8 lbs. to 1 bbl. cement) is the right quantity to be used.

DESCRIPTION OF MEDUSA WATERPROOFING—The paste is identical with the powder in resulting composition, and is as everlasting as the concrete itself. It forms in concrete a water-repellent compound, thoroughly and effectually rendering the mass impermeable.

Ordinary concrete consists of from 20% to 40% of microscopic pores or capillary tubes, thus making it a porous material. Medusa Waterproofing possesses the characteristic of forming a thin film, capable, when properly supported, of holding back, by surface tension and its own cohesion, the layer of water to which it is exposed.

ADVANTAGES—It causes concrete work to dry off immediately after a rain, avoiding the unsightly dark appearance which water-soaked concrete retains for hours.

It makes concrete basement walls, tanks, cisterns, mortar and all concrete work positively waterproof and dampproof.

It does not affect the color, strength, or setting of concrete work and prevents the white efflorescence which renders cement work unsightly. It also minimizes the formation of shrinkage cracks.

Being sealed within the pores of the concrete, and not being subject to depreciation, the waterproofing effect is permanent.

It adds very little to the cost of the concrete and needs no renewal.

USES—Medusa will give positive watertight and dampproof results in the construction of concrete reservoirs, water towers and tanks, bathing pools, tunnels, disposal plants, pumping stations, elevator pits, stucco, basement walls and floors, cisterns, cement blocks, etc.

SPECIFICATIONS—Specify "According to manufacturers' directions." Write for specification booklet.

Medusa Portland Cements.

DESCRIPTION—Medusa Waterproofed Cements are

slow setting and quick hardening, remarkably uniform and especially noted for their fineness and strength. They constitute the regular white and gray brands waterproofed, ready for use, with Medusa Waterproofing. Highly recommended for basement walls and floors, swimming pools, reservoirs, elevator pits, and in a multitude of other uses where resistance to water percolation is required.

OUTPUT—Annual production, 3,000,000 bbls.

QUALITY—Medusa Portland Cements are guaranteed to pass standard and United States Government specifications. Every carload is tested before being shipped. A record of laboratory tests will be furnished on request.

SPECIFICATIONS—Specify "According to manufacturers' specifications." Write for specification booklet.

MEDUSA WHITE PORTLAND CEMENT—Especially suited for exterior or interior work, stucco work, and all kinds of construction where a beautiful white color is desired. Unexcelled for stucco, concrete bridges, floors, building trim and ornamentation.

MEDUSA GRAY PORTLAND CEMENT—Best suited for concrete work in which a white finish is not required. It is used extensively in roads and farm, factory and general industrial construction.

MEDUSA WATERPROOFED WHITE PORTLAND CEMENT—Consists of Medusa Waterproofing ground with Medusa White Portland Cement in the process of manufacture, insuring a thorough mixture in exactly the right proportions. It is the most reliable waterproofed cement manufactured.

Makes mortar or concrete absolutely waterproof, preventing the slightest penetration of moisture or dampness. It prevents discoloration of concrete blocks or stucco after heavy rains, and does not affect strength, setting or hardening qualities of concrete.

Intended for use the same as ordinary portland cement. Also used in stucco or exterior plaster. Its use prevents corrosion of metal lath, which may occur if cement plaster allows moisture to penetrate.

Concrete blocks are now being used in the construction of a great variety of buildings, in many of which waterproofing is absolutely necessary. Concrete blocks faced with Medusa Waterproofed White Portland Cement will be absolutely proof against water and moisture and permit plastering directly on blocks, thus saving expense of furring and lathing.

MEDUSA WATERPROOFED GRAY PORTLAND CEMENT—A standard portland cement containing the correct amount of Medusa Waterproofing ground in during the process of manufacture, thereby saving mixing changes and preventing errors in mixing. Medusa Waterproofed Cement should be used wherever waterproof and damp-proof concrete is required.

LITERATURE—Literature describing any of the above furnished on request.



TRADE-MARK



TRADE-MARK

ESTABLISHED 1848

TOCH BROTHERS

Technical and Scientific Paints, Waterproofing Compounds and Enamels,
Varnishes and Colors

320 Fifth Avenue
NEW YORK, N. Y.

DISTRIBUTING AGENCIES IN THE WORLD'S PRINCIPAL CITIES
WORKS AND LABORATORIES: LONG ISLAND CITY, N. Y.; LONDON, ENGLAND

Products and Services.

Inventors and manufacturers of
STEEL PROTECTIVE PAINTS; DAMPPROOF-
ING and WATERPROOFING PAINTS and
COMPOUNDS.

Also, Decorative Paints for all pur-
poses; Insulating Paint; Machinery En-
amel; Smokestack Paint; Roofing Paint; Cement Floor
Coatings; Enamels; Mortar, Cement and Plaster Colors.

A thoroughly equipped chemical laboratory is main-
tained by us and the services of the chemists are at the
disposal of clients who desire paints for special condi-
tions. Correspondence and personal inquiries are in-
vited on technical paint and waterproofing problems.

"R. I. W." Tockolith (Patented).

A Portland cement paint, gray in color, used only
as a priming coat on iron, steel or other metal. Must
be painted over as soon as practicable, and in any event
not more than 4 to 6 months after application. Can be
made specially to withstand longer exposure where con-
ditions demand it. A finishing coat must always be ap-
plied according to the character of the finished surface
required and the nature of the service expected.

An unexcelled combination for preventing chemical
or electrolytic corrosion is "R. I. W." Tockolith for the
priming coat and "R. I. W." Damp Resisting Paint for
the finishing coat. Approximate covering capacity (1
coat) per gal., 500 to 700 sq. ft.

No. 137 "R. I. W." (Red).

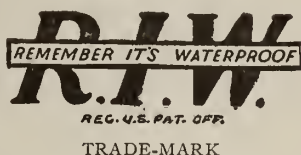
For interior or exterior use. Resists acid fumes.
Endures the excessive heat and moisture in the tropics.
A remarkable preservative of wood and metal under
adverse conditions in chemical works where acid fumes
prevail; on roofs, gutters, tanks, shutters, fire escapes
and structures constantly exposed to the weather.

Should be used as a finishing coat over a priming
coat of "R. I. W." Tockolith. Approximate covering
capacity (1 coat) per gal., 400 to 600 sq. ft.

No. 110 "R. I. W." Damp Resisting Paint.

Black or maroon, waterproof, specially adapted for
painting steelwork in factories or laboratories where
paint is not subjected to atmospheric conditions, but
must resist severe corroding agencies such as the fumes
of acids or alkalis.

Used as a finishing coat on structural grillage work
which is to be embedded in masonry, also on railroad
bridge floors and column footings, sprinkler pipes, poles
and pipes buried in the ground. Adheres perfectly to
concrete. Positive protection against electrolytic cor-
rosion, having an insulating value of over 800 volts per
millimeter. Usually applied over "R. I. W." Tockolith,
but 2 coats may be used without primer, if desired.
Approximate covering capacity (1 coat) per gal., 250 to
400 sq. ft.

**No. 112 "R. I. W." Damp Resisting Paint.**

Similar to No. 110 "R. I. W.," but
has the additional advantage of resisting
the influence of the elements during erec-
tion of steel. Also used on brine and
condenser pipes, and interior iron and
wood work subjected to moisture, alkalis,

acids, or electrolytic action.

Has an insulating value of over 550 volts per milli-
meter. Approximate covering capacity (1 coat) per
gal., 300 to 500 sq. ft.

"R. I. W." Battleship Gray.

Designed primarily for United States Navy and
still in use by them. Endures excessive heat and mois-
ture in the tropics.

Particularly adapted for molasses tanks, fire
escapes, and other steel or metal structures. Used by
many sugar centrales as a finishing coat over a priming
coat of "R. I. W." Tockolith, as it does not attract
and intensify heat on metal structures as is the case
with black or dark colored paints. Does not turn white,
streak, or lose its gloss near sea water.

Should be used as a finishing coat over a priming
coat of "R. I. W." Tockolith. Approximate covering
capacity (1 coat) per gal., 500 to 600 sq. ft.

"R. I. W." Self-Healing Bridge Cement.

A black, viscous, non-hardening material which
maintains a homogeneous, unbroken membrane coating
under normal conditions. Remains elastic at low tem-
peratures. Will not run in summer. Free from the de-
fects of tar, pitch or asphalt compounds that contain sul-
phur, which chemically attacks and destroys adjoining
layers of paper, burlap and other materials. Approxi-
mate covering capacity (1 coat) per gal., 20 to 40 sq. ft.

"R. I. W." Toxement (Patented).

A dry powder to be mixed with neat Portland ce-
ment on the job or, in very large operations, with clinker
at the mill. "R. I. W." Toxement fulfills the require-
ments of an integral waterproofing compound, because,
owing to its colloidal nature, it lubricates the mass, pro-
duces a denser body, and makes Portland cement con-
struction waterproof.

No. 421 "R. I. W." Acidproof Toxement (Patented).

A special grade of "R. I. W." Toxement, which,
when mixed with Portland cement, will produce a con-
crete that will withstand the action of 50% sulphuric
acid. An ideal material for concrete floors and walls
in chemical plants.

Used in conjunction with "R. I. W." Acidproof
Filler to protect concrete storage tanks against the action
of acids and oils.

Catalogue.

A copy of Toch Specification Book is worth having.
One may be had on request.

THE TROPICAL PAINT & OIL CO.

Manufacturers of Technical, Structural, and Dampproofing Paints of Scientific Reliability

GENERAL OFFICES AND FACTORIES
CLEVELAND, OHIO

Special Products.

ENGLISH STRUCTURAL STEEL PAINT.
ELASTIKOTE—Exterior Protective Paint.
TOCO GRAPHITE—Superior Quality.
CEMENTKOTE—A Dampproofing for walls of brick, cement, etc.
FLOORKOTE—Cement Floor Paint.
TROPICAL WATERPROOFING PAINT—Foundation Waterproofing.
TROPOLITE—High Heat Resisting Black.
TROPICAL RUBBER PAINT—A Waterproof Roof Black.
TOCOSEAL—Cement Plastic Roofing.
TROPICAL FINEST OUTSIDE GLOSS WHITE PAINT.
TOCO MILL WHITE—In Dull and Gloss.
TOCOTONE—Interior Flat Wall Finish.
B. and P. SPECIAL ENAMEL—Interior Finish for hard service.
BOILER SEAL—A Heatproof Insulation for boiler settings.
ARCHITECTURAL VARNISHES—Of the Highest Grade.



many users have against the ordinary prepared paint; and in working out the Elastikote problem it was discovered that, in the practical application of Elastikote, certain new and unusual protective features were developed.

In its wide adaptability, Elastikote, applied to wood, metal, iron or steel, brick, stone, cement, etc., is probably the only paint that possesses the necessary elasticity, toughness, adhesive qualities and extreme weather resisting qualities necessary to conform to the various conditions met with in treating the several surfaces mentioned, and from which dependable results can be obtained.

In the manufacture of Elastikote a certain percentage of a specially prepared natural hardened gum is incorporated by a process of our own. This gum, scientifically fused and blended with the usual paint pigments finely ground, and the resulting combination thoroughly mixed with pure linseed oil and dryers, forms the basis of Elastikote, to which is added only the purest and most durable tinting colors.

Although Elastikote is made in light colors, such as white, buff, fawn, etc., its greatest elasticity is obtained in the darker positive colors, such as the greens, reds, browns, maroon colors, etc., for the reason these darker shades carry a higher percentage of the gum base, which so greatly adds to the flexibility and durability of Elastikote.

Elastikote comes ready to apply. It is a full, heavy bodied paint, stays well in suspension and will thoroughly cover more surface than any prepared or hand mixed paint. Two coats are recommended.

Toco Graphite.

A full bodied graphite paint of the greatest durability and wear resisting qualities. It will follow the expansion and contraction of metal perfectly without scaling or cracking and is particularly adapted for coating structural steel to be incased in concrete. In this dampproofing and alkali resisting feature, Toco Graphite is superior to other graphites, which renders it especially desirable for bridge and railroad work.

Toco Graphite dries with a tough, glossy, dark steel gray finish and will stand up under the most severe test.

While ordinary metallic paints are not claimed to cover more than 300 to 400 sq. ft. under favorable conditions, Toco Graphite will cover from 600 to 700 and as high as 1000 sq. ft. to the gal. Two coats are recommended.

Cement Coatings.

Long experience in dealing with the problem of waterproofing and painting cement and concrete surfaces qualifies us to place at our customers' disposal the following products of proved reliability:

Cementkote, for cement, brick, stone or concrete walls above ground; Floorkote, for concrete and cement floors.

English Structural Steel Paint.

There are certain classes of work requiring the highest grade of ferric oxide paint. English Structural Paint is made specifically for exposed metal surfaces, such as iron and steel construction work, bridges, railway and tramway maintenance; gas, electric and water plants; towers, tanks; telegraph, telephone and trolley poles.

The protection of metal against rust, corrosion, and electrolysis is a waterproofing problem and its solution can only be accomplished by the use of a continuous, impervious insulation that will protect it from contact with moisture. Corrosion can not exist without oxygen, which is supplied by water. Rust is steel or iron chemically changed by the presence of moisture.

To properly protect exposed metallic surfaces requires a paint film which is, first, impervious; second, elastic; and third, one having a pigment base that is inert, finely ground, and at the same time powerfully adhesive. English Structural Paint is the result of years of practical tests. The combination of pigments and vehicles used in its make-up has proved to be of very great durability.

English Structural Paint is made in the usual standard colors: maroon, English oxide red, green, brown, lead color, and black; is full bodied, and ready for the brush. Two coats are recommended.

Elastikote.

A high standard protective and preservative paint made in strong positive colors, black and white, designed for general use on all exterior surfaces exposed to severe weather-wear, requiring solid, substantial, durable paint protection.

Elastikote is the result of thirty years' experience and scientific research to overcome certain prejudices

All concrete or cement work is permeated with a fine network or system of capillaries, which absorb and distribute moisture to all its parts. These ducts or capillaries can not be filled during the curative stage of the concrete without materially interfering with the chemical action of the cement, as these conduits are necessary to introduce the moisture so essential during the curative stages.

Nothing therefore should be used in mixing mortar that will fill these capillaries, but they should be left open until the chemical action of the cement has taken place, thoroughly set and hardened, also dried out and seasoned for several months. The surface is then ready to paint. Walls should be painted and dampproofed with 2 coats of Cementkote applied according to directions.

CEMENTKOTE—A preservative and decorative paint for exterior dampproofing of cement, brick or stone walls above ground. Cementkote dries with a flat finish.

Covering capacity 150 to 200 sq. ft. to gal., 2 coats.

FLOORKOTE—A durable, wear resisting coating for cement floors. Dries with a full gloss.

Cement floors should be painted with Floorkote, which not only fills and finishes the surface in a beautiful glossy tilelike effect but also prevents staining, grinding and dusting that is sure to follow the use of unpainted concrete floors.

Covering capacity 200 to 250 sq. ft. to gal., 2 coats.

Floorkote is superior to ordinary floor paint for wood floors as well.

Tropical Waterproofing Paint.

All concrete, cement, brick and porous stone foundation walls should be thoroughly waterproofed on the exterior side before filling in the earth between the foundation and the unexcavated ground. Tropical Waterproofing Paint has proved itself to be a foundation proofing of the highest order. It is a tenacious black which is easily and readily applied, covering about 65 sq. ft. to the gal., 2 coats.

Tropical Waterproofing Paint produces a continuous film which has sufficient elasticity to remain intact regardless of the expansion and contraction of the surface to which it is applied.

Tropical Waterproofing Paint prevents water seeping through the walls of concrete cisterns, swimming pools, elevators, elevator pits, water troughs, etc.

Tropical Waterproofing Paint prevents metal lath from rusting, and should be used on all artificial stone and concrete work, marble, etc., to prevent mortar stains.

Tropolite.

In this product this company has developed the greatest heat resisting paint known. It dries with a black, glossy enamel finish and is unaffected by heat that will break down the best graphites, boiler and front end paints on the market. Tropolite will stand from 700° to 800°, which is 200° higher than any other known paint coating will stand. Two coats are recommended.

Tropical Rubber Paint.

A black roof and metal paint that is tough and elastic. For general use. Dries with a brilliant black gloss finish. Two coats are recommended.

Tocoseal.

An asbestos cement plastic roofing. This product is manufactured from genuine asbestos fiber, combined with mineral gum. It comes in the form of a soft, pliable paste and is applied to new or old roofs with an ordinary oblong shaped smoothing trowel. It sets up in 2 or 3

days and gradually hardens into a rough rubbery coating, that is waterproof, fire resistant and extremely durable. Tocoseal puts a new roof on a building, without removing the old one, at a moderate cost, and will last longer than several coats of the most expensive paint. Consult the company on any roofing problem and be helped.

Tropical Finest Outside Gloss White.

Made originally for private use only. This product is the last word in exterior white paint. It is of unusual whiteness, magnificent body, and will outwear and outlast any other white paint made. Two coats are recommended.

Toco Mill White.

A high grade, durable, solid body white paint for factories, textile mills, warerooms, where lighting and cleanliness are essential features. Made in both gloss and dull finish. Toco Mill White is durable and washable; will not scale or check off, and holds its color to a remarkable degree.

Tocotone.

A durable, non-absorbent, washable interior flat paint. Tocotone can be used upon all plaster surfaces—rough, smooth, sand finished or pebbled; also upon composition wall board, metal ceilings, wood trim, and upon burlap and other cloth wall coverings, and, in fact, it is suitable for any interior wall surfaces. Two coats are recommended.

B. and P. Enamel.

For plaster, cement, wood or metal. This special line of interior enamels has been produced to fit the peculiar and exacting requirements of breweries, packing houses and bakeries, where the interior finish of these buildings must withstand condensation of steam, fumes and odors, or for condensers, ammonia pipes, hop jackets, boiling or storage tanks and where the interiors must be kept scrupulously clean for washing.

This enamel does not absorb moisture, because when applied it produces a porcelainlike, hard and durable film. Sulphate or carbonate of lead is not used in this product. Many government laws and regulations restrict the use of lead in paints used where food products are manufactured or handled.

B. and P. Special Enamel is sanitary, decorative, and free from detrimental volatile odors. It is damp-proof, therefore, no mildew, mold, dry rot, decay or dampness can exist, preventing the breeding or growth of fungi or germs.

Recommended for the protection and decoration of walls and ceilings in killing rooms, butter and sausage rooms, refrigerators, coolers, engine rooms, the outside of aging tanks, offices and showrooms.

Covering capacity on concrete or plaster 200 to 250 sq. ft. per gal., 2 coats.

Tropical Boiler Seal.

A plastic insulating cement for boiler settings. It eliminates the suction of cold air through the cracks, crevices and pores of the brick, thus preventing cooling of the boiler shell and furnace gases. An accurate, unprejudiced test shows an increase of CO₂ from 9% to 11½% by its use.

Architectural Varnishes.

In addition, this company manufactures a line of highest grade architectural varnishes to meet every possible requirement.

THE TRUSCON LABORATORIES

Waterproofings, Dampproofings, Technical Paints and Concrete Hardeners
DETROIT, MICH.

BRANCH OFFICES

PITTSBURGH, PA., 702 House Building
PHILADELPHIA, PA., 1611 Sansom Street
NEW YORK, N. Y., 110 West 40th Street
SYRACUSE, N. Y., 416 Gurney Building
ATLANTA, GA., 604 Forsyth Building
CHICAGO, ILL., 22 West Monroe Street
EL PASO, TEX., 1701 Olive Street
INDIANAPOLIS, IND., 604 City Trust Building
MINNEAPOLIS, MINN., 2362 University Avenue
BOSTON, MASS., 146 Summer Street

OMAHA, NEBR., 307 Baird Building
BALTIMORE, MD., 1124 Munsey Building
COLUMBUS, OHIO, 261 Taylor Avenue
NORFOLK, VA., 416 Dickson Building
WASHINGTON, D. C., 314 Woodward Building
SPOKANE, WASH., 1416 Old National Bank Building
PORTLAND, ORE., 194 North 13th Street
SAN FRANCISCO, CAL., 517 Second Street
BUFFALO, N. Y., 644 Prudential Building
SEATTLE, WASH., 601 Central Building

Products.

TRUSCON PRODUCTS, which include DAMPPROOFINGS, WATERPROOFINGS, FLOOR HARDENERS, TECHNICAL PAINTS and COMPOUNDS, WOOD PRESERVATIVES.

Truscon Waterproofing Paste, Concentrated.

Integral waterproofing compound, in paste form for concrete and cement mortar, mixes perfectly with water and diffuses readily through the mix, giving uniformly dependable results.

For foundations, dams, tunnels, reservoirs, tanks, and floors where absolute waterproofness is essential.

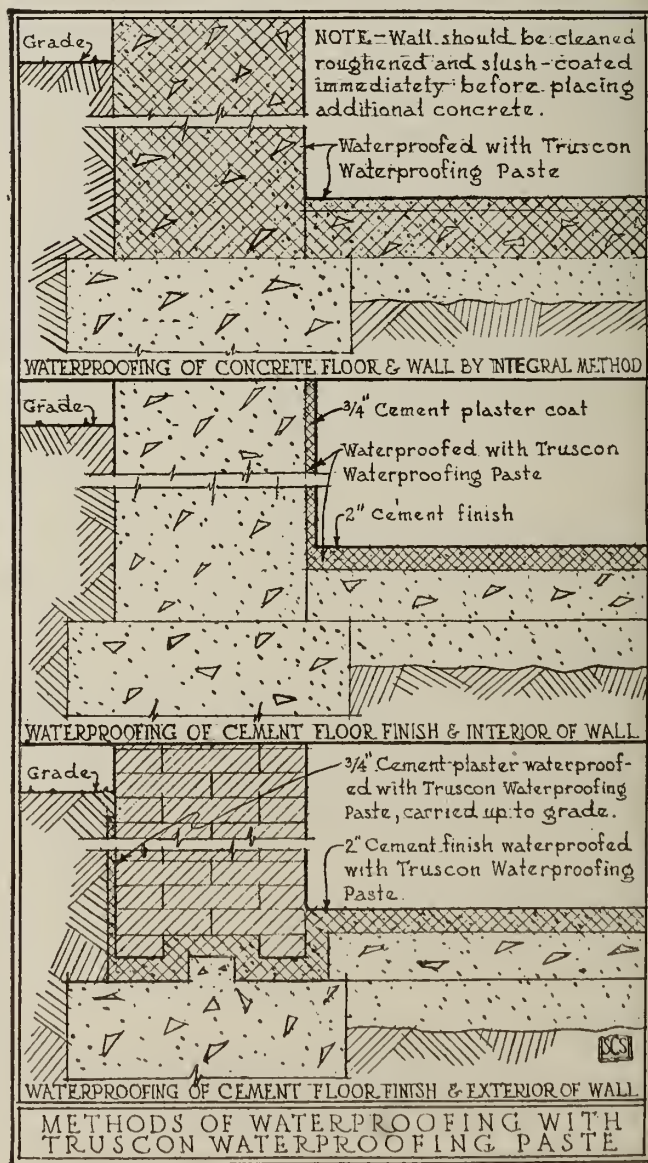
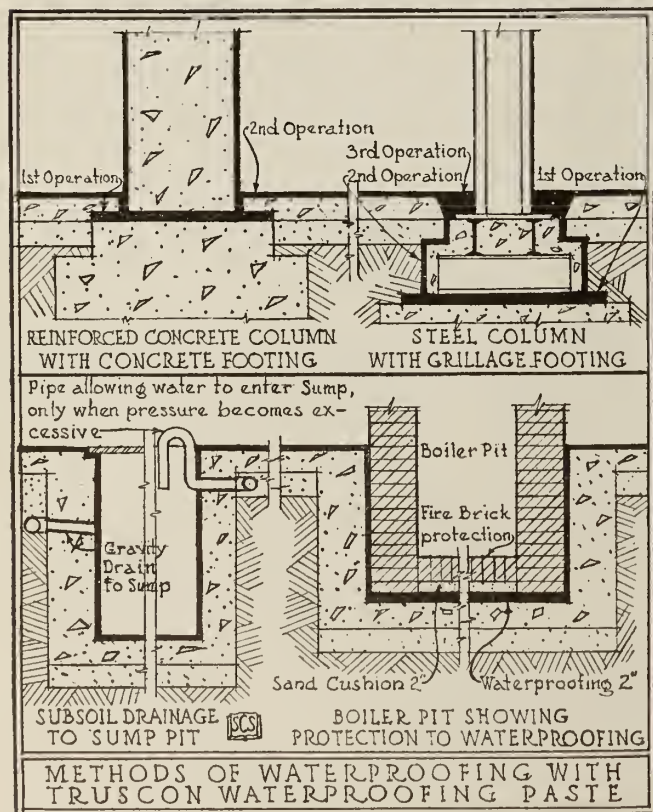
SPECIFICATIONS—Mass Concrete—The dry mix of cement, sand and stone (1:2:4) to be tempered with water containing Truscon Waterproofing Paste in the proportion of one part of Truscon Waterproofing Paste, Concentrated, to every 36 parts of water as per manufacturer's directions. All concrete to be placed in one continuous operation, each pouring to be thoroughly spaded to insure uniform density.

Waterproof Plaster Coat Applied to Concrete or General



Masonry—The dry mixture of cement and sand in the proportions of one to two (1:2) by volume to be tempered to required consistency with a mixture of one part of Truscon Waterproofing Paste, Concentrated, and eighteen parts of water as per manufacturer's complete directions. Before applying waterproofing plaster coat, chip to thoroughly roughen up masonry and clean thoroughly to obtain a satisfactory bond.

Further treatment of such surfaces as directed by manufacturer.



Truscon Stonetex.

A specialized liquid cement coating for damp-proofing, protecting and beautifying exposed stucco, concrete and masonry surfaces of all kinds. Applied with a brush like any paint. Seals pores and hair checks, prevents absorption and penetration of moisture, and gives a handsome stonelike appearance to the coated surface. Especially formulated to meet the exact physical and chemical requirements of exposed walls.

SPECIFICATIONS—The surface to be coated must be absolutely dry. Surface must be freed from dirt and loose particles that would interfere with a perfect bond. Apply Truscon Stonetex in two (2) coats; the second coat to be applied seventy-two (72) hours after the first.

For full information and color card, see Truscon Stonetex Booklet, furnished free on request.

Truscon Plaster Bond.

A special bituminous coating for dampproofing all exposed walls. Its use provides a continuous damp-proofing element in all such walls, and perfectly insulates the interior from any evidence of dampness. On application to the surface, it is partially absorbed into the pores, thoroughly sealing them and establishing a most inseparable bond. Also furnishes a bond for plaster, and eliminates the necessity for furring or lathing.

SPECIFICATIONS—Truscon Plaster Bond shall be applied with a brush to a clean dry surface. Very porous places should be retouched the following day to insure an even, uniform coating. Special care should be taken to make the coating of Truscon Plaster Bond perfectly continuous over entire surface. Should be used only on vertical surfaces. Plaster shall not be applied until twenty-four (24) hours after surface has been coated.

Free booklet on request.

Truscon Industrial Enamel.

An economical, durable, sanitary enamel manufactured especially for coating interiors of factories and industrial plants. Possesses many of the qualities of enamels selling at much higher prices. It gives a high enamel finish resembling porcelain, utilizing and diffusing all available light and bringing the brightness of daylight within the four walls. It insures the utilization of all light in the interior by reflecting it directly upon the machinery and parts of the plant where it is most needed.

SPECIFICATIONS—Undercoatings—(a) The wall shall first be coated with one (1) coat of Truscon Industrial Flat, which shall be well rubbed into the pores to insure proper penetration and bond and lightly smoothed off to a uniform even coat.

(b) After the first coat of Truscon Industrial Flat has been given at least forty-eight (48) hours to dry and harden, a second coat shall be carefully applied to provide an even, uniform foundation for the application of the enamel coating.

Enamel Coatings—After the second coat of Truscon Industrial Flat has become thoroughly hard and dry, the surface shall be finished with a uniform coating of Truscon Industrial Enamel.

Truscon Floor Enamel.

This product produces a tough, hard, elastic and reasonably durable finish on cement floors. Affords a perfect and attractive enamel finish that prevents dusting and granulation of floor surfaces. Protects floor from stain due to absorption of oils, greases and other foreign matter. It is applied with a brush, and should only be used on floors subjected to light traffic, such as office buildings, garages, hospitals, engine rooms, etc.

SPECIFICATIONS—Surface shall be absolutely dry and thoroughly cleaned. Truscon Floor Enamel shall be applied in two (2) coats; forty-eight (48) hours should be allowed between application of the first and second coats. The finishing coat shall be allowed to dry forty-eight (48) hours before being subjected to any use.

For floors laid directly upon the ground a coat of Truscon Floor Primer is required before the coating of Floor Enamel.

For full details and color card, see Truscon Floor Enamel Booklet, furnished free on request.

Truscon Bar-Ox "Inhibitive" Coating.

A protective coating for structural steel bridges and all exposed iron and steel surfaces. Formulated in strict accordance with the electrolytic theory of corrosion. This product forms an absolutely impenetrable film that completely excludes the moisture necessary for the beginning of corrosion.

SPECIFICATIONS—All steel shall receive a thorough coat of Truscon Bar-Ox "Inhibitive" Red, well brushed on.

All surfaces to be riveted in the shop shall receive two (2) thorough coats of Bar-Ox "Inhibitive" Red before assembling.

All surfaces to be riveted on the field shall receive two (2) thorough coats of Bar-Ox "Inhibitive" Green, in addition to the priming coat, before leaving the shop.

After erection, all abrasions shall be touched up with Bar-Ox "Inhibitive" Red.

The entire structure shall then receive a second coat of Truscon Bar-Ox "Inhibitive" Black or Green.

No painting shall be done in wet weather, and no paint applied to a wet or damp surface.

Free booklet sent on request.

Truscon Agatex.

Chemically transforms a soft, dusting cement floor to a hard, dense, impenetrable surface without changing its color or appearance. Actually enters into chemical reaction with the constituents of the cement and forms entirely new compounds, that are hard, enduring and resistive to wear. Affords three indispensable factory requirements—dustproof, wearproof and sanitary floors.

SPECIFICATIONS—All cement floors shall be given three (3) liberal treatments of Truscon Agatex as manufactured and recommended by THE TRUSCON LABORATORIES, Detroit, Mich.

Condition of the Surface—The floor shall be free from all dust, dirt, and oil, or other foreign matter that would retard the penetration and absorption of the Agatex into the pores of the surface.

Application—The product as supplied shall be diluted with water in the following proportions, and applied in liberal saturating coats with a long handled brush.

For the first application—Use one (1) part Truscon Agatex and two (2) parts water.

For the second application—Use one (1) part of Truscon Agatex and one (1) part of water.

For the third application—Use two (2) parts Truscon Agatex and one (1) part of water.

An interval of twenty-four (24) hours shall be allowed between coats.

One (1) gal. of Truscon Agatex will cover approximately 100 sq. ft. for three (3) applications, depending on the porosity of the surface.

Truscon Wood Floor Preservative.

Formulated to meet the heavy demand for a product capable of protecting wood floors, both from the wear of traffic and from rotting and decaying. It is a translucent liquid of a rather yellowish tinge. Applied with a wide brush, it dries overnight without materially changing the physical appearance of the treated surface. A floor treated with this product sheds water and can be easily kept clean and sanitary. Slivering and splintering are effectively and permanently prevented.

Covering capacity 400 sq. ft. per gal. 1 coat on close grained wood and 300 sq. ft. on open grained wood.

Truscon Fibrotex.

A plastic compound made of gums and asbestos. Has about the consistency of putty, but is much stronger because of the asbestos. Has valuable application for the repairing, mending and patching of tin, shingle and slate roofs, and is also excellent for re-covering composition roofs. Is also valuable for sealing cracks, pointing up around chimneys, packing about pipes, and mending skylights.

UNIVERSAL COLD WATER PAINT CO.

TELEPHONE:
WEST 1933

30 North La Salle Street
CHICAGO, ILL.

FACTORY, 2011-13 West Lake Street, CHICAGO, ILL.

Products and Services.

UNIVERSAL COLD WATER PAINT for industrial interiors.

Contracts for application of paint taken within 500 miles of Chicago.

Universal Cold Water Paint.

A mill white (i.e. a dull white paint) that is sprayed, or can be brushed on. The most economical paint on the market for application to interiors of mills, factories, etc. Reflecting and diffusing the light perfectly—unlike whitewash or ordinary glossy paint, it presents absolutely no glare.

It will not blister, crack, peel or drop off; due to the *secret formula* and superior facilities for proper mixing, will hold fast longer than any other cold water paint. Equally applicable to wood, cement or brick. Other colors may be had by mixing. And it costs only 12¢ per 100 sq. ft.

CLEANLINESS—Clean, healthful, "Universalized" buildings help keep the air germ-free. Recently a large candy manufacturer saved his shops from being closed by the state factory inspector by hurriedly "Universalizing" them.

SAFETY AND EFFICIENCY—Too strong lights in shops where there are dangerous machines or spots cause many accidents. *Fifteen states* already have factory lighting codes which have brought about greatly improved and increased production, a reduction in the number of accidents, greater efficiency in workers and their outputs and better working conditions.

FIRE RETARDANT—Regularly listed by the Underwriters Laboratories, Inc., as a fire retardant.

ECONOMY—Pleasant and soft to the eyes, increasing efficiency among employees. Saves three-fourths of the light bill. Reflects sunlight so well that in many cases, except on very dark days artificial light may be completely displaced. Before one large manufacturer



TRADE-MARK

applied Universal Cold Water Paint he was obliged to use electricity from 4:30 P.M. to 5:30 P.M.; now, except on unusually dark days he uses Universal reflected daylight only.

GUARANTEE—The UNIVERSAL COLD WATER PAINT Co. absolutely guarantees that when used in normal shop conditions,

properly mixed and sprayed according to printed instructions, it will *never blister nor crack*. The only reason it will ever have to be renewed is because in from two to four years, depending on the amount of smoke, dust and soot, it will, like anything else, get dirty.

Cost.

Cheaper to buy, cheaper to apply and covers more space than any other cold water paint.

COST OF MATERIAL—One 375-lb. barrel of dry powder, when mixed, will cover about 12,500 sq. ft. In 3-barrel lots and over, the price is 4¢ per lb. Due to added overhead in furnishing spray outfit in 2-barrel lots, the cost is 5¢ per lb.; and 1 single barrel costs 6¢ per lb.

COST OF APPLICATION—Sprayed on; no brushes required. Spraying outfit is furnished free of charge. One barrel of the powdered paint makes 2 barrels of liquid. Inexperienced help can apply it, and 2 men in 1 day can cover 20,000 sq. ft. with 2 coats, which would require 20 men with brushes. The spray does better, more even work, leaves no streaks and gets into the corners and cracks that the brush can not possibly reach.

How Shipped.

In dry powder form in barrels of about 375 lbs., ready to mix. Spraying outfit will be shipped, packed complete, ready for use with full directions enclosed. Return in its original case. Outfit may be retained for \$25.00. Write for particulars.



BEFORE SPRAYING WITH UNIVERSAL COLD WATER PAINT



AFTER SPRAYING WITH UNIVERSAL COLD WATER PAINT

WADSWORTH, HOWLAND & CO., INC.

Manufacturers of Coating for Steel, Brick and Cement

SALES OFFICE AND WAREHOUSE

139-141 Federal Street

BOSTON, MASS.

FACTORIES: MALDEN, MASS.

BRANCH STORES AND OFFICES

BOSTON, MASS., 84 Washington Street and

222 Clarendon Street

BROOKLINE, MASS., 297 Harvard Street

SPRINGFIELD, MASS., 30 Harrison Avenue

WORCESTER, MASS., 555 Main Street

HARTFORD, CONN., 153 Asylum Street

NEW HAVEN, CONN., 382 State Street

BRIDGEPORT, CONN., 1001 Broad Street

NEW YORK, N. Y., 101 Park Avenue

Distributing Agents in all large cities in the United States and Canada

Products.

"BAY STATE" STEEL PROTECTIVE COATING, a Metal Protective Paint; "BAY STATE" BRICK and CEMENT COATING, a Dampproofing Paint for brick, cement and plaster surfaces above grade; WAHCOLITE and DIXIELITE, Factory Whites.

"Bay State" Steel Protective Coating.

This metal preservative is the result of years of research and of many practical and laboratory tests. Made from the purest pigments, it has proved, under actual severe exposure, a most effective rust inhibitive. It is adhesive, moisture-proof and a resistant of acid fumes, such as are encountered in the atmosphere of railroad and manufacturing districts.

TESTS—All pigments used in this product have been thoroughly tested out on the Atlantic City and Washington Test Fences, where they were exposed for several years, and withstood the severest conditions.

APPLICATION—"Bay State" Steel Protective Coating is recommended for use on structural metal in buildings, bridges, subways, elevated railway structures, smokestacks, tanks, etc.

Its use should be preceded by a thorough cleaning of the surfaces to be protected, sand blasting being the most desirable method; in lieu of which method wire brushes and scrapers should be used. All scale, grease and rust spots should be thoroughly removed.

COVERING CAPACITY—About 400 sq. ft. per gal., 1 coat.

COLORS—"Bay State" Steel Protective Coating is prepared in 4 standard colors: rich brick red, dark green, dove gray and coal black.

Note—For permanence where acid fumes are encountered the coal black and dove gray are to be preferred.

PACKAGES AND PRICES—Packed in the following quantities: 5-gal. can, 1/2 barrel and barrel. Quotations on application.

SAMPLES, ETC.—Further details regarding "Bay State" Steel Protective Coating, together with samples for experimental purposes or inspection, sent promptly on request.

Please send for Color Card No. 20.

"Bay State" Brick and Cement Coating.

An effective dampproofing coating for above grade. It waterproofs the surface and, being manufactured in



THE BAY STATE
TRADE-MARK
(Reg. U. S. Pat. Off.)

various colors, beautifies the structure without destroying the distinctive feature of the cement, as it dries dead flat and has the same appearance as cement. For interior decoration it dries with that soft, velvety finish similar to that obtained in water colors, but will resist the action of gases, alkalis or water.

This coating is composed of carefully selected pigments, carried in volatile liquids, which evaporate upon application, and when applied to concrete cement, brick or plaster, incorporates itself as a part of the material.

Contains no lead, glue, casein or water.

Made in white and colors.

APPLICATION AND COVERING CAPACITY—"Bay State" Brick and Cement Coating should be applied with a wide, stiff, bristle brush, keeping the brush full and flowing it out. In extreme cases where absorption is very great and 2 coats are necessary, the first coat may be thinned with pure spirit turpentine, not over 1 pt. to 1 gal. of "Bay State" Cement Coating Special Thinner. Under no circumstances use benzine or oil in thinning. Allow 24 hours between coats. If tinting is desired, use only oil colors thinned with turpentine.

On brick or concrete, hard finish, use 1 gal. to cover not over 18 sq. yds.; on brick, concrete or stucco, tough, or porous, use 1 gal. to cover not over 15 sq. yds.

COMPARATIVE COST—"Bay State" Brick and Cement Coating costs less per gallon than lead and oil paint. While it covers slightly less surface in area, 1 coat covers better than 2, and frequently better than 3, coats of lead and oil or other paints, showing a reduction in cost of material, with a great saving of labor and time.

PACKAGES—Packed in the following quantities: 1-gal. can, 5-gal. can, 1/2 barrel and barrel.

SAMPLES, ETC.—Samples of "Bay State" Brick and Cement Coating sent on request.

Please write for Color Card and Booklet 21.

Wahcolite and Dixielite.

Wahcolite and Dixielite are factory whites especially designed for the walls and ceilings of factories, mills and warehouses.

These whites are used by the largest mills in this country, with a remarkable saving in lighting bills and a great increase in labor efficiency.

Made in flat, semi-flat and gloss finish. These enamels, made on an oil and varnish base, are easily washed and kept clean.

Samples on application.

WAILES DOVE—HERMISTON CORPORATION

FORMERLY AMERICAN BITUMASTIC ENAMELS COMPANY

Manufacturers of Protective Paints and Coatings

17 Battery Place
NEW YORK, N. Y.

BRANCH OFFICES

PHILADELPHIA, PA., 322 South Delaware Avenue

CLEVELAND, OHIO, Rockefeller Building

WORKS, GARWOOD, N. J.

Products.

BITUMASTIC and HERMASTIC SOLUTIONS and ENAMELS—Protective Coatings for iron, steel and concrete exposed to atmospheric moisture, electrolysis, acids, acid fumes, sewage, brine, gases, alkalis, etc., buried in the ground or submerged in fresh, salt, or mine water.

Description of Bitumastic and Hermastic Compositions.

These compositions are of a bituminous base, so treated in manufacture as to eliminate all useless and harmful substances. Being free from those ingredients which limit the life and usefulness of ordinary coal-tar and asphaltum compounds, they possess exceptional physical properties—i. e., toughness, tenacity and pliability. These properties they retain throughout a far broader range of temperature and under more severe mechanical distortion and abrasion than have generally been considered to be within the scope of a bituminous composition.

BITUMASTIC SOLUTION—A heavy, black, bituminous paint of superior preservative properties and mechanical strength. It dries quickly, forming a tough, elastic coating. Under conditions of moderate severity where ordinary paints last but a short time, the solution gives exceptional protection for long periods.

It is used against acid fumes, sewage, brine, water, gases, alkalis, moisture, electrolysis, etc. In industrial plants it is used to paint structural steel, boiler fronts, smokestacks, coal bunkers, brine systems, tanks, pipe lines, sheet iron and steel, and for other similar purposes. In the engineering and construction field its applications will suggest themselves to the engineer.

Method of Application—The surfaces to be coated must be thoroughly clean and free from rust, scale, paint, oil and moisture. Bitumastic and Hermastic Coatings should not be applied to wet, frosty or greasy surfaces.

On metal, two coats are customary, the second following the first after an interval of 12 to 24 hours. On wood, three coats are recommended.

Covering Capacity—Properly applied, is as follows: On steel, 1 coat, 1 gal. to 200 to 250 sq. ft.; 2 coats, 150 sq. ft. On cast iron, covering capacity is a trifle less; on concrete surfaces, approximately 100 sq. ft. to the gal.

Put up in 1-gal., 2-gal., and 5-gal. cans and in 50-gal. barrels, and is suitable for use on any surface to which paint may be applied.

HERMASTIC ENAMEL—A durable, protective coating to be used under the most severe corrosive conditions where lasting protection and ultimate economy are of the first importance. It is applied hot over a coat of priming solution, to such thickness as may be desired (usually $\frac{1}{16}$ in.), and forms a black coating which hardens immediately, ready for service.

This coating is exceptionally ductile, strongly adhesive and impervious to moisture, chemical fumes, sulphurous gases, salt water, salt atmosphere, most acids and other corrosive agents. As its insulating capacity is

high it is an effective protection against electrolysis. The resistance of this coating to mechanical injury from distortion and abrasion under service conditions is exceptional and marks a distinct and noteworthy advance in the art.

Adaptability and Method of Application—Hermastic Enamel is particularly recommended for the following: internal and external surfaces of steel pipe lines, and other parts of drainage systems; tanks of every description, coal bunkers, ventilating fans and blowers which must handle moist air and acid fumes; conveyors, penstocks, trash racks and other steel items of hydraulic plant; cooling towers, bridges and other steel structures exposed to salt air and spray or other especially corrosive conditions; sheet steel buildings, chemical installations, sheet steel piling, and many other uses too numerous to be listed here but familiar to every engineer, architect and industrial executive. The coating is sanitary, tasteless and odorless and may safely be used as a lining for tanks to contain drinking water.

Hermastic Enamel may be applied in the field or at the point of fabrication, as may be preferable and consistent with best results, either by dipping, brushing or pouring, as may be required by the specific exigencies of the work in hand. When the dipping process is used the priming coat may be dispensed with, provided the surfaces to be coated can be heated before dipping to a temperature of 350° to 400° Fahr. This is the prevailing practice when steel pipe lines are coated at a shop where a dipping tank and a heating furnace are available.

The enamel is shipped in solid form in drums, barrels or blocks. It is heated to between 350° and 400° Fahr. and applied while in a molten state, after the primer has dried to a tacky consistency. It sets immediately, and when applied about $\frac{1}{16}$ in. thick covers approximately 2 sq. ft. per pound. Full instructions for application will be supplied upon request. Whenever necessary, the manufacturers are prepared to supply expert instruction and supervision over the application of these coatings, or, under special conditions where the best interest of the purchaser will be served thereby, to do the work on a contract basis with their own workmen.

SPECIFICATIONS—The form of specification for Bitumastic and Hermastic products is dependent upon the nature of the work and the exposure to which surfaces are subjected. A thoroughly protective specification to meet any given condition will be furnished on application.

Ultimate Economy of Hermastic Coating.

The chief item in the maintenance cost of steel structures is the cleaning and preparation of the surfaces for repainting. After the application of Hermastic Enamel this expense is saved, for this coating will outlast many coats of the ordinary protective paints.

It is this saving of the cost of continual repainting that makes Hermastic Enamel the protective coating of ultimate economy.

THE WATERPROOFING COMPANY

Engineers and Contractors for Waterproofing

345 East 33rd Street
NEW YORK, N. Y.

BRANCH OFFICES

BOSTON, MASS., 65 Albany Street

PITTSBURGH, PA.

Product and Services.

Manufacturers of "Cow Bay" WATER-PROOF CEMENT.

Engineers and Contractors for WATER-PROOFING, making a specialty of CEMENT WATER-PROOFING. This company contracts for the waterproofing of basements, subways, reservoirs, vaults, tunnels, swimming pools, etc., guaranteeing a positive and permanent waterproofing for all kinds of masonry construction.

Also Designers of and Contractors for REINFORCED CONCRETE CONSTRUCTION, which includes OIL STORAGE TANKS.

Specialists in OILPROOFING CONCRETE TANKS for the storage of fuel oil.

"Cow Bay" Waterproof Cement.

ADVANTAGES—Ease and economy with which repairs may be made.

No extra supporting walls are required; they are left with a neat finish; no furring and plastering necessary. No additional floor finish is necessary.

"Cow Bay" waterproof cement, when set, is as hard as the best portland cement mortar, and may be placed beneath grillages and column bases without danger of settlement—eliminating the metal pans used with tar and felt waterproofing.

EXPERIENCE—"Cow Bay" waterproof cement is beyond the experimental stage, having been employed since 1900. During the past 15 years this company has waterproofed a majority of the important buildings in New York, Boston and Pittsburgh.

SPECIFICATIONS—Material—All interior surfaces of all exterior walls, and upper surface of concrete floor slab throughout basement (or subbasement), elevator pits, machinery foundations, trenches, etc., as shown on plans, shall be waterproofed with "Cow Bay" Waterproof Cement.

Workmanship—All surfaces, before application of waterproof coating, shall be thoroughly chipped or cleaned, and coating applied not later than 24 hours after surface has been prepared. A perfect bond must at all points be secured with underlying masonry.

Wall coating shall be 5/8-in. thickness, applied in 2 coats, thoroughly floated and troweled to a smooth and even finish, free from imperfections. Floor work shall be 1-in. thickness, and to serve the double purpose of a waterproofing agent



TRADE-MARK
Reg. U. S.
Patent Office

and wearing surface. Floor coating shall be floated and finished as described for wall coating.

Guarantee—Waterproofing contractor shall furnish written guarantee that his work will be waterproof; that during a period of 5 years after completion of the waterproofing, he will promptly repair any leaks appearing through same which are not due to causes beyond his control.

A FEW IMPORTANT WATERPROOFING CONTRACTS—Building, location, and name of architect:

Singer Building, New York, N. Y., Ernest Flagg
Morgan & Co., New York, N. Y., Trowbridge & Livingston
Hudson Terminal Buildings, New York, N. Y., Clinton & Russell
United States Express Co., New York, N. Y., Clinton & Russell
City Investing Building, New York, N. Y., Francis H. Kimball
Adams Express Co., New York, N. Y., Francis H. Kimball
Western Union Telegraph Co., New York, N. Y., Wm. Welles Bosworth
Municipal Building of New York, N. Y., McKim, Mead & White
Guaranty Trust Building, New York, N. Y., Yorke & Sawyer
Woolworth Building, New York, N. Y., Cass Gilbert
New York State Education Building, Albany, N. Y., Palmer & Hornbostel
Union Bank Building, Pittsburgh, Pa., MacClure & Spahr
Jones & Laughlin, Pittsburgh, Pa., MacClure & Spahr
Fort Pitt Hotel, Pittsburgh, Pa., Janssen & Abbott
Oliver Office Building, Pittsburgh, Pa., D. H. Burnham & Co.
Copley Plaza Hotel, Boston, Mass., Henry J. Hardenbergh
John Hancock Building, Boston, Mass., Shepley, Rutan & Coolidge
Wentworth Institute, Boston, Mass., Peabody & Stearns
R. H. Stearns Building, Boston, Mass., Parker, Thomas & Rice
New Opera House, Boston, Mass., Wheelwright, Haven & Rice
Over 25 Telephone Buildings in various cities, McKenzie, Voorhees & Gmelin

Concrete Oil Storage Tanks.

During the past few years, hundreds of concrete tanks for the storage of fuel oil have been constructed and oilproofed by this company.



Before being Waterproofed
SAME POINT IN PENNSYLVANIA TUNNELS BEFORE AND AFTER BEING WATERPROOFED WITH
"COW BAY" WATERPROOF CEMENT

THE WATERPROOFING CO. OF AMERICA

Manufacturers, Engineers, Contractors

TELEPHONE:
HARRISON 2113

Railway Exchange Building
CHICAGO, ILL.

AGENCIES

NEW YORK, N. Y., 24 Stone Street
MILWAUKEE, WIS., 307 East Water Street
LOS ANGELES, CAL., 202 San Fernando Building

DULUTH, MINN., 611 Torrey Building
PHILADELPHIA, PA., 625 Lafayette Building

Products and Services.

HYDRITE LIQUID WATERPROOFING.
HYDRITE LIQUID CONCRETE FLOOR

HARDENER.

HYDRITE METALLIC CONCRETE FLOOR HARDENER.
HYDRITE ANTI-FREEZING COMPOUND.
Hydrite Liquid Dampproofing.
Hydrite Liquid Oilproofing.

A Service and Contracting Department is maintained, composed of practical engineers in all waterproofing problems. Contracts are executed in all parts of the United States.

Hydrite Liquid Waterproofing for Concrete.

An opaque, neutral liquid, forming a chemical combination, filling all voids. Does not affect the strength or change the color of concrete.

SPECIFICATIONS FOR INTEGRAL WATERPROOFING OF CONCRETE—Hydrite Waterproofing Compound shall be used according to manufacturer's directions.

Use 1 part best quality portland cement, 2 parts clean sharp sand and 4 parts uniformly graded stone from $\frac{1}{2}$ to $1\frac{1}{2}$ in. To each cubic yard of dry mixed materials add 1 gal. of Hydrite Waterproofing placed in gauging water. Where excessive water pressure is encountered, add $\frac{1}{2}$ gal. Hydrite per cu. yd. to each additional 10 lbs. of hydrostatic pressure.

SPECIFICATIONS FOR WATERPROOF CEMENT COATING—Use 1 part best quality portland cement and 2 parts clean, sharp sand, dry mixed. Add 1 gal. of Hydrite mixed with the gauging water to each 10 cu. ft. of cement plaster. All surfaces where cement is to be applied shall be thoroughly cleaned, roughened and moistened. When this has been done, apply two $\frac{1}{4}$ -in. coats of the waterproof cement plaster, first coat to be left rough.

Waterproof Grouting Under Pressure.

For basements, tunnels, pits, emplacements, etc., where excessive water pressure is encountered in present structures.

We have specialized in this class of work for the past 10 years. This process is employed exclusively by us and from an engineering standpoint is the only permanent one. The surfaces are made lastingly watertight and moistureproof through the forcing of waterproof cement grout by means of bleeders to the exterior or pressure side of the walls, using suitable machinery to accomplish this result. Data is solicited on the most difficult problems.

Hydrite Liquid Concrete Floor Hardener.

SPECIFICATIONS FOR FINISHED CONCRETE FLOORS—Hydrite Liquid Floor Hardener, as manufactured by THE WATERPROOFING CO. OF AMERICA, shall be used in the following manner: Thoroughly clean floor of all dust, dirt and oil. Float on evenly Hydrite Hardener with long handled brush, allowing surface to absorb all the material it will take. When first application has thoroughly dried, a second application to be applied in similar manner, allowing from 4 to 6 hours for drying after each application.

"Hydrite"

TRADE-MARK

1 gal. Hydrite Hardener will cover approximately 100 sq. ft. in two coats.

SPECIFICATIONS FOR USE INTEGRALLY IN TOP FINISH—For 1-in. topping on fill, use 1 part portland cement, 2 parts clean, sharp sand and 1 gal.

Hydrite Liquid Hardener for each 100 sq. ft. of surface. Add Hydrite to gauging water. Use same proportion for less thicknesses of topping.

Hydrite Metallic Concrete Floor Hardener.

Consists of evenly ground mineral substance which, when incorporated in the concrete, will prevent dusting and disintegration. Furthermore, will seal the pores and prevent discoloration, making the surface very dense and wearproof.

SPECIFICATION FOR APPLICATION, RED OR GRAY—After floating of topping and before troweling, add dry mixture of 1 part Hydrite Metallic Hardener by weight carefully mixed to a uniform color, and to be not less than 20 lbs. of Hydrite Hardener and 20 lbs. of portland cement for each 100 sq. ft. of surface. This mixture to be sprinkled evenly over surfaces.

The dry mixture of cement and Hydrite Floor Hardener shall be well floated to form a perfect combination and troweled. The surface shall receive a second troweling when it has set sufficiently to finish smoothly.

Hydrite Anti-Freezing Compound.

A liquid which is added to the gauging water at the rate of 1 gal. to each cu. yd. of concrete. This material is guaranteed not to reduce the strength of the concrete.

Co-operative Service.

Circulars descriptive of the products above mentioned with details of their application furnished upon request

References.

Contracts have been successfully executed for the following companies, for the most of whom a number of commissions have been performed:

Marshall Field & Co., Chicago, Ill.
Buildings of the McCormick Estate, Chicago, Ill.
Mandel Brothers, Chicago, Ill.
Boston Store, Chicago, Ill.
Rothschild & Company, Chicago, Ill.
Corn Products Refining Company, Argo, Ill.
Illinois Central Railroad Co.
New York Central Railroad Co.
Atchison, Topeka & Santa Fe Railroad Co.
Salt Lake & Los Angeles Railroad Co.
Southern Pacific Railroad Co.
Standard Oil Company
Commonwealth Power Co.

The following are a few of the well-known architects and consulting engineers who have specified Hydrite products:

Marshall & Fox
Holabird & Roche
Graham, Anderson, Probst & White
Ritter & Mott, Consulting Engineers

THE BARRETT COMPANY

Wood Preservative

NEW YORK	CHICAGO	PHILADELPHIA	BOSTON	ST. LOUIS	CLEVELAND	CINCINNATI
PITTSBURGH	DETROIT	NEW ORLEANS	BIRMINGHAM	KANSAS CITY	MINNEAPOLIS	NASHVILLE
SALT LAKE CITY	SEATTLE	PEORIA	ATLANTA	DULUTH	MILWAUKEE	BANGOR
COLUMBUS	RICHMOND	WASHINGTON	LATROBE	BETHLEHEM	JOHNSTOWN	ELIZABETH
LEBANON	BUFFALO	YOUNGSTOWN	BALTIMORE	TOLEDO	DALLAS	

THE BARRETT COMPANY, LIMITED

MONTREAL, QUE.	TORONTO, ONT.	WINNIPEG, MAN.	VANCOUVER, B. C.	ST. JOHN, N. B.
	HALIFAX, N. S.		SYDNEY, N. S.	

Product.

BARRETT CARBOSOTA — *Grade-One Liquid Creosote Oil* for Preserving Wood.

Description.

A standardized, pure coal-tar distillate, from which all objectionable properties of crude creosote oil have been completely eliminated.

Coal-tar creosote has been the universally recognized standard wood preservative for over fifty years. There is no authentic record of the failure of creosote, properly applied, to protect wood from decay. First used in Europe, the recognition of its value in America is indicated by a normal consumption of 100,000,000 gals. per annum.

Advantages and Superiority.

Carbosota is superior to commercial coal-tar creosote for non-pressure treatments, because:

It is liquid; free from water; practically non-volatile; does not evaporate or leach from the wood; has high specific gravity. It has low viscosity, and being liquid, penetrates readily and deeply into the wood.

It has increased antiseptic and decay-preventing qualities, and imparts a pleasing, dark brown color to the wood. It is a clean, uniform, standardized oil.

Carbosota conforms strictly to the *established standard* for non-pressure treatments as represented by specifications issued by the U. S. Shipping Board Emergency Fleet Corporation and the U. S. Railroad Administration.

Methods of Application.

Timbers, whether used in buildings or exterior structures, which will be exposed to conditions favorable to the development of decay, should be protected by preservative treatment. Specifications should include detailed requirements as to method of treatment and grade of creosote oil; specific instructions as to procedure and equipment, and provision for inspection.

Carbosota can be readily injected into many species of seasoned wood by the open tank process or applied by surface treatments. Green lumber or timber can not be effectively creosoted by non-pressure processes. It should be air-dry.



TRADE-MARK

OPEN TANK PROCESS—Consists of the impregnation of structural wood with refined coal-tar creosote oil (Carbosota Creosote Oil) by immersion in two baths—first in a hot bath, the oil being at 150° to 200° Fahr., and following this by a cold bath with the oil at atmospheric temperature. Where but one tank is available; the hot oil is allowed to cool and the wood is kept submerged. However,

time is saved by using two tanks, one kept hot and the other cold. Advantage is taken of the vacuum formed within the wood, due to the differences in temperature, and a good penetration is thus obtained. The duration of the two baths will depend upon the dimensions of the timbers, and the maximum advantage is derived when the time is sufficient to bring the temperature of the wood to that of the bath.

Special detail data relative to quantity of Carbosota required for various species and treatment obtainable by addressing nearest office.

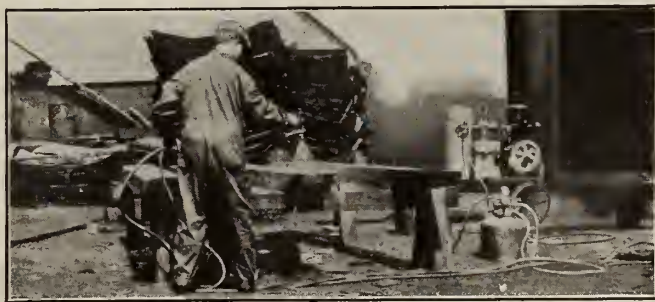
SURFACE TREATMENTS—Surface applications of preservative at all points of contact of timbers, such as mortises, tenons and bearings, or where it is the dual purpose of retarding decay as well as decorative painting, may be applied (a) by brush treatment, that is, application of two or more coats of Carbosota with a broad wire-bound brush; (b) by spraying, which is often preferable because of rapidity with which large areas may be covered; (c) by dipping, that is, complete immersion for short periods of entire stick in heated Carbosota.

Sufficient intervals of time should elapse between treatments to permit of thorough drying of previous application. It is advisable in surface treatments that Carbosota Creosote Oil should be maintained at a temperature of about 150° Fahr. Cold oil may be used during favorable weather, but to obtain best results the oil should be heated. One gallon of Carbosota will cover approximately 150 to 200 sq. ft. of surface.



OPEN TANK PROCESS

Two wooden tanks lined with galvanized sheet iron, soldered at joints, one for "hot treatment," the other for "cold treatment"



SURFACE TREATMENT

Spraying sills and floor joists with Carbosota

SAMUEL CABOT, INC.

Manufacturing Chemists

141 Milk Street
BOSTON, MASS.

NEW YORK, N. Y., 1133 Broadway

BRANCHES

CHICAGO, ILL., 24 West Kinzie Street

Products.

CONSERVO WOOD PRESERVATIVE for preserving ties, timbers, pilings, planks, bridges, boats, posts, poles, sills, sleepers, etc., from wet and dry rot, insects and worms.

Also, Dampproofing; Insulating and Deadenening Quilt; Creosote Shingle Stains; Waterproof Brick and Cement Stains.

Description of Conservo Wood Preservative.

Conservo is a carbolineum compound of high-boiling coal tar distillate, non-volatile, insoluble, non-viscous, and antiseptic. Its tone on wood is rich butternut brown.

Advantages.

Conservo is a scientific product made to cover the three cardinal principles of wood preservation, i. e.:

- (1) Penetrating power—to get into the wood.
- (2) Permanence—to stay in the wood.
- (3) Sterilizing power—to destroy the bacteria that cause decay.

Penetration.

No preservative can preserve the wood unless it penetrates; and Conservo is so limpid that its penetrating power is unique. The heavier carbolineums are from twice to five times as viscous (viscosity is that "cold molasses" quality that prevents most wood preservatives from penetrating) as Conservo.

Permanence.

It not only goes more quickly and deeply into the wood than more viscous products but, when it gets in, it stays in, because it is insoluble and non-volatile. It will not dissolve out nor evaporate out. Heavy preservatives can not penetrate and are washed off the surface by the first rains.

Sterilizing.

Decay is caused by bacteria in the wood.

Conservo has always carried the proper percentage—7% to 10%—of phenols or tar acids to sterilize the wood and poison this bacteria. The phenols also combine with the lignin of the wood and increase the penetrating power. This is of special value for unseasoned wood. These phenols in Conservo form permanent asphaltic bases in the wood, that make the preservative results lasting.

Non-inflammable.

Conservo is non-inflammable and, as it gives off a cooling vapor under flame, it actually makes the wood less inflammable after drying than untreated wood.

Application.

Conservo is so limpid, and has such great penetrating power, that it can be effectively applied without heating. At normal temperatures this quality is of great importance where heating arrangements are not feasible, but heat should always be used, if possible, because it increases the limpidity, and helps to expel moisture from the wood.

Conservo can be applied by any method preferred. The most common methods are:

Brush coating, like paint, with a wide flat brush or a mop brush for speed, or with a spraying machine.

Dipping, using tanks of appropriate size for the lumber to be dipped.

Soaking, using tank equipment for either cold or alternate hot and cold soaking, as in the open tank vacuum method.

Temperature for hot treatment, from about 170° Fahr. for seasoned timber, to about 225° Fahr. for unseasoned timber.

The length of treatment depends upon the condition and character of the timber; seasoned and porous woods requiring a shorter treatment than unseasoned or dense woods.

Cost.

The cost of treating depends upon the method selected, the character and condition of the wood, and the economy of handling, which includes wages, waste, etc.

Prices and estimates furnished on request.

Covering Capacity.

BRUSH COATING—1 gal. covers about 100 sq. ft. of rough sawed lumber, 2 coats; 1 gal. covers about 200 sq. ft. of rough hewn lumber, 2 coats; 1 gal. covers about 250 sq. ft. of dressed lumber, 2 coats.

The amount varies somewhat, according to the character and condition of the wood; but these are safe and conservative figures.

DIPPING—About the same as brush coating, if the Conservo is drained back into the dipping tank to prevent waste.

SOAKING—The covering capacity varies so greatly for both methods of soaking, owing to differences in wood, heating, length of immersion, etc., that it is impossible to give exact figures; but simple soaking for a short time will take about twice as much as dipping; the vacuum process, from 4 to 12 cu. ft. per gal.; and, by the expensive impregnation pressure process, the wood can be made to take up 2 or 3 gals. per cu. ft.



OLD CHAIN BRIDGE,
NEWBURYPORT-AMESBURY, MASS.
The oldest suspension bridge in America, restored
in 1910, and woodwork preserved
with Conservo.

CARBOLINEUM WOOD PRESERVING CO.

36 Barclay Street
(Only Address)
NEW YORK, N. Y.

Products and Services.

PROTEXOL WOOD PRESERVATIVE.

TORON WOOD PRESERVER.

NEOSOTE PRESERVATIVE.

TECHNICAL WOOD PRESERVATIVES.

Shingle Oils and Stains, Black Preservative Varnishes for wood and iron, Detergent and Soluble Disinfectants, Weed Killers, Crude Carbolic Acids, Waterproofing Pitches, etc.

Also a complete line of American and English Creosote and Anthracene Oils according to chemical specifications.

Complete Treating Equipment for brush, spray or open tank creosote treatments of timber.

Services include Chemical Analyses, Researches, Experimental Work, Design and Layout, Estimates for Covering Capacity on submitted timber schedules and all matter pertaining to Consulting Practice on the subject of Timber Preservation.

Wood Preservatives—Technical Description.

PROTEXOL—A non-volatile, heavy oil, derived from the highest boiling distillate of coal tar. Its constituents belong to the anthracene group, the permanent anti-septic properties of which are generally acknowledged. After filtration and refining, the oil is chemically treated to improve its character and to increase its efficiency. It readily penetrates wood, imparting a durable nut brown color, and is highly toxic.

TORON—A straight run anthracene oil distillate to meet the chemical standard for what is known as the carbolineum type of oil.

NEOSOTE—A mixture of the lighter anthracene oils obtained in redistilling to produce Protexol wood preservative and heavy creosote oils. A pure coal tar product run to a uniform standard. Liquid at all temperatures.

Trade-names.

The adoption of the American trade-mark Protexol for the highest grade wood preservative is a recognition by this company of changed conditions resulting from the war.

The discontinuance of *selling* Avenarius Carbolineum accentuates the belief that an American product can be *manufactured* to the old established standard of excellence more economically in America.

The erection of works at Kenilworth, N. J., to produce as primary products a complete line of wood pre-



TRADE-MARK

servatives aimed at economical production and distribution. This has enabled the maintenance of the old standard of quality for Protexol without practically any advance in price.

Quality is the 40-year old standard.

Other Products.

In addition to the wood preservatives the Protexol Products include disinfectants, both soluble and detergent for all purposes. Black preservative varnishes for wood and iron, weed killers, crude carbolic acids, etc.

Specifications.

See former editions of SWEET'S CATALOGUES.

These are designed especially to meet the requirements of each case and include a consideration of the conditions to be met and the kind and quality of timber to be used.

Cost estimates will be prepared when schedule of timber is submitted.

Literature.

A list or all available bulletins and circulars will be sent on request. Each is written to answer definite questions.

Inspection Invited.

The only test on the value of a wood preservative is time. References are available in town or country, factory or residence, where a personal inspection will demonstrate the wood preserving value of Protexol—the standard wood preservative for surface treatments.



THE PENNSYLVANIA HOTEL

McKIM, MEAD & WHITE, Architects, specified the use of Protexol Wood Preservative for all nailing pieces and carpet strips

THE NORTHEASTERN COMPANY

Wood Preservatives

74 Wall Street
NEW YORK, N. Y.

80 Beverly Street
BOSTON, MASS.

Products.

LETTENY WOOD PRESERVATIVE (Carbolineum).

Anthracene Oil and Dead Oil of Coal Tar (to specifications).



TRADE-MARK

Record.

Letteny has an unequalled record of more than 50 years of efficient treatment of timber.

Description of Letteny.

Letteny is a liquid compound manufactured from by-products of wholly bituminous coal tar. Guaranteed to contain at least 99.5% pure coal tar oil. Distills only at high temperatures and contains no light volatile matter.

Guaranteed to be well within standard specifications for carbolineum and similar wood preserving oils.

Letteny penetrates the wood and remains there permanently. It is not soluble in water and will not wash out.

Permanent color is dark red brown.

Specifications.

Have the wood, before treating, as well seasoned as possible. Posts, poles, ties, piles, etc., should have all bark removed before being treated.

If there is any accumulation of dirt or other foreign matter on the timber, it shall be scraped off with a wire brush before the preservative is applied.

BRUSH TREATMENT—When the wood is dry, thoroughly apply Letteny Wood Preservative with a broad, flat, stiff bristle brush, by two applications; the second after the first has been absorbed. Apply the preservative at a temperature of from 175° to 210° Fahr.

OPEN TANK TREATMENT—After cutting and fitting, all lumber shall be completely immersed for 20 minutes in a tank containing Letteny Wood Preservative, which must be maintained at a temperature of from 175° to 210° Fahr.

SPRAYING TREATMENT—This treatment shall consist of one heavy spraying with Letteny Wood Preservative, heated to a temperature of approximately 175° Fahr. Surfaces must be thoroughly covered, and treatment given to the refusal point whenever spraying seasoning checks, joints and contact surfaces.

Covering Capacity for Good Practice.

ON ROUGH LUMBER—

2 brush coats	} 100 sq. ft. per gal.
20 minute dip	
Sprayed	
1 brush coat	150 sq. ft. per gal.

ON DRESSED LUMBER—

2 brush coats	} 150 sq. ft. per gal.
20 minute dip	
Sprayed	
1 brush coat	300 sq. ft. per gal.

NOTE—Correspondence is solicited for details of treatment and handling of lumber in open tank.

Packages.

Letteny Wood Preservative is put up *ready for use* in the following size packages: 50-gal. barrels, drums, ½ barrels, and in 5-gal. and 10-gal. cans.

Prices.

Delivered prices to all freight stations furnished promptly on application.



TANK USED FOR TREATING 300,000 FT. TIMBER WITH LETTENY



APPLYING LETTENY WITH SPRAYING MACHINE TO UNDER-PLANKING OF NEW YORK CITY PIER

AMERICAN CREOSOTING COMPANY, INC.

COLONIAL CREOSOTING COMPANY, INC.
 GEORGIA CREOSOTING COMPANY, INC.
 INDIANA CREOSOTING COMPANY, INC.

LONDON OFFICE
 4 Lloyd's Avenue, E.C.

GENERAL OFFICES
 401 West Main Street
 LOUISVILLE, KY.

SOUTHERN SALES OFFICE
 BOGALUSA, LA.

MANVILLE, N. J.
 BLOOMINGTON, IND.
 KANSAS CITY, MO.
 BOGALUSA, LA.

PATERSON, N. J.
 TOLEDO, OHIO
 MARION, ILL.
 DERIDDER, LA.

PLANTS

ROME, N. Y.
 RUSSELL, KY.
 BRUNSWICK, GA.
 HUGO, OKLA.

INDIANAPOLIS, IND.
 SPRINGFIELD, MO.
 SHREVEPORT, LA.
 TRENTON, ONT.

CHALMETTE, LA.

OIL STORAGE STATIONS
 BAYONNE, N. J.

ANTWERP, BELGIUM



ONE OF THE PLANTS OF THE AMERICAN CREOSOTING COMPANY, INC.

Products.

The world's largest producers of CREOSOTED MATERIALS, including Creosoted Cross Ties, Structural Timbers, Paving Blocks, Piling, Poles, Cross Arms, Fence Posts, Water Tanks, Silos, Lumber, etc.

Facilities.

A responsible organization with an established reputation, now supplying the treated tie requirements of over 30,000 miles of railroad; furnishing creosoted materials to the United States Government, states, counties and municipalities, and giving special service to the demands of construction engineers, traction lines, telegraph and telephone companies, factories, farmers and builders generally. A record of 3,500,000,000 bd. ft. forest products treated since 1904; annual capacity now 350,000,000 bd. ft.; ample storage capacity for season-

ing under approved scientific methods; fullest opportunity for plant inspection.

Lowry Process.

A pressure and vacuum process for the efficient and economical treatment of wood, patented in the United States and Canada, insuring maximum penetration and distribution through structural cells with final retention (according to specifications) of minimum quantity of creosote oil consistent with proper preservative effect; a system affording accurate gauging and recording of results.

Creosote Oil.

Oil used is best obtainable grade of pure coal tar creosote oil, conforming to specifications of American Railway Engineering Association and American Wood Preservers' Association. Analyses furnished.

BROWN COMPANY

FOUNDED 1852

FORMERLY BERLIN MILLS CO., AND BURGESS SULPHITE FIBRE CO.

Manufacturers of Kyanized Lumber, Pulp, Paper and Chemicals
PORTLAND, ME.

NEW YORK OFFICE, Woolworth Building

CHICAGO OFFICE, 110 South Dearborn Street

WORKS AT BERLIN MILLS, N. H.

Products.

KYANIZED LUMBER, PULP, PAPER and CHEMICALS:

Timber; Cedar Shingles; Manufactured Lumber, Doors, Window Frames, Mouldings, Posts, Columns; Sheathing and Novelty Siding, Clapboards, Laths and Gutters; Flooring of all kinds; Spruce, Pine and Fir Lumber.

Kyanized Lumber, preserved by treatment in the company's own Kyanizing plant; Sheathing and Roofing Papers, Wrapping Papers; Fibre Tubes; Bleached and Unbleached Sulphite; The "Nibroc" Line, including Kraft and Bond Papers.

Waxo.

The BROWN COMPANY'S "Nibroc" Kraft is now furnished, when desired, with a special waterproofing treatment and is branded "Waxo." In this form it is both tough and highly resistant to moisture, forming an excellent protecting cover for shipments of high grade mechanical and engineering products and for all goods which need extra protection from the elements.

Kyanizing.

Decay follows the growth of fungi in structural timbers exposed to moisture. Kyanizing preserves the wood by preventing the development of fungi. The strength of the wood is not affected, nor its color changed. Kyanized timber is less combustible than natural timber, shows a clean surface and will take paint. By careful kyanizing, salts are formed within the wood which are insoluble and so remain as a permanent protection. Every stick of timber which the

BROWN COMPANY kyanizes is branded with the company's name and date of treatment. A generation of success with kyanizing gives further weight to the company's guarantee.

"Bermico" Brand, Sheathing Paper.

In connection with its extensive timber and pulp interests, the company is in a position to apply to each of its paper specialties the materials best suited to that particular service.

BERMICO
TRADE-MARK

"Bermico" sheathing paper is a case in point. It is made from fibre—pure, clean, long, rosin sized fibre, and has absolutely no filler.

It is therefore a permanent and dependable building material; tough and resistant to wear and tear. Being correctly made, from the right materials, it can be depended upon to give the longest service.

Range of Products.

The company's output includes a wide range of manufactures which can not be adequately presented here; but in general these comprise the products and by-products resulting from forestry operations. The forest products are applied in a manner to conserve the natural values, merchantable timber being used as such, and pulpwood utilized in both the sulphite and sulphate processes to obtain the best possible types of pulp and paper. White pine, too rare now for reckless use, is made up into window frames; small wood is used in box shooks. Certain fibres of exceptional strength are reserved for use in a new line of fibre pipes and conduits; and important industrial chemicals are derived from the mill waste.

Catalogue.

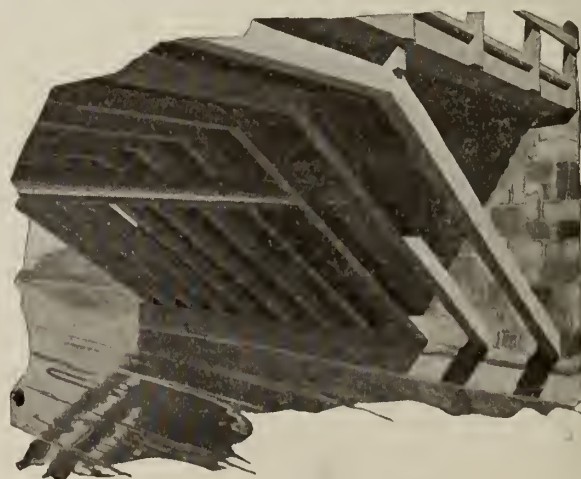
The company's principal products are covered by special catalogues or sample books, which are gladly mailed on request.



KYANIZED SPRUCE TRESTLE



KYANIZED GREENHOUSE



KYANIZED BRIDGE WORK

E. N. BIEGLER MFG. CO.

SUCCESSORS TO MAS-OLEUM FLOOR MFG. CO.

Manufacturers of Mas-Oleum Mastic and Almada Cork Composition Floors

TELEPHONE:
HUMBOLDT 135

2734 North Rockwell Street
CHICAGO, ILL.

Products and Services.

MAS-OLEUM (Mastic Linoleum) SANITARY FLOORING and COVE BASE: Fiber Mastic Floor Covering, Composition Flooring, Rubber Flooring and Asphalt Mastic Flooring.

ALMADA CORK COMPOSITION FLOORING.

Contracts for Installation executed anywhere in the United States.

For Roofing, Waterproofing and Paint, see page 276.

Mas-Oleum Flooring.

DESCRIPTION—Mas-Oleum (mastic linoleum) is an asphalt mastic linoleum, a combination of hydrocarbons with mineral caoutchouc and asbestos fiber, to which has been added color pigments, and then sufficiently fluxed with mineral oil, permitting its use on weak and unsupported floors, where a heavy material would be prohibited.

Mas-Oleum can be nailed, sawed or drilled like wood. It contains no sand, slag cement or sawdust and is fireproof, waterproof and dustless.

ADVANTAGES—Mas-Oleum mastic is easily applied by trowel over a smooth surface and furnishes a sanitary, resilient, dust resisting and waterproof topping.

It is non-slippery and not affected by ordinary acids.

It bonds readily to the subfloor and becomes a permanent part of the building, thus differing from unsanitary and more expensive floor coverings.

It is laid without seams and joints, and a cove base can be extended up on the wall to any height desired, forming a hermetically sealed and perfectly sanitary floor.

Mas-Oleum mastic floors can be easily cleaned, being absolutely waterproof.

APPLICATION—Mas-Oleum is laid directly on any floor surface—wood, concrete, steel, tile, brick, asphalt or fabric surfaces.

It is laid in 5 or more thin coats trowelled or rolled and the 5 coats when completed should be $\frac{1}{8}$ in. in thickness. The first or primer coat is followed by 3 or more filler or body coats, with a finishing coat trowelled hard, which may be waxed, if desired.

Any ordinary workman, by following printed instructions furnished, can lay Mas-Oleum.

SCOPE OF USE—For hospitals, churches, theaters, schools, warehouses, factories, dairies, hotels, comfort stations, jails, club houses, sanitariums, railroad stations, silos, bridges, tunnels, subways, track elevations, etc., on either floors, walls or ceilings, interior or exterior.

Also corridors and hallways, stair treads, landings, manual training rooms, gymnasiums, playrooms, toilets, locker rooms, damp basement floors, laundries, side-walks, porches, etc.

ECONOMY—Mas-Oleum is the cheapest permanent floor covering offered today; costs less than battleship linoleum, composition, and, in many cases, less than wood flooring.

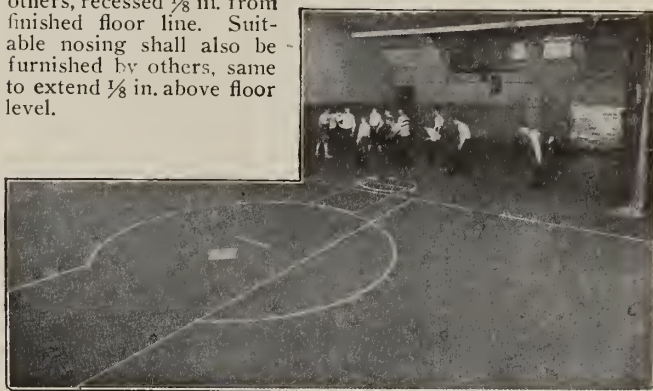
GUARANTEE—This company guarantees every Mas-Oleum floor laid by them for a period of 2 years and

will repair, without charge, any and all defects due to defective material or imperfect workmanship. Surety bond furnished when desired.

SPECIFICATIONS—*Over Cement or Metal Surfaces*—A cement subfloor or metal surface shall be provided by others. The cement surface shall be equal in construction to what is generally termed a sidewalk finish laid perfectly true and level. Either shall be recessed $\frac{1}{8}$ in. from finished floor level and be thoroughly dry before the mastic material is applied.

Over Wood Surfaces—Mas-Oleum Composition Scratch Coat should be used. First apply metal lath or wire mesh securely over the wood boards, then install Mas-Oleum Composition Scratch Coat at least $\frac{3}{8}$ in. in thickness and allow this to set hard. Mas-Oleum mastic should then be applied. The total thickness of Mas-Oleum mastic floors with composition foundation over wood shall be $\frac{1}{2}$ in.

Over Stair Treads—A smooth surface shall be provided by others, recessed $\frac{1}{8}$ in. from finished floor line. Suitable nosing shall also be furnished by others, same to extend $\frac{1}{8}$ in. above floor level.



MAS-OLEUM FLOOR, Y. M. C. A. NORTH SIDE BOYS' CLUB, CHICAGO

Almada Cork Composition Flooring.

DESCRIPTION—Almada cork composition flooring is a sanitary, seamless, fireproof, lightweight composition for floors, base, stair treads, etc.

All ingredients are scientifically compounded so as to insure a fireproof, non-slippery, non-dusting and sanitary floor suitable for the varied types of floor service.

COLOR—Generally red is used, owing to its permanency, although black, green, yellow, and natural can be had. Where color effect is desired a varied number of color schemes can be installed, such as borders in a different color than the field.

INSTALLATION—The E. N. BIEGLER MFG. CO. contracts to execute work anywhere in the United States and is also in position to furnish Almada composition with complete instructions for the mixing and installation of the same, so that it can be laid by local plasterers or cement finishers if desired. This is a special advantage for small areas.

Co-operative Service and References.

Mas-Oleum and Almada floors have been used in hundreds of buildings successfully. Names of engineers, architects and contractors, also list of buildings in which Mas-Oleum floors and Almada cork composition floors have been used will be furnished on request. Also circulars describing the features of the two different floors will be furnished on request, including specifications and samples.

CARTER BLOXONEND FLOORING CO.

SALES OFFICES

KANSAS CITY, MO., 1303 R. A. Long Building—Telephone, Main 1177
 CHICAGO, ILL., 332 South Michigan Avenue—Telephone, Harrison 6491
 CLEVELAND, OHIO, 406 Electric Building—Telephone, Main 961
 NEW YORK, N. Y., 501 Fifth Avenue—Telephone, Murray Hill 558

MILL: KENSETT, ARK.

Product.

BLOXONEND FLOORING, a Wood Block Flooring.

Uses.

A high grade, heavy service floor for factories, warehouses, shipping rooms, loading platforms, shops, freight houses, baggage, mail and express rooms, railroad stations, baggage, mail and express cars, assembly rooms, industrial schools, elevator and scale platforms, and all surfaces subjected to trucking (hand or power), or concentrated footwear.

Advantages.

Durability. Resilience. Smoothness. Adds to volume and efficiency of production. Absorbs vibration. Insulates. Warm. Quiet. Comfortable. Smooth but not slippery. Firm, safe foothold. A soft bed for tools or materials dropped. Advantages of good block pavement, with greater smoothness and adaptability of best matched flooring to building work, whether steel, concrete or wood structure, new or old.

Construction.

Built up in flooring sections (Fig. 1). (Should not be confused with loose paving blocks.) Blocks of selected Southern pine, on end, are dovetailed to horizontal baseboards, presenting end of grain to wear, forming flooring sections which are finished to uniform height and grooved in the sides for heavy splines (slip tongues). Splines are used to break joints, giving support to end joints and keeping flooring sections in alignment.

Size.

After exhaustive experiments and practical use, Bloxonend is made in one standard size, 2-in. blocks on base made from 1 in., making sections finish $2\frac{9}{16}$ in. thick by $3\frac{1}{2}$ -in. face, in lengths up to 8 ft. Not made in specified lengths.

Application.

(1) OVER CONCRETE, STANDARD (FIG. 2)—Laid at right angles on and nailed to beveled sleepers bedded in slab or laid over slab and filled flush. 2- by 4-in. sleepers at $15\frac{3}{4}$ -in. centers are standard. Size of sleepers can be increased and centers reduced for extra heavy or exposed service or other special conditions. Advice for such special conditions furnished on receipt of details.

(2) OVER CONCRETE, ALTERNATE (FIG. 3)—Over neat concrete slab or old concrete floors grouted smooth, Bloxonend may be laid at right angles on flat strips not bedded. Strips should practically cover slab except for slight air space between. 1- by 6-in. strips (SIS) are standard for this type. Nail through strips with nail of size and length to snub on concrete and clinch under strips, forming whole into a floating floor or mat. This type is desirable only for strictly dry locations and occupations, and particularly where height or weight of sleepers and fill are objectionable.

(3) OVER WOOD STRUCTURE—Over joists or open sleepers Bloxonend should be laid on

substantial subfloor of proper thickness to furnish firm level support, according to spans and loads contemplated, allowing for Bloxonend itself tensile strength of a good inch floor. Where structural conditions admit and service requires, subfloor laid diagonally at not less than 45° to supports (or better 60° or 75°) and Bloxonend at right angles to supports will preserve maximum strength and stiffness of both.

(4) NAILING—Bloxonend may be toe-nailed through base before inserting splines, blind nailed in groove or nailed through splines after same are inserted, according to location and use of floor. Nails will vary in gauge and length with location and method of nailing. More detailed instructions for laying specific jobs will be furnished on application.

Treatment.

Bloxonend can be treated before shipment where specified. Treatment is essential for exposed use and desirable in other places where the nature of occupation does not make it objectionable and maximum life is essential.

Information.

List of installations of interest and details desired furnished on request. In writing for prices and other information, advise areas to be covered, use of floors and nature of construction.



FIG. 1. SHORT SECTION OF BLOXONEND



FIG. 2. BLOXONEND ON BEVELED SLEEPERS IN CONCRETE



FIG. 3. BLOXONEND ON FLAT STRIPS OVER NEAT CONCRETE

CHENEY & COMPANY, INC.

Sole Owners and Manufacturers of Troegerlith Composition Flooring

TELEPHONE:
CHELSEA 4253

134 West 18th Street
NEW YORK, N. Y.

Products.

TROEGERLITH COMPOSITION, a Plastic Tile for Flooring, Base, Stair Treads, Risers.
Pollo Oil for care of Troegerlith.

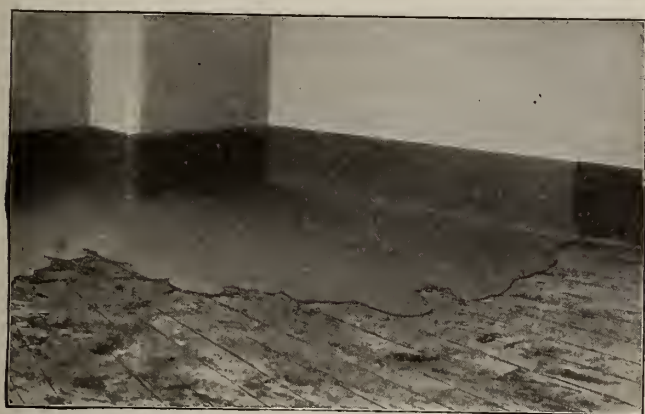
Troegerlith Flooring.

Troegerlith Composition is a magnesium-oxy-chloride cement, consisting mainly of commercial magnesite, long fiber asbestos, mineral colors, and magnesium chloride.

All materials are standard, thoroughly tested and mixed with the utmost care and precision.

The finished floor is warm, resilient, fireproof and sanitary, of strength and durability.

Troegerlith absolutely will not dust; it does not contain either portland cement, sand or lime products.



AN ACTUAL PHOTOGRAPH OF AN OLD WOODEN FLOOR, UPON WHICH TROEGERLITH COMPOSITION IS BEING LAID

It depicts all of the unsanitary features of the wooden floor, and also how easily all are eradicated. The Troegerlith floor is most attractive in appearance, and absolutely sanitary. Note the special treatment of base and corners. Fireproof, germproof, waterproof. The new floor is as resilient and easy of tread as the old, and far more serviceable.

Installation.

Troegerlith is laid in plastic form and finished by troweling to a perfectly smooth, close grained, even surface without seams, cracks or joints, in one, two or more layers (minimum thickness $\frac{1}{2}$ in.) depending upon the type and condition of foundation and the service to which the floor will be subjected.

This material bonds firmly to new or old wood, cement or steel foundation. It is quickly and easily installed and the floor may be used in 24 hours after completion.

Metal reinforcement, if required for any special condition or purpose, may be used with perfect result.



HEAVY DUTY TROEGERLITH COMPOSITION FLOORING INSTALLED IN WAREHOUSE OVER ROUGH CONCRETE UNDERFLOORS

Adaptability.

Troegerlith floors are giving eminently satisfactory service through entire buildings; are appropriate for all classes of buildings and are especially suitable where a clean, dustless and warm flooring of pleasing appearance is desired, such as in banks, offices, hotels, schools, dormitories, hospitals, apartment houses, and industrial buildings.

This material is an important factor, and is extensively used in factory construction, being especially and scientifically built to give the maximum service to fill all requirements of the heavy duty prevailing in this type of construction.

Guarantee.

CHENEY & COMPANY, INC., squarely and fully guarantee its products against defects of material and workmanship.

References.

Performance has proved the superior quality and durability of Troegerlith floors.

List of installations will be furnished on request. Write for Catalogue S-6.

Service.

CHENEY & COMPANY, INC., have offices and warehouses in many of the larger cities, where complete organizations are ready to render prompt and efficient service to engineer, builder and owner.

All installations of Troegerlith are made under the direct supervision of the local office. This service insures perfect work at a minimum cost.

GENERAL KOMPOLITE CO.

Composition Floors and Wainscots, Mastic Floors, Plastic Floor Compounds
Calciners and Grinders of Magnesite

TELEPHONE:

HUNTERS POINT 5361, 5362

325-327 Borden Avenue

LONG ISLAND CITY N. Y.

Products.

"KOMPOLITE," a Monoplastic, Sanitary, Seamless Composition Floor and Wainscot.

"MASTOLITH," a Mastic, Plastic Flooring.

"Kompolite."

"Kompolite" is a magnesium asbestos composition made in many attractive colors. It is sanitary, seamless, fireproof, sound deadening, water repelling, easy under foot, germproof and dustproof. For heavy service and hard wear. Applied in plastic form on concrete, wood or iron, in new or old buildings.

It is light in weight, so that it can be used on weak structures where heavier material can not be employed. It is in daily use in places where wood, cement, asphalt, concrete, slate, marble, etc., have not been satisfactory.

Fifteen years of successful application and millions of feet of it in daily satisfactory use attest to the value of "Kompolite."

It has proved wonderfully durable under the most severe conditions. A floor now in use nearly 12 years, over which loads of 2 to 4 tons are drawn and sharp shod horses are driven, shows hardly any sign of wear. Another floor, over which 60,000 to 80,000 people have passed each day, has been in uninterrupted use for over 8 years.

Nearly 250,000 ft. of "Kompolite" have been installed in a public institution and after almost 6 years of use not a single foot was removed, repaired or relaid because of defective or unsatisfactory material or workmanship. After 2 years of test and service and in comparison with many other composition floors, "Kompolite" was accepted by the architects of the Grand Central Terminal, New York, and is the only composition floor laid in that great railroad station.

After careful, scientific test and numerous experiments by the Bureau of Standards, Washington, "Kompolite" was installed in many of the United States Post Offices, Government Printing Offices, the Capitol of the United States and other public buildings.

"Kompolite" has been laid in fine residences, tenements, hotels, restaurants, factories, stores, railroad stations, hospitals, schools, churches, office and loft

buildings, theaters, clubs, etc. In all it has been satisfactory.

Every foot is guaranteed by a contract which has never been questioned and has always been carried out to the satisfaction of architect, contractor or owner.

"Kompolite" is specified by leading architects, indorsed by noted contractors, and approved by property owners as the solution of many floor troubles.

Being calciners and grinders of magnesite this company can guarantee the quality of the most important materials used in every composition floor installation.

"Mastolith."

"Mastolith" is a plastic, seamless surface made from mineral gum with vulcanized oil and asbestos fiber. It has the advantages of light grade battleship linoleum without any of its disadvantages.

It is furnished in a medium red, chocolate brown and dark gray, laid $\frac{1}{8}$ in. to $\frac{3}{16}$ in. thick. It sets rapidly and may be used for foot traffic within 24 hours.

"Mastolith" is waterproof and is not affected by foot usage or trucks in warehouses.

It deadens noise and is agreeable to the tread.

It is absolutely sanitary and non-absorbent.

It will not crack or loosen from the underflooring.

It can be repaired perfectly with little trouble.

It retains its elasticity and always presents an attractive appearance.

"Mastolith," used as a covering, bonds excellently to concrete or wood floors, either old or new, concrete roofs, porches, walks, stair treads, or is used to protect concrete floors from dusting or from wear.

It forms an ideal floor for schools, churches, hospitals, asylums, jails, and for theaters, restaurants and all public or private buildings.

References.

"Kompolite" and "Mastolith" have been subjected to most severe tests in practical use. References will be given to architects, engineers, or contractors to prove that "Kompolite" and "Mastolith" are the most reliable and, quality considered, the most moderate priced monoplastic floors and wainscots now made.

THE HASTINGS PAVEMENT COMPANY

TELEPHONE:
BROAD 1496

25 Broad Street
NEW YORK, N. Y.

WORKS
HASTINGS-ON-HUDSON, N. Y.

Products.

COMPRESSED ASPHALT FLOORING and PAVING BLOCKS, and TILES.

Asphalt Blocks.

A scientifically manufactured material for the wearing surface of streets and roads, and of piers, warehouses, loading platforms, factory floors, bridges, driveways, courtyards, etc.

Manufactured at a large permanent plant; shipped in block form ready to lay; and always obtainable in any quantity for extension and repairs.

COMPOSITION—A properly proportioned mixture of natural asphalt, crushed rock and limestone dust is heated to 300° Fahr., and shaped into uniform blocks under a pressure of 6000 lbs. per sq. in.

SIZE AND WEIGHT—The blocks are 5 in. wide, 12 in. long and 2 and 2½ in. deep, and weigh respectively 11 and 13½ lbs. A square foot of 2 in. block weighs 26 lbs. The "Eightfour" blocks are 8 in. long, 4 in. wide and 1¼ in. deep, and weigh 3½ lbs. A square foot of 1¼ in. "Eightfour" weighs 15½ lbs. The specific gravity of asphalt block is 2.40. Blocks of other thicknesses can be made to meet special conditions.

ADVANTAGES—Asphalt blocks are pleasing in appearance; smooth, noiseless, dustless, warm and easy under foot; sanitary, because non-absorbent; and next to granite, the most durable. They present a gritty, non-slippery, non-skiddable surface, and are easily taken up and relaid. They are non-expansive, odorless and free from exudations; and are not affected by standing loads, extremes of temperature, or by automobile oils. They are reasonable in cost, and are made to suit any climate and traffic conditions.

METHOD OF LAYING—Upon the surface of the concrete foundation there is spread a bed of portland cement mortar ½ in. thick, which is struck to a true and even surface. Upon this bed the blocks are immediately laid, with close joints and uniform top surface, the joints being broken 4 in. After being laid, the blocks are given a light coat of sharp, fine sand, well broomed into the joints. Traffic is permitted in 4 or 5 days.

"Eightfour" Blocks.

The "Eightfour" asphalt flooring block is designed especially to meet those conditions in which weight and thickness of flooring must be at a minimum consistent with durability under heavy traffic. They are laid in the same manner as the large blocks, except that the joints are grouted.

For roofs subject to traffic an "Eightfour" is manufactured 1 in. in thickness, which weighs 12½ lbs. per sq. ft.

Asphalt Tiles.

A wearing surface especially designed for cemetery and park walks, sidewalks, and other surfaces, subject to foot traffic.



COMPRESSED ASPHALT FLOORING AND PAVING BLOCKS

References.

MANUFACTURING PLANTS, ETC.—Quintard Iron Works, New York, N. Y.; Remington Arms Co., Bridgeport, Conn.; Otis Elevator Co., Harrison, N. J.; Westinghouse Electric & Mfg. Co., Essington, Pa.; U. S. Navy Yard, Brooklyn, N. Y.; Scoville Mfg. Co., Waterbury, Conn.; Waclark Wire Co., Baway, Elizabeth, N. J.; Navy Supply Base, Brooklyn, N. Y.; U. S. Navy Yards, Boston, Mass., and Washington, D. C.; U. S. Naval Operating Base, Hampton Roads, Va.; Studebaker Corp., South Bend, Ind.; Morgan Engineering Co., Alliance, Ohio; Standard Steel Works, Burnham, Pa.; Samson Tractor Co. (G. M. C.), Janesville, Wis.; Oakland Motors (G. M. C.), Pontiac, Mich.; Olds Motor Works (G. M. C.), Lansing, Mich.

PIERS—Bush Terminal Pier No. 6, Brooklyn, N. Y., largest pier in the world—30,000 sq. yds.; N. Y. Dock Co., Piers 17, 18 and 36, Brooklyn, N. Y.; Savannah Terminal Piers of Ocean Steamship Co., Savannah, Ga.—26,000 sq. yds.; Pennsylvania R. R. Pier, Greenville, N. J.—18,000 sq. yds.; Larnport and Holt Line Piers, Hoboken, N. J.—13,000 sq. yds.; U. S. Army Supply Base, Brooklyn, N. Y.—65,000 sq. yds.

LOADING PLATFORMS—Arbuckle Building, Brooklyn, N. Y.; B. R. & P. Warehouse, Rochester, N. Y.; U. S. Army Supply Base, Brooklyn, N. Y.

CEMETERIES—Greenwood Cemetery, Brooklyn, N. Y.; St. Peter's Rectory, Haverstraw, N. Y.

HOSPITALS—Roosevelt Hospital, New York, N. Y.; United Hospital, Port Chester, N. Y.

BRIDGES—New York Central R. R., New York and Westchester Co., N. Y.; Pennsylvania Railroad, Sunnyside Yards, Borough of Queens, N. Y.; Long Island R. R., Bay Ridge Improvement, Brooklyn, N. Y.

DRIVEWAYS AND COURTYARDS—St. Joseph's Seminary, Yonkers, N. Y.; Whitelaw Reid Residence, Museum of Natural History, and Aphthorp Apartments, New York, N. Y.

CAB STANDS—Biltmore Hotel and Grand Central Station, New York, N. Y.

TILE SIDEWALKS—Van Cortlandt Park, New York, N. Y.; Prospect Park, Brooklyn, N. Y., and numerous other parks around New York City.

STREETS AND ROADS—Over 4,000,000 sq. yds. laid in New York City; 10 miles on upper Broadway; 87th St., from Columbus Avenue to Central Park West, laid 1889; Bronx and Pelham Parkway, laid 1910. The Albany Post Road for several miles north of Tarrytown, N. Y., paved in 1910 and 1911 with 2-in. block on 4-in. concrete foundation. The Boston Post Road, Rye, N. Y., laid 1912.

IN FOREIGN COUNTRIES—Lima, Peru; Johannesburg, South Africa; Havana, Cuba; Manaus, Brazil; San Juan, Porto Rico; and Quebec, Canada, have streets paved with Asphalt Blocks.

GRANITE PAVING BLOCK MANUFACTURERS' ASSOCIATION OF THE U. S.

INCORPORATED
JAMES J. TOBIN, FIELD ENGINEER

31 State Street
BOSTON, MASS.

BRANCH OFFICES

NEW YORK, N. Y., 13 Park Row
NEW ORLEANS, LA., Sewer and Water Board Building
CINCINNATI, OHIO, 108 Bell Block

BALTIMORE, MD., Law Building
ATLANTA, GA., PINE MOUNTAIN GRANITE Co., Central Building
CHICAGO, ILL., 11 South La Salle Street

Products.

IMPROVED GRANITE PAVING BLOCKS and GRANITE CURBING.

Services.

Expert engineering consultation and advice furnished *gratis*, where this material is under consideration.

Specification Data.

Specification data adapted from the standard specifications of the American Society of Municipal Improvements.

NEW GRANITE PAVING BLOCKS—Paving blocks shall be of medium grained granite, showing an even distribution of constituent materials; of uniform quality, structure and texture; without seams, scales or disintegration; free from an excess of mica or feldspar, and equal in every respect to the sample in the office of the engineer.

Improved Granite Paving Blocks used with cement concrete base where extreme durability is desired, and heavy traffic encountered.

5-INCH STANDARD BLOCK—8 to 12 in. long, $3\frac{1}{2}$ to $4\frac{1}{2}$ in. wide, $4\frac{3}{4}$ to $5\frac{1}{4}$ in. deep. To be laid either with sand cushion or with mortar cushion on concrete base. The most durable pavement in existence today.

RESURFACING BLOCKS—7 to 11 in. long, $3\frac{3}{4}$ to $4\frac{1}{4}$ in. wide, $3\frac{1}{2}$ to 4 in. deep. For use generally as a replacement block in cases where wood block or brick is worn out; and to be used on original concrete base which was under the wood block or brick, saving expense of new concrete base.

4-INCH GRANITE BLOCK—7 to 11 in. long, 4 to $4\frac{1}{2}$ in. wide, 4 to $4\frac{1}{2}$ in. deep. To be used preferably with 1 to 3 or 4 dry mortar cushion, on concrete base.

6-INCH GRANITE BLOCK—8 to 12 in. long, $3\frac{1}{2}$ to $4\frac{1}{2}$ in. wide, 6 to 7 in. deep.

CUTTING AND DRESSING—Blocks shall be so dressed that face will be approximately rectangular in shape, and ends and sides sufficiently smooth to permit blocks to be laid with joints not exceeding $\frac{1}{2}$ in. in width at top, and for 1 in. downward therefrom, and not exceeding 1 in. in width at any other part of joint. Top surface of block shall be so cut that there will be no depressions measuring more than $\frac{3}{8}$ in. from a straight-edge laid in any direction on top and parallel to the general surface thereof.

NOTE—Above blocks are cut under standard schedules by agreement with the Granite Paving Block Cutters, and cost less money than special cut blocks. Used generally with cement grout or bituminous mastic joint.

Tests.

For heavy traffic, the granite shall have a toughness of not less than 9 and a "French Co-efficient of Wear" of not less than 11. For medium traffic, the granite may have a toughness of not less than 7 and a "French Co-efficient of Wear" of not less than 8 if a cement grout filler is used.

Tests shall be made by methods described in Bulletin No. 44, United States Department of Agriculture, Office of Public Roads.

The average of 3 tests shall be used for determining toughness and the average of 6 tests for determining the "French Co-efficient of Wear."

Test certificates and samples and name of quarry producing same shall be filed with the engineer.

Construction Specifications.

After properly excavating and compacting the subgrade and constructing thereon a proper concrete base conforming to the American Society of Municipal Improvements' specifications for same, upon the concrete base so constructed shall be spread:

CUSHION COURSE—A layer, averaging 1 in. in depth, of clean, coarse, dry sand, free from all gravel exceeding $\frac{1}{4}$ in. in size; or, substituting for the dry sand cushion course, 1 part of cement, 4 parts of sand, by volume, mixed dry. Care shall be taken that this mortar cushion shall not be laid too far in advance of the laying of blocks, and that it shall not become wet and set up before ramming and grouting of the paving is accomplished.

LAYING BLOCKS—Upon this sand, or sand and mortar, cushion, blocks shall be laid in courses of uniform width at right angles to line of street, and in a straight line from curb to curb, except in special cases, when they shall be laid at such an angle as may be directed by the engineer. Blocks shall be laid as closely as possible, each block touching adjoining one on sides and ends, and in courses of uniform width. Care shall be taken that blocks are laid flush and true to the finished surface of roadway. All blocks shall be broken with a lap of at least 3 in. Blocks shall not be laid more than 25 ft. in advance of the ramming.

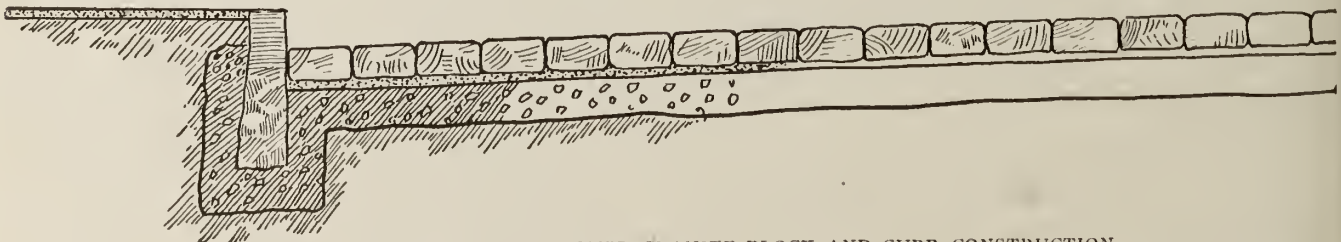
RAMMING—After blocks are laid, they shall be rammed to a solid bearing, joints shall be adjusted, and all unsatisfactory blocks shall be taken out with tongs and all low blocks shall be raised by adding to the bed. The whole pavement shall then be rammed to an even and true surface. Pinch bars shall not be used except by special permission of engineer, and no sand shall be placed in joint except when mixed with joint filler specified hereafter.

The best practice, in the matter of ramming, is to use one rammer to each two pavers, or, at the most, three pavers; and these rammersmen shall be men skilled in their craft and of proper previous experience.

JOINT FILLER—*Cement Grout Filler*—After pavement has been brought to a uniform surface, portland cement grout shall be "poured" into joints until it appears on surface. Grout shall be broomed or scraped into the joints if necessary to fill same and operation shall be repeated as grout settles and before initial set has taken place, until joints are thoroughly filled flush with surface of blocks. Immediately after this the entire pavement shall be broomed to a smooth surface. Blocks shall be wetted immediately before applying grout, except when bituminous mastic filler is used.

Cement grout shall be composed of 1 part portland cement and 1 part clean, sharp sand. Cement and sand shall be thoroughly mixed dry, and only enough clean fresh water shall be added to make a grout which will flow to bottom of joints.

Grout shall be machine mixed in a batch mixer approved



CROSS SECTION SHOWING IMPROVED GRANITE BLOCK AND CURB CONSTRUCTION

by engineer, and shall be applied to joints before ingredients have separated. Particular attention is called to the importance of ascertaining the proportional amount of water to be used with the mixture of different kinds of cement and sand to give best results; and when the most advantageous proportions have been ascertained, these shall be used.

After grouting is completed, and sufficient time for hardening has elapsed so that a coating of sand will not absorb moisture from cement mixture, $\frac{1}{2}$ in. of sand shall be spread over whole surface and shall be kept damp until street is opened for traffic.

After grouting is completed, street shall be kept closed and no carting or traffic allowed on any part of the grouted pavement until at least 7 days have elapsed.

Should the bond between blocks become broken before work is accepted, such defective work shall be relaid and again barricaded, as previously described.

If paving blocks are dirty, or have a film of oil, the grout will not obtain a proper hold on sides and difficulty will be experienced through their letting go. When grout once "lets go," no further sustaining power can be expected from it, and the only possible repair is a complete replacement with new grout in joints.

Around web and flanges of street railway tracks much better results are obtained by allowing the grout to fill in against rail, care being taken to add more grout as shrinkage in setting takes place; through this method a toothing bond being accomplished with the rail area grouting at each joint between different blocks abutting on rail.

Tar Pitch Filler—Joint filler used shall be paving pitch, hereafter described, thoroughly mixed with as much hot, dry sand, as pitch will carry, but in no case shall volume of sand exceed volume of pitch. Sand shall be fine and clean, and all of it shall pass a 20-mesh screen. It shall be heated to a temperature of not less than 300° Fahr. nor more than 400° Fahr. and shall be between these limits when mixed with paving pitch.

Paving pitch shall be heated in kettles properly equipped with an approved thermometer, which shall register temperature of pitch.

Mixture shall be flushed on surface of blocks and pushed into the joints with suitable tools, refushing or repouring if necessary, until the joints remain permanently filled flush with surface of pavement. As little as possible of the mixture shall be left on the surface.

The tar pitch shall comply with the following requirements:

(a) It shall have a specific gravity between 1.23 and 1.33 at 60° Fahr.

(b) It shall have a melting point between 115° and 135° Fahr. determined by the cube method in water.

(c) It shall contain not less than 20%, nor more than 35%, of free carbon insoluble in hot benzol or chloroform.

(d) It shall contain not more than $\frac{1}{2}\%$ of inorganic matter.

(e) It shall be free from water.

(f) It shall have a ductility of not less than 60 cm. at 77° Fahr.

The tar pitch shall be used on the work at a temperature of not less than 250° Fahr. and shall at no time be heated above 325° Fahr.

It shall be delivered where directed by the engineer in time to allow for examination and analysis.

In applying filler, care shall be taken that pavers are closely followed by filler gang, and in no case shall paving be left overnight, or when work is stopped, without filling of joints being completed. In case of rain stopping the filler gang before its work is finished, joints shall be protected by use of tarpaulins, or other means, to keep out water. Under no circumstances shall filler be poured into wet joints.

Asphalt Filler—Joint filler used shall be asphalt cement, hereafter described, thoroughly mixed with as much hot, dry sand as cement will carry, but in no case shall the volume of sand exceed volume of cement. Sand shall be fine and clean, and all of it shall pass a 20-mesh screen. It shall be heated to a temperature of not less than 300° Fahr. nor more than 400° Fahr. and shall be between these limits when mixed with cement.

The asphalt cement shall be heated in kettles properly equipped with an approved thermometer, which shall register the temperature of cement.

Mixture shall be flushed on surface of blocks and pushed into joints with suitable tools, refushing or repouring if necessary, so that joints remain permanently filled flush with surface of the pavement. As little as possible of mixture shall be left on surface.

The asphalt paving cement shall be obtained by distillation of an asphaltic petroleum at a temperature not exceeding 700° Fahr. and shall comply with following requirements:

(a) It shall be homogeneous,

(b) Melting point shall not be less than 130° Fahr. nor more than 145° Fahr.

(c) Solubility in carbon tetrachloride shall not be less than 98 $\frac{1}{2}\%$.

(d) Penetration at 77° Fahr. shall not be less than 60 nor more than 100, the penetration test being made with No. 2 needle for 5 seconds under a load of 100 g. and the penetration at 100° Fahr. shall not exceed three times its penetration at 77° Fahr., the condition of time and load being as above established. The contractor, before beginning work, shall obtain, from engineer, a statement in writing as to the penetration desired for any particular contract and a variation of not greater than 10 points either way from this penetration will be permitted.

(e) Ductility at 77° Fahr. shall not be less than 40 cm., the rate of elongation being 5 cm. per minute.

(f) It shall not lose more than 3% by volatilization when maintained at a temperature of 325° Fahr. for 5 hours, nor shall the penetration of the residue, after such heating, be less than one-half the original penetration.

Asphalt filler shall be used on work at a temperature of not less than 275° Fahr. and shall at no time be heated above 350° Fahr.

It shall be delivered where directed by the engineer in time to allow for examination and analysis.

In applying filler, care shall be taken that pavers are closely followed by filler gang, and in no case shall paving be left overnight, or when work is stopped, without the filling of joints being completed. In case rain stops filler gang before its work is finished, joints shall be protected by tarpaulins, or other means, so as to keep out water. Under no circumstances shall filler be poured into wet joints.

Expansion Joint Strips.

These are sometimes used against street curbing, extending from the top of the finished grade to the bottom of the concrete base, if one is used. This in a great measure eliminates any vibration which might occur through the curb and granolithic walks communicating to the building adjacent. Joint strips are absolutely unnecessary transversely in the roadway.

Grooving on Hillsides.

Where the cement grout is used on hillsides and steep inclines, in order to provide a toehold for horses, the grout in the joint is sometimes raked out for about $\frac{1}{2}$ in. in depth, with a tool resembling an ordinary poker, or by stiff brooming. But owing to the fact that ordinarily no difficulty is experienced in this manner until about five years after it is constructed, it is better practice, although a little more expensive, to wait until such times as difficulty is experienced, and then with a tool similar to a pean hammer, or else with compressed air tools, cut channels at each joint, making the proper grooving for toehold for horses. In this manner a much better riding surface is obtained than if the joints are raked out or broomed out at the start.

Track Blocks.

It often becomes necessary to pave against tee rails, street railway construction. In this case a special block is cut, taking the place of the flange on the grooved girder rail, to receive the flange of the car wheel.

Protection in Freezing Weather.

Protection in cases where work has to be done in freezing weather can be best accomplished by the use of fine sawdust, preferably pine, as oak or chestnut would be apt to stain the pavement temporarily, leaving a very disagreeable looking piece of work, but otherwise not harming it in any way. It will be found that a thin layer of sawdust is a very efficient protection against severe cold. This material is light, easily handled and spreads readily over the surface of the pavement, and if necessary can be covered against rain by rolling out tarred felt over the top.

IMPERIAL FLOOR COMPANY, INC.

Sanitary Fireproof Flooring

ROCHESTER, N. Y.

Products.

Manufacturers of IMPERIAL SANITARY FIREPROOF FLOORING, which can be applied to Iron, Concrete, or Old or New Wood Floors; IMPERIAL SANITARY KITCHEN TABLES.

Imperial Flooring.

Imperial sanitary flooring is a non-porous composition material applied in plastic form over iron, concrete, or old or new wood floors.

CHARACTERISTICS—Imperial sanitary flooring differs from others of a similar nature in that it contains no sand, which is almost invariably used as a filler in other flooring material because of its cheapness. Sand materials have a tendency to crack and disintegrate after short usage, and also increase weight to the prohibitory point in many cases, whereas Imperial flooring is light and durable and can be applied to any floor. Sawdust is another cheap material commonly used, which does not form a part of Imperial flooring.

DURABILITY—Owing to its elasticity, Imperial flooring will outwear floors of the character of tile, terrazzo, etc.; does not disintegrate, chip or crack, or loosen from its foundation, and improves with use.

APPLICATION—Imperial sanitary flooring can be applied to any floor so as to produce a smooth but not slippery surface, with base or wainscoting perfectly sealed to floor as shown in illustration. Can be laid any thickness from $\frac{3}{8}$ to $\frac{1}{2}$ in. and hardens for use in 48 hours. If necessary to open floor for any purpose it can be readily and neatly repaired at nominal cost.

SANITARY—Being laid in a plastic state, the floor becomes one solid sheet with neither crack nor crevice for the accumulation of grease, dirt or moisture, and can be thoroughly cleansed with water without injury to floor or foundation.

WATERPROOF, FIREPROOF—Floors covered with Imperial sanitary flooring are absolutely waterproof, and fire can not reach wood covered with this material.

ELASTICITY—Owing to its great elasticity Imperial sanitary flooring is noiseless, and pleasant to the tread; never producing the fatigue experienced from cement, stone or other hard floors, and is not cold to the feet.

COLORS—Imperial sanitary flooring is made in many colors, and makes a very artistic appearance when laid with border. Especially recommended for public dining rooms, hospitals, schools, churches, auditoriums, amusement halls, corridors, bathrooms, lavatories, kitchens, restaurants, stores, banks, police stations, powerhouses, etc.

SAMPLES AND ESTIMATES—Samples of Imperial sanitary flooring gladly furnished at all times.

Send brief description of foundation, area and nature of space to be covered, and definite estimate of cost of material installed or material ready for laying will be supplied.

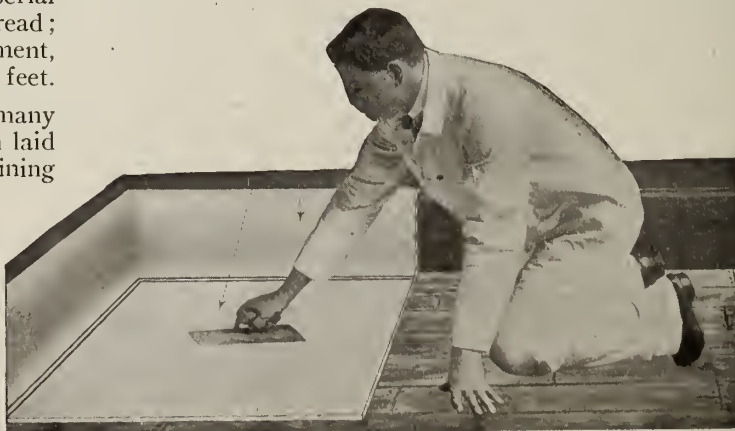
Sanitary Kitchen Tables.

Sanitary kitchen tables are made with composition tops that possess the following desirable features: Easy to keep clean; can be used as bread board; germproof; will not crack from heat; not injured by hot dishes; resemble marble, and are not expensive. Size of top, 24 by 42 in. Frame of natural maple or white enamel finish. Price, \$10.00.

References.

Buildings in which Sanitary fireproof flooring has been applied:

Monroe Tuberculosis Hospital, Monroe Co., N. Y.
 State Industrial School, Industry, N. Y.
 Rockefeller Hall, Rochester, N. Y.
 Y.W.C.A. Building, Rochester, N. Y.
 Duffy-Powers Department Store, Rochester, N. Y.
 Hubbard, Eldredge & Miller, Furniture Manufacturers, Rochester, N. Y.
 Vacuum Oil Co.'s Laboratory, Rochester, N. Y.
 Graham Sanitarium, Rochester, N. Y.
 Brick Church, Rochester, N. Y.
 Salem Church, Rochester, N. Y.
 Fire-Proof Film Co.'s Plant, Rochester, N. Y.
 Buffalo, Rochester & Pittsburgh Railroad Stations: Ridgeway, Pa.; Rochester, N. Y.; Brockwayville, Pa.; Stanley, Pa.; Springville, Pa.; Bradford, Pa.; Salamanca, N. Y.; East Salamanca, N. Y.; Mumford, N. Y.; Scottsville, N. Y.; Orchard Park, N. Y.
 Selden Motor Vehicle Building, Rochester, N. Y.
 East High School, Rochester, N. Y.
 Brick Church Institute, Rochester, N. Y.
 Deininger Bros. Bakery, Rochester, N. Y.
 Fitzhugh Hall Picture Theater, Rochester, N. Y.
 Mechanics' Institute, Rochester, N. Y.
 Homeopathic Hospital, Rochester, N. Y.
 St. Mary's Parish, Scottsville, N. Y.
 Central Police Station, Rochester, N. Y.
 Warsaw Courthouse, Warsaw, N. Y.
 Brewster, Gordon & Company, Rochester, N. Y.
 Symington-Anderson Company, Rochester, N. Y.
 Bridgeford Machine Tool Company, Rochester, N. Y.
 Fort Ontario, Oswego, N. Y.
 National Tube Company, Pittsburgh, N. Y.
 National Home for Disabled Volunteer Soldiers, National Soldiers Home, Me.
 United States Post Office, Batavia, N. Y.
 Perry Knitting Company, Perry, N. Y.



METHOD OF LAYING IMPERIAL SANITARY FLOOR
 Base and floor one continuous piece

THE JENNISON-WRIGHT COMPANY

Manufacturers of Kreolite Wood Block Floors

2480 Broadway
TOLEDO, OHIO

BRANCH OFFICES

CHICAGO, 138 No. La Salle Street
CLEVELAND, Builders' Exchange
BOSTON, 6 Beacon Street
TORONTO, CAN., P. O. Box 267

NEW YORK, Whitehall Building.
PHILADELPHIA, Crozer Building
PITTSBURGH, 609 Chamber of Commerce Building

ST. LOUIS, Railway Exchange Building
MINNEAPOLIS, 636 Plymouth Building
DETROIT, Builders' Exchange
CINCINNATI

Products and Services.

KREOLITE WOOD BLOCK FLOORS and
PAVEMENTS.

This company maintains a corps of expert superintendents who are sent out to instruct purchasers how to properly install Kreolite wood block floors, or to supervise the construction; or, if preferred, they can arrange to have the floor installed.

Use.

Kreolite wood block floors are used in factories, machinshops, warerooms, loading platforms, annealing rooms, foundries, pickling rooms, dye rooms, glass factories, paper mills, rubber tire plants, garages and stables.

General Description of Kreolite Wood Blocks.

Manufactured in various designs to meet special conditions. They are rectangular in shape, surfaced on two sides and one end to a uniform size, 3 to 4 in. in width and from 2 to 4 in. in depth depending on the severity of service. All blocks are furnished of the same width and depth for any one job.

MATERIAL—All blocks are manufactured from carefully selected Southern long leaf yellow pine, thoroughly air seasoned and free from bark, loose or rotten knots or other injurious defects.

TREATMENT—All blocks for interior floors are treated in air-tight cylinders by the Kreolite pressure and vacuum process, as much Kreolite creosote oil being forced by hydraulic pressure into the timber as it is possible to inject under safe temperatures and pressures, but in no case leaving less than 6 lbs. of oil per cu. ft. of timber.

Blocks that are to be used for exterior purposes, such as driveways, loading platforms and court pavements, or that are subjected to much moisture, are treated by the Kreolite "two-stage" process which consists of a second application of hot Kreolite oil injected to insure a more thorough waterproofing of the blocks.

A pure grade of Kreolite creosote oil is used.

CONSPICUOUS FEATURES—In the average machine-shop or iron working plant where sharp heavy castings are handled or where trucking is done, Kreolite wood blocks will outwear any other type of floor except iron plates. United States Government experts rank wood blocks just slightly below granite blocks in point of durability. The dropping of iron castings or the constant passing of heavy trucks on Kreolite wood blocks has the

Kreolite Wood Block Floors
"They outlast the factory"
TRADE-MARK

tendency to further compress the fibers, making the blocks tougher and harder.

After a Kreolite wood block floor is once laid there will be no expense for re-

pairs for many years to come. As the blocks are not ground by wear, there is no dust to get into the bearings of valuable machinery. They are non-conductors of heat and very easy on the workmen's feet.

Specifications for Installing Kreolite Block Floors.

The following method of laying Kreolite blocks is recommended for the average floor. Special specifications will be gladly furnished for unusual conditions.

CONCRETE FOUNDATIONS—(Concrete foundations are recommended to be used wherever practicable). The minimum thickness of concrete base shall be not less than 4 in. and shall increase in thickness, depending upon load the floor is designed to carry. Under extremely heavy loads and impact where settling of the subgrade is liable to occur, reinforcements shall be placed to distribute the load. The concrete base shall be composed of 1 part portland cement, 3 parts sand and 6 parts stone or gravel, or hard, clean cinders. The top of the concrete foundation shall be brought to a true, smooth and even surface exactly the depth of the block below top of finished floor.

PITCH CUSHION—After the concrete has thoroughly dried out, it shall be given a thin and even coating of Kreolite bituminous cement about $\frac{1}{8}$ in. in thickness, which shall be allowed to harden before laying of the blocks.

ALTERNATE DRY MORTAR CEMENT—If the concrete is not finished smooth or level enough to permit the block to be laid directly thereon, it shall be brought to a true and even surface with dry cement mortar, mixed 1 part portland cement and 4 parts sand. This should be mixed dry and well sprinkled with water just before the blocks are laid.

MANNER OF LAYING—The blocks shall then be laid tightly together, with grain vertical directly upon the cushion as prepared, with their length at right angle to line of traffic, care being taken to break joints by at least 2 in. After every 4 rows of blocks shall have been laid in place, the courses shall be lined up and driven together as tightly as possible by means of a 2 by 4 plank laid alongside the outside edge of the blocks. The blocks in each separate row shall also be tightened lengthwise by forcing them together from the end with a lever, pick or other instrument. When the dry mortar cushion has been used the blocks shall be rolled or tamped until they are brought to a smooth surface immediately after laying.

APPLICATION OF FILLER—After the blocks have been laid in place and brought to as true and level a surface as possible, the joints between the blocks shall be filled with Kreolite bituminous filler, applied hot. The filler should be applied by flushing over the surface of the floor, using a rubber-edged squeegee to force it into the joints. Care must be taken to see that the filler penetrates the full depth of the blocks and that the joints are completely filled at the time of application. Dry sand shall then be swept over the floor, completely covering the blocks, same to be left there until the blocks are well set.

EXPANSION JOINTS—Against walls on all sides of the floor, as well as around all columns and other obstructions, there shall be laid a bituminous expansion joint 1 in. in width.

Solution of Various Floor Problems.

Hundreds of metal working concerns, textile mills, paper mills and various other plants now have Kreolite wood block floors, which are withstanding service under varying conditions. The fact that 85% of these concerns are sending in repeat orders, is the best evidence that their managers and factory engineers regard Kreolite floors as a good investment.



KREOLITE GROOVED
BLOCK



KREOLITE LUG
BLOCK

THE MARBLELOID COMPANY

Manufacturers of and Contractors for Magnesite Products and Cork Composition Flooring

Broadway and Thirty-fourth Street
NEW YORK, N. Y.

FACTORY, NEW DURHAM, N. J.

BRANCH OFFICES

*PITTSBURGH, PA., 6624 Hamilton Avenue
*PHILADELPHIA, PA., 1524 Chestnut Street
*CLEVELAND, OHIO, 528 Erie Building
*DETROIT, MICH., 1333 Dime Bank Building
*BOSTON, MASS., 200 Devonshire Street

CINCINNATI, OHIO, 507 Mercantile Library Building
NORFOLK, VA., 905 National Bank of Commerce Building
KNOXVILLE, TENN., 407 Burwell Building
WASHINGTON, D. C., 511 Woodward Building
MINNEAPOLIS, MINN., 1115 Metropolitan Life Building
MONTREAL, CANADA, 908 New Burks Building

Products.

"MARBLELOID" FIREPROOF PLASTIC FLOORING, a Magnesite Composition for Floors, Coved Sanitary Base, Wainscot, Trim, Treads, etc.

"MARBLELOID" MAGNESITE STUCCO, a Magnesite Cement Stucco and Plaster for exterior and interior work.

"Tredlite," a distinctive Cork Composition Tiling, for the unusual floor.

Physical Characteristics, Properties and Advantages of Marbleloid Flooring.

Marbleloid is a sanitary, standardized, permanent, light weight, fireproof and resilient composition. It is installed in a plastic state, $\frac{1}{2}$ in. thick, and sets in a few hours into a seamless, tough, elastic body, presenting a fine grained, smooth surface.

The fact that it is jointless, remarkably free from a tendency to crack and practically non-absorbent gives it unusual sanitary value. It is easily kept clean; it is quiet to the tread; it is non-dusting, offering high resistance to abrasion; it is not slippery; it is waterproof. Owing to its elasticity, it is not fatiguing; it is a non-conductor of heat, and therefore, never cold; it has great crushing and structural strength and does not contract nor expand to any appreciable degree.

Marbleloid adheres firmly to wood, concrete or iron, and may be installed over old flooring, base or wainscot, as well as upon new construction. It is made in all colors, offering possibilities in the working out of any desired color scheme. Only inert mineral colors are used.

ADAPTABILITY—Over 8000 Marbleloid installations of large area have been made in the most varied types of flooring service. Marbleloid is being installed in almost every type of building. Because of the advantages enumerated above it is used to a very large extent in offices, institutions, schools, public buildings, churches, restaurants, clubs, hotels, theaters, libraries, banks, industrial plants, residences, apartment houses, laboratories, stores, garages, and in railroad cars and railroad stations and steamships. Approximately 2,000,000 sq. ft. of Marbleloid are annually installed in the United States and Canada.

PHYSICAL TESTS—Marbleloid weighs approximately 3 lbs. to the sq. ft.; it has a very low percentage of absorption; its compressive strength is over 6000 lbs. per sq. in.; it has a tensile strength of from 800 lbs. to 900 lbs. per sq. in. It has great resistance to abrasion and will stand under light trucking.

Marbleloid has been tested and approved by the Bureau of Buildings, Borough of Manhattan, New York City, as *fireproof material*. Copies of this report and other physical tests made by Prof. Woolson at Columbia University may be had on request.

*Indicates warehouse



MARBLELOID INSTALLED THROUGHOUT OFFICE OF
AMERICAN PULLEY COMPANY, PHILADELPHIA, PA.
HEACOCK & HOKANSON, Architects

MARBLELOID SERVICE—THE MARBLELOID COMPANY maintains thoroughly trained and skilled workmen at the principal building centers of the country, and is, therefore, unusually well equipped to perform work in any section with its usual high standard of excellence.

Owing to the fact that installations are unsuccessful when made by local cement masons, inexperienced in the handling of material of this nature, Marbleloid flooring is not sold in bulk. *All work installed by the Marbleloid organization is rigidly guaranteed.*

Before actually beginning the installation of the Marbleloid material, a preliminary inspection is made by an engineer thoroughly familiar with all phases of building construction.

At the plant and in the field, Marbleloid facilities are such that the company is always prepared to handle all work, no matter how large, with the utmost dispatch and efficiency.

In order to maintain the superior merit of its product, THE MARBLELOID COMPANY has in its employ a graduate chemist who has specialized in this line for the past seventeen years. The laboratory is constantly engaged in research work and all raw materials entering into the Marbleloid composition are carefully tested or analyzed, assuring a standardized product.

MARBLELOID SPECIFICATIONS—Before drawing up specifications covering the use of Marbleloid, the company suggests that engineers or architects secure a copy of this company's Standard Specification Sheet, giving detailed drawings showing construction of sanitary base, iron stair tread construction, etc. This Specification Sheet contains foundation requirements and other data that is essential for securing satisfactory results.

RELATIVE LOW COST—Marbleloid is a permanent flooring which requires no unusual or expensive foundation. It may be put into service 24 hours after it has been installed. It may be used just as readily over wood flooring (finished or under) as it can be over concrete fill or finished cement floor. Thus in alteration work, both the time and expense of the preparation of a special foundation may be eliminated. In the large areas it costs but a trifle more than the best grade hardwood or linoleum and will outwear many applications of the latter.

The price of Marbleloid flooring, sanitary coved base, wainscoting, stair work, etc., varies, naturally, with the area involved, nature of the foundation (wood, concrete, or iron) and location. The price of Marbleloid, unlike that of other flooring materials has increased but from 10% to 15% since 1916. With crews of Marbleloid mechanics in the various building centers of the country, economy and efficiency are assured.

Upon receipt of data giving information regarding nature of foundation, the area of floor and wainscot, lineal extent of sanitary base, treads, etc., a definite proposal for the work completely installed will be furnished.

GUARANTEE—THE MARBLELOID COMPANY rigidly guarantees the quality of its material and all work performed by its workmen, and will repair, free of charge, all defects due to the use of improper materials or workmanship.

SAMPLES, ETC.—Samples and color card, together with full literature including booklet, Standard Specification, etc., will be gladly mailed on request.

REFERENCES—As an indication of the merits of Marbleloid flooring, a portion of a list, giving the names of nationally known corporations for whom repeated installations of this material have been placed is printed below:

FIRM	CONTRACTS
American Can Company.....	14
American Sheet & Tin Plate Co.....	11
Atlas Powder Co.....	12
Bethlehem Shipbuilding Corp.....	7
Bethlehem Steel Company.....	12
Carnegie Steel Company.....	22
Crucible Steel Company.....	10
Frankford Arsenal.....	14
General Chemical Company.....	7
General Electric Company.....	20
Metropolitan Stores, Inc.....	17
New Jersey, State of.....	14
New York, City of.....	55
New York Edison Co.....	19
New York, State of.....	11
Pennsylvania R. R.....	28



INTERIOR EVENING NEWS BUILDING, DETROIT, MICH.
ALBERT KAHN, Architect



NEW YORK EDISON COMPANY'S WATERSIDE NO. 2 PLANT,
NEW YORK, N. Y.

FIRM	CONTRACTS
Philadelphia, City of.....	5
Pennsylvania, State of.....	18
Pittsburgh, City of.....	16
Standard Oil Co.....	11
Yale & Towne Mfg. Co.....	6

Marbeloid Magnesite Stucco.

Marbleloid magnesite stucco is an oxy-chloride cement stucco, which presents numerous advantages over the portland cement product, chief among which are the following:

Marbleloid magnesite stucco, because of its elasticity, high tensile strength (750 lb. per sq. in.) and the fact that it does not depend wholly upon a key for a bond, will neither crack, warp, nor come loose from the foundation over which it is applied. It is light in weight, considerably lighter than portland cement stuccos.

This material is absolutely fireproof. It can be applied successfully in freezing weather, no water being employed in preparation. Due to a slight expansion when setting, an absolutely tight joint is formed against all trim, coping, etc., thus obviating all possibility of dampness penetrating behind the material, causing it to loosen from the foundation over which it is applied, a serious objection in portland cement stucco.

Marbleloid magnesite stucco is furnished in three parts—undercoat, topcoat, and dash.

Due to the fact that mineral colors can be incorporated in the top coat, as well as variegated aggregates used in the dash, most pleasing and artistic effects can be secured. Not only can this material be used for exterior work but highly decorative schemes can be worked out with it as an interior finish.

Not only is Marbleloid magnesite stucco filling a long felt want in providing a durable, attractive and economical finish in new construction, but it is also being used extensively in the renovation and remodelling of old structures.

This company is prepared to furnish complete and explicit directions for the application of Marbleloid magnesite stucco, insuring absolutely satisfactory results upon the part of local plastering or stucco contractors. Samples, booklets, detailed specifications, outlining foundation requirements, will be furnished on request.

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION

812 Engineers Building
CLEVELAND, OHIO

MEMBER ASSOCIATIONS

EASTERN PAVING BRICK MANUFACTURERS ASSOCIATION, Lincoln Building, Philadelphia, Pa.
ILLINOIS PAVING BRICK MANUFACTURERS ASSOCIATION, Chamber of Commerce Building, Chicago, Ill.
INDIANA PAVING BRICK MANUFACTURERS ASSOCIATION, Fidelity Trust Building, Indianapolis, Ind.

OHIO PAVING BRICK MANUFACTURERS ASSOCIATION, Hartman Building, Columbus, Ohio
SOUTHERN PAVING BRICK MANUFACTURERS ASSOCIATION, Volunteer Building, Chattanooga, Tenn.
WESTERN PAVING BRICK MANUFACTURERS ASSOCIATION, Dwight Building, Kansas City, Mo.

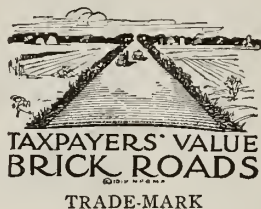
Products.

VITRIFIED PAVING BRICK (or BLOCK, as they are sometimes called).

Uses.

Vitrified paving brick are used for paving city streets and country highways, alleys, driveways, walks and sidewalks, railway tracks, railway station platforms, factory floors, areas and drives about manufacturing plants, barn floors, stock feeding platforms. Adapted for paving anywhere that extreme resistance to wear and tear are essential or where imperviousness to moisture, acids, etc., is necessary.

They are also frequently and successfully used in the construction of sewers, conduits, buildings such as factories, garages, dwellings, warehouses, foundations for structures of all kinds, tanks, silos, and similar structures.



Paving brick may be used for all the purposes enumerated. For uses other than paving, off-grades—those that are not entirely suitable for paving by reason of being a little out of shape or perhaps too regular in shape, owing to extremes of the burning process—may be specified with entire satisfaction.

Only Number One pavers should be specified for paving purposes.

Paving Specifications.

The NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION and its Member Associations will furnish paving specifications on request.

These specifications may be followed in factory floor, driveway and area paving or under other comparable conditions.



A BRICK PAVED COUNTRY HIGHWAY

Sizes.

The standard paving product of the NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION is a plain wire-cut, square edged brick 3 by 4 by 8½ in. in size. Thirty-six are required to lay a square yard when laid to the 3-in. depth; 48 when laid to the 4-in. depth. They weigh approximately 4 tons per thousand. Other sizes special.

Many manufacturers of paving brick also make vitrified brick 2½ by 4 by 8½ in. in size for sewer and building construction.



THE RENKERT BUILDING, CANTON, OHIO, FACED WITH VITRIFIED PAVING BRICK

Specifications are available as follows:

STANDARD SPECIFICATIONS

Base—Rolled stone, slag or gravel.

Concrete.

Worn macadam, gravel, and slag pavements (utilized).

Worn concrete pavements (utilized).

Natural soil foundation.

Bedding—Sand, stone screenings or granulated slag.

Brick—3 by 4 by 8½ in. plain wire-cut, square edged, without lugs.

Filler—Asphalt.

ALTERNATIVE SPECIFICATIONS

Bedding—Cement—sand.

Filler—Sand, combined tar and asphalt, cement grout.

Brick—3 by 4 by 8½ in., square edged with lugs.

Specifications also can be furnished for the Green Concrete Foundation Type of pavement.

SPECIFICATIONS FOR STANDARD VITRIFIED PAVING BRICK

Section 1. Description—All brick shall be the Number One grade of standard vitrified paving brick. They shall be wire-cut, without lugs, and shall have square edges.

Section 2. Size—The size of standard vitrified paving brick shall be three (3) by four (4) by eight and one-half (8½) inches.

Section 3. Variations in Size—Vitrified paving brick shall not vary from the standard dimensions more than one-half (½) inch in length or more than one-eighth (⅛) inch in width and depth.

Section 4. Quality—Vitrified paving brick shall be evenly burned, thoroughly annealed, and uniform in texture. They shall be hard and tough. They shall show a uniform fracture when broken, free from marked laminations.

Section 5. Shape—The wearing face of the brick when laid shall be reasonably straight.

Section 6. Test—Brick shall not lose their weight more than twenty-four (24) per cent. when tested in the standard rattler and in accordance with the Standard Specifications for Paving Brick, of the American Society for Testing Materials, Serial Designation C 7-15.

Section 7. Samples—Samples for testing shall be chosen according to the Standard Specifications for Paving Brick of the American Society for Testing Materials, Serial Designation C 7-15.

Section 8. Brands—The contractor shall name the brands of standard vitrified paving brick, with the prices respectively, upon which he submits bids.

Section 9. Factory Inspection—When shipments of brick to any one project, or the combined shipments to separate projects under the jurisdiction of the engineer, are sufficient to make it economical, then the brick may be inspected and tested at the place of manufacture.

Merits.

Vitrified brick pavements are known as "Taxpayers' Value" pavements on account of their unequalled wearing qualities, low repair and maintenance cost, extreme durability under the severest use and their long-run economy. The buyer is protected by the following guarantee of vitrified paving brick used in paving.

Guaranty of Paving Brick.

The members of the NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION guarantee their product against defects in material and manufacture. Each brick in street or highway surface gives assurance of long and worthy service because each brick is a guaranteed service unit, complete and finished before it is laid.

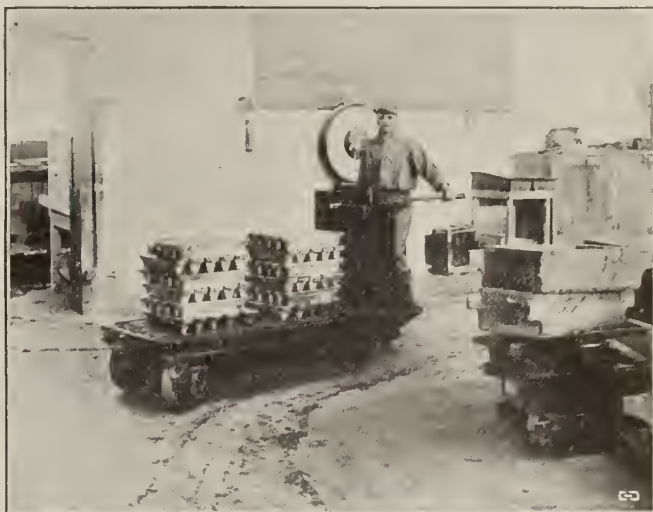
Prices.

A list of manufacturers will be furnished on request from whom prices may be obtained.

Co-operative Service.

The office of the Association is always ready to consult with engineers concerning "Taxpayers' Value" paving brick and its uses and will be glad to furnish all

detailed information within its power, literature, list of manufacturers, and in general to be as helpful as possible.



VITRIFIED PAVING BRICK FLOOR IN WILLARD STORAGE BATTERY PLANT

Note weight of pig lead being trucked



WILLARD STORAGE BATTERY COMPANY

Enormous weight of pig lead stacked on vitrified paving brick floor



BRIDGE PAVED WITH VITRIFIED PAVING BRICK

THE OHIO WOOD PRESERVING COMPANY

Manufacturers of Wood Block Floors

1053 Century Building
PITTSBURGH, PA.

PLANTS: ORRVILLE, OHIO; BROADFORD JUNCTION, PA.; REED CITY, MICH.

Products.

CENTURY CREOSOTED WOOD BLOCK FLOORS.

Also, Creosoted Wood Paving Blocks, Creosoted Ties, Lumber, Timbers, Piling, Poles and Posts.

Century Wood Block Floors.

Century wood block floors are manufactured from dense, air seasoned long leaf yellow pine.

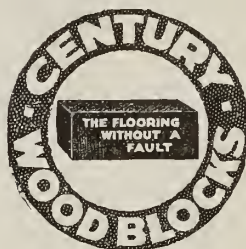
The blocks are accurately cut to uniform size, thoroughly seasoned and treated with creosote by a special process and under high pressure, to meet conditions existing in factories and shops. This treatment absolutely prevents decay and renders the blocks impervious to water.

The blocks are laid with the grain of the wood vertical so that the pressure and blows of heavy traffic come on the ends of the grain of the wood. Hard use has no effect other than to compact and "iron out" the ends of the wood fibers and make the floor smoother and more resistant to wear.

The blocks are laid on a concrete base, which is first coated with pitch or on which is spread a thin mortar cushion. Being uniform in size, Century blocks can and should be laid as tightly together as possible, the joints between the blocks being filled with hot pitch.

Uses.

Century block floors are manufactured especially



TRADE-MARK

for use in machinshops, foundries, metal working plants, automobile factories, railroad shops, pickling rooms, warehouses, stables, and other industrial plants where wearing quality, elasticity, sanitation and economy are prime requisites; also for loading platforms, driveways, courtyards and bridges.

Advantages.

Century block floors withstand the hardest and most severe traffic and actually improve with use.

They are smooth, making trucking easy; and having no "wearing surface" to grind off, do not wear away into ruts and holes. Furthermore, there is no splintering or abrasion under hard use, so no dust is formed to damage machinery.

They are comfortable to stand on, as they absorb vibration, are non-conductors of heat and sound, and are resilient—not hard, unyielding and cold.

Blocks require practically no attention after installation. They will last for years under constant use; while sections can easily be removed and replaced for repairs or installation of machinery whenever required. See illustration below.

Specifications.

The size, type and treatment of blocks and the method of installing floors differ with conditions under which they are used. Complete specifications sent on request.



SHOWING METHOD OF LAYING FLOOR ALONG TRACKS AND AROUND MACHINERY FOUNDATIONS

REPUBLIC CREOSOTING COMPANY

Manufacturers of Creosoted Wood Blocks, Improved Creosote Oils and Coal Tar Products

1614 Merchants Bank Building
INDIANAPOLIS, IND.

BRANCH OFFICES

CHICAGO, ILL., 315 Peoples Gas Building
PHILADELPHIA, PA., 834 Real Estate Trust Building
CLEVELAND, OHIO, 222 Society for Savings Building
TORONTO, CANADA, 52 Bay Street

DETROIT, MICH., 211 Hammond Building
BUFFALO, N. Y., 204 Erie County Bank Building
BOSTON, MASS., 638 Old South Building

PLANTS: INDIANAPOLIS, MINNEAPOLIS, MOBILE, SEATTLE, NORFOLK

Products.

KREODONE INTERIOR WOOD BLOCK FLOORS.

Creosoted Ties, Poles, Posts, Piling and Lumber of All Kinds.

Reilly's Improved Creosote Oil; Reilly's Wood Preservative Oil ("R. W. P. O.").

Wood Block Floors.

Kreodone interior wood block floors are superior to all other types of floor construction where durability and low cost of upkeep are the requisite factors. Best for machineshops, foundries, metal and woodworking plants, bakeries, paper and textile mills, automobile plants, rolling mills, breweries, barns, loading platforms, warehouses, railroad shops of all kinds, round-houses, freight depots, platforms, driveways, etc.

No other floor will withstand such heavy service nor last as long without requiring repairs. And no other floor can be so quickly and easily repaired.

CONSTRUCTION—Kreodone interior wood block floors consist of blocks of the best long leaf yellow pine, thoroughly seasoned and then impregnated with Kreodone Oil. The blocks are perfectly rectangular, 3 in. deep parallel to the grain, 4 in. wide, and from 5 to 10 in. long.

These blocks are laid on a suitable foundation which is first covered with a cushion of sand or pitch. The grain of the blocks is laid vertical to the surface of the floor and the blocks are laid close together, breaking joints between courses.

ADVANTAGES—The heaviest traffic has never been known to wear out or produce ruts in a Kreodone interior wood block floor. Hard service makes the floor stronger and more compact.

It forms a perfect trucking surface, as there is no give or traction wave such as plank floors produce; the floor can not dust and crumble like concrete; it can not disintegrate under the action of water, steam, acids and oils like composition floors; and it can not form ruts and humps like asphalt.

The blocks are all of the same height, hence the surface is smooth and even.

It is warm, non-slippery, easy under foot, dustless, free from noise and glare, resilient and free from vibration. The remarkable resiliency of the floor reduces the damage to tools and castings that may fall upon it.

As Kreodone Oil can never leave the wood, these Kreodone blocks are permanently proofed against water and decay.

In cases where sections of the floor have to be taken up to install alterations, the individual blocks are simply lifted out and then put back in place when the work is finished, leaving a floor that is as perfect and even as before they were removed.

COST—Prices furnished on application to any of the above sales offices. Figured in years of service and cost of upkeep, Kreodone interior wood block floors are more economical than any other type of floor yet discovered.

SPECIFICATIONS—Where specially severe or unusual conditions are to be met, the engineering department will gladly prepare specifications. Printed specifications for laying a Kreodone interior wood block floor will be sent on request.

The life of a Kreodone Interior Wood Block Floor depends primarily upon the preservative used. The oils must be free from volatile elements and adulterants of either coal tar or petroleum products. Kreodone Oil is the highest grade pure creosote oil on the market. It has no equal.

KREODONE OIL SPECIFICATIONS—Oil shall be wholly an *unadulterated* distillate of coal tar. No material of any kind, such as liquid tar, petroleum, or other products, shall be added to or mixed with it. Its specific gravity at 38° C. shall be not less than 1.09 and not more than 1.12.

It shall conform to the following distilling points: Up to 200° C., not more than 2% shall distill; up to 210° C., not less than 3% and not more than 5%; up to 235° C., not less than 10% and not more than 20%; up to 315° C., not less than 30% and not more than 40%.

Residue at 355° must be a crystalline solid, and shall not be in the least sticky; and when a small portion of it is placed on white filter paper and warmed, oil spot produced, when viewed by transmitted light, shall appear of a dark amber color. Specific gravity of residue shall not be less than 1.15.

Coke test applied to oil, according to N.E.L.A. method, shall show not more than 1½% coke.

Specific gravity of distillate between 235° C. and 315° C. at 38° C. shall be not less than 1.04 and the unsulphonated residue of this fraction shall not exceed 2½%. Also, a distillate shall be taken from oil between 300° C. and 360° C., inclusive, and the unsulphonated residue of this fraction shall not exceed 3½%.



KREODONE WOOD BLOCK FLOOR LAID IN PLANT OF VAN DORN IRON WORKS, CLEVELAND, OHIO

THE SOUTHERN WOOD PRESERVING CO.

THE RODD COMPANY

Creosoted Materials

805 Century Building
PITTSBURGH, PA.

Products and Services.

CREOLIGNUM WOOD BLOCK FLOORS.
Creosoted Cross Arms, Conduit, Lumber, etc.

THE SOUTHERN WOOD PRESERVING Co. has a complete organization for Superintendence and Installation of Creolignum Floors.

Creolignum

TRADE-MARK

Creolignum Floors.

Creolignum is a trade-name designed to represent, first, the finest quality of creosoted yellow pine blocks, manufactured to meet the special conditions of each floor; and, secondly, an engineering service which is the result of wide and complete experience of different problems of floor construction. Poor quality of material can not be overcome; nevertheless, the highest quality of material may fail if poorly designed or ignorantly installed.

Creolignum floors are especially designed for machineshops, warehouses, shipping rooms, roundhouses, freight platforms, etc.; also for dairies and stables.

Creolignum floors are primarily for heavy duty and long service. They are especially designed for each situation.

Creolignum floors, in addition to their great durability, represent the greatest comfort to workmen and are ideal for trucking over.

Inquiries should state as exactly as possible the conditions and service required.

Material.

Long leaf yellow pine has become established as the most suitable and durable wood for heavy service floors. Its close grained structure and strength joined to the fact that it readily accepts a thorough treatment of creosote makes it an ideal material.

Short leaf yellow pine takes treatment even better than long leaf, but is somewhat lower in strength. Under lighter conditions of service, however, it is equally as satisfactory as long leaf and is somewhat lower in price.

Dense Southern yellow pine has become established as the most suitable and durable wood for heavy service floors. It has great strength and this, combined with the readiness with which it accepts treatment, makes it an ideal material.

The Southern Yellow Pine Association in conjunction with the American Society for Testing Materials have adopted density specifications rather than any other, in order to overcome the usual difficulty of inspection through confusion of species.

Creosote Oil.

Creosote oil, more properly called tar oil, is a by-product of the destructive distillation of coal tar, which

in turn is a residuum from the manufacture of coke and gas. There are several grades of creosote in use, ranging from the water gas tars to the pure distillate oils, and much controversy as to the proper oil to

use in treatment has arisen. As good a rule to follow as any is to use the cheapest and most available creosote, which can be guaranteed to do the work required with the treatment suitable for the purposes. It would be obviously unsound to preserve a timber against decay for 30 years when its mechanical life might be only 15, and equally so to preserve wood under fairly dry and uniform conditions in the same manner as that which would be subjected to very stringent conditions.

Treatment.

The recognized method of treatment of interior wood block floors is by "The Rueping Process" which thoroughly impregnates the blocks with creosote, and thereby insures complete preservation and at the same time leaves the wood free from excess oil, which might bleed and render the floor unusable.

Manufacture.

It is essential that blocks be cut properly. This requires good machinery and great care, as the blocks must be uniform in size, or trouble will result.

Determining Factors.

Entering into the highest quality of wood block flooring are:

- (1) Best lumber suitable for the purpose.
- (2) The best creosote available and suitable for the purpose.
- (3) Correct manufacture.
- (4) Correct size of blocks for service required.
- (5) Proper treatment to preserve against decay under prevailing conditions.

To gain the above factors, absolute efficiency and integrity of manufacture are required.

Service and Maintenance.

A correctly designed and properly installed wood block floor will last for years—practically no maintenance is required. The elasticity of the blocks is of the greatest advantage to the workmen, and their freedom from dust and insulating qualities make them an ideal floor.

Adaptability of Specifications.

The following specifications are scientifically and economically sound and will cover by far the majority of conditions in factories and warehouses. Special cases may arise, as, for instance, the conditions present in the pickling rooms of large steel plants, where moisture is at all times present on the floor; here a block of heavier

treatment is required and the installation calls for special methods.

Specifications for Floor in Heated Building Not Exposed to Weather or to Water Liquids.

MATERIAL—Blocks shall be THE SOUTHERN WOOD PRESERVING Co.'s Creolignum Blocks manufactured from first quality dense Southern yellow pine, thoroughly seasoned, containing at least an average of 6 rings to the inch, measured radially across the grain. The blocks shall be cut uniformly with sharp saws and shall vary not more than $\frac{1}{8}$ in. in width and $\frac{1}{16}$ in. in depth.

DIMENSIONS—Blocks shall be 3 or 4 in. in width. Average 8 in. long and 3 in. in depth (depth varies with service required).

TREATMENT—Blocks shall be creosoted by the following process (Rueping):

Blocks shall be placed in an airtight treating cylinder and subjected to an air pressure of from 40 to 80 lbs. per sq. in., depending on the condition of the wood. Preservative at a temperature of not less than 160° Fahr. shall then be introduced into the cylinder and additional oil pumped in until the cylinder is completely filled with the preservative and from 100 to 180 lbs. to the sq. in. is recorded in the gages. This pressure shall be maintained until the blocks are thoroughly impregnated with from 12 to 16 lbs. of creosote oil per cu. ft. of wood, after which the pressure shall be released, the cylinder drained and the excess oil removed from the blocks.

CREOSOTE OIL—Shall be completely liquid at 38° C. and not more than 3% of water-free oil. Shall be insoluble in chloroform or hot benzol. Specific gravity at 38° C. shall not be less than 1.05 nor more than 1.14. When distilled as described in Bulletin 96 of the A. R. E. & M. W. Assn., distillate shall not exceed the following:

To 200° C.....	no distillate
To 210° C.....	less than 5%
To 235° C.....	not more than 25%
To 315° C.....	not more than 50%

The oil shall not contain more than 2% of water.

Specifications for Laying Blocks on Concrete Base Coated with Pitch.

PITCH COAT—The smooth concrete foundation shall receive a hot mopped coat of pitch just prior to laying the blocks. This coat of pitch shall be thick enough to overcome all irregularities in the surface of the concrete and to give a smooth, even surface on which to lay the blocks. In case the surface of this coat of pitch is not smooth, it shall be ironed with hot smoothing irons such as asphalt pavers use.

PLACING BLOCKS—Blocks shall be carefully laid with the grain of the wood vertical in straight parallel courses at right angles to the length of the room or building, the blocks being laid with close, tight joints. The joints shall be broken by a lap of at least two (2) in. Nothing but whole blocks shall be used, except in starting or closing a course, and in no case shall less than one-third of a block be used in starting a course.

EXPANSION JOINTS—Expansion joints shall be provided along the walls of the building or room and around all pillars, machinery foundations, manhole frames and pit walls. The expansion joints shall be made by placing three-quarter ($\frac{3}{4}$) in. boards or strips on edge against the walls or foundations before the blocks are laid. The blocks shall be laid lightly against the strips.

After the blocks have been bedded by rolling or tamping, and the joints between the blocks have been filled, as hereinafter specified, the strips shall be removed and the spaces filled to within three-quarter ($\frac{3}{4}$) in. of the surface of the floor with hot coal tar pitch.

TAMPING OR ROLLING—Blocks shall be rolled or tamped until they are firmly bedded and brought to a smooth surface on the grade of the finished floor.

SAND COVERING—After the joints have been filled, the surface of the floor shall be covered with clean sand which will pass a ten- (10) mesh sieve. The sand shall be left on the floor for a few days until the joints are filled flush with the surface of the floor and any surplus sand shall then be removed.

Alternative Specifications—Cement Mortar Cushion.

LAYING BLOCKS—Upon the concrete foundation, prepared as heretofore specified, shall be spread a layer of dry mortar, approximately one-half ($\frac{1}{2}$) in. in thickness, composed of one (1) part portland cement and four (4) parts sand thoroughly mixed without the addition of water. The dry mixture of sand and cement shall be struck to a true surface parallel to the grade of the finished floor. The thickness of the mortar cushion shall be such that, when the blocks are set and properly bedded by tamping or rolling, their top surface will conform to the grade of the finished floor.

NOTE—A sand cushion may be used in place of the mixture of sand and cement, but it is not recommended.

PLACING BLOCKS—After the mortar bed has been spread and struck, it shall be dampened by using a sprinkling can, immediately before the blocks are laid. The blocks shall then be carefully laid with the grain of the wood vertical in straight parallel courses at right angles to the length of the room or building, the blocks being laid with close, tight joints. The joints shall be broken by a lap of at least two (2) in. Nothing but whole blocks shall be used, except in starting or closing a course, and in no case shall less than one-third of a block be used in starting a course.

EXPANSION JOINTS—Expansion joints shall be provided along the walls of the building or room and around all pillars, machinery foundations, manhole frames and pit walls. The expansion joints shall be made by placing three-quarter ($\frac{3}{4}$) in. boards or strips on edge against the walls or foundations before the blocks are laid. The blocks shall be laid lightly against the strips. After the blocks have been bedded by rolling or tamping, and the joints between the blocks have been filled, as hereinafter specified, the strips shall be removed and the spaces filled to within three-quarter ($\frac{3}{4}$) in. of the surface of the floor with hot coal tar pitch.

TAMPING OR ROLLING—Before the mortar cushion has started to set, the blocks shall be rolled or tamped until they are firmly bedded and brought to a smooth surface on the grade of the finished floor.

SAND COVERING—After the joints have been filled, the surface of the floor shall be covered with clean sand which will pass a ten- (10) mesh sieve. The sand shall be left on the floor for a few days until the joints are filled flush with the surface of the floor and any surplus sand shall then be removed.

NOTE—The direction of the courses of the blocks at right angles to the length of the building or room contemplates that the direction of the heaviest trucking or traffic will be parallel to the length of the room or building. If otherwise, the blocks should be laid in courses at right angles to the direction of the heaviest traffic.

SPECIAL SERVICE FLOORING CORPORATION

Composition, Asphalt, Mastic, Non-slip and Industrial Floors

Grand Central Terminal
NEW YORK, N. Y.

BRANCH OFFICES IN ALL PRINCIPAL CITIES
FACTORY, MAMARONECK, N. Y.
CANADIAN OFFICE, MONTREAL, P. Q., 332 Bleury Street

Products and Services.

SPECIAL SERVICE MAGNESITE COMPOSITION FLOORING.

SPECIAL SERVICE ASPHALT FLOORING.

SPECIAL SERVICE MASTIC FLOORING.

SPECIAL SERVICE SOLRY 100% NON-SLIP FLOORING.

Special Service Colored Cement Flooring, Special Service Concrete Hardener.

FLOORING ENGINEERS and CONTRACTORS.

Special Service Floors.

Sanitary, durable, dustproof, resilient, fireproof, verminproof and germproof; they are sound deadening, quickly installed, and never become slippery even when wet.

Designed to meet the various service requirements. The entire floor problem is assumed by the corporation, one of whose engineers interviews the architect to ascertain what may be particularly required of the new floors; after these specific data shall have been obtained, the flooring materials will be manufactured at the company's factory expressly for the special service to which the new floor is to be subjected. The best materials and treatments are used to take care of the individual floor in question, the traffic to be met, etc. Complete specifications furnished.

ADAPTABILITY—Special service floors can be laid over wood, concrete or steel and are extensively used in industrial buildings, public buildings, hospitals, schools, residences and naval vessels.

INSTALLATION—Floors are installed by the experienced mechanics of this corporation anywhere in the United States and Canada. These materials can be used over all kinds of construction and are suitable for floor, base, wainscot and stair work, in both new construction and in existing buildings.

The formulæ and methods of installations are based on 11 years' actual experience in various installations of special service floors in all kinds of buildings in all parts of the country, the results of different formulæ and methods being carefully noted in all cases. This policy, therefore, will assure the proper floor for each particular requirement.

Special Service Magnesite Composition Flooring.

Special service magnesite composition flooring is generally laid $\frac{1}{2}$ in. thick over wood, concrete, or steel. It is not affected by changes of temperature or humidity; is fireproof; does not dust; having the quality of springiness, it does not tire a person who stands on it; is smooth, sanitary and adapted for use where the absence of dust is necessary. Made in all colors.

Special Service Solry 100% Non-slip Flooring.

Special Service Solry 100% non-slip floor is a travel surface for floors, ramps, stairways, landings, etc., that will not wear smooth or slippery, will be wear resisting and is of sanitary construction. The material is fireproof, acidproof, waterproof, resilient, and installed in all colors. The non-slippery qualities are permanently maintained by distribution of an abrasive

material through the entire thickness of the material so it can never wear slippery.

Special Service Asphalt Flooring.

Is laid usually from $\frac{5}{8}$ to $1\frac{1}{2}$ in. thick over wood, concrete or steel and is guaranteed not to creep. Has been successfully used in factories, recreation roofs and other places where a floor or decking is required to be extremely resilient, waterproof and durable.

Special Service Mastic Flooring.

It is installed by cold process and is built up in 4 layers. Is very resilient and presents a pleasing appearance; is flashproof and a good thermal and electric insulator; is usually installed over concrete, composition, steel, or wood, in brown, black, red and green.

Special Flooring for Special Conditions.

Special floors are installed by this corporation in acid plants, pickling rooms, coal bunkers, battery storage rooms, and under difficult conditions.

Manufacture of Products.

Raw materials, magnesite, asphalt, color, and all other ingredients of the very highest grade and test, are carefully selected; analyzed by means of chemical tests conducted by the company's chemical engineers at time of purchase, before manufacture and before shipment.

Supervision.

Corps of skilled mechanics, located in the principal industrial centers of the United States and trained 11 years, work under the direction of the company's president, insuring uniformly successful installations. These men have had long experience in floor operations under all conditions in all parts of North America.

Estimates, Specifications, Samples, etc.

Gladly supplied on application.

Guarantee.

All products installed by the corporation are guaranteed by it against all defects of materials and workmanship.

Quick Shipments.

Large stocks of raw materials are kept at all times at the main factory, also at the principal agencies, facilitating shipment of materials.

References.

This corporation has installed work for many of the leading architects and engineers in the United States and Canada, and for the U. S. Government. Names will be gladly given on request.

Some prominent industrial installations are:

Aeolian Company	New York Central R. R. Co.
American Can Company	New York Edison Company
American Everready Company	New York Telephone Company
Brooklyn Rapid Transit Co.	National Screw and Tack Company
Bordens Condensed Milk Company	Proctor and Gamble Company
General Chemical Company	Worthington Pump & Machinery Company
General Electric Company	United States Aluminum Company
Johnson and Johnson Company	
National Carbon Company	
New Departure Mfg. Company	

STANDARD ASPHALT & REFINING COMPANY

Producers of Mineral Rubber Asphalts

208 South La Salle Street
CHICAGO, ILL.

Products.

SARCO MINERAL RUBBER MASTIC and FLUX for asphalt mastic floors, platforms, driveways, etc.

Sarco Mineral Rubber No. 6 Waterproofing; Fabric and Expansion Joint for Waterproofing. Other Sarco Mineral Rubber Asphalt Products: Asphalt Filler, Roof Cement, Pipe Coating, Refrigerator Compound, A. P. (acidproof) Tank Lining, Cork Cement, Battery Seal, Insulation (Thermal and Electric); Protective Coatings for metal, concrete and masonry.

Quality and Services.

All Sarco mineral rubber asphalts are 99.5% pure, unvaryingly uniform, completely waterproof and non-absorbent, odorless and tasteless, and highly resistant to acids and alkalis. They are insensible to extreme, quick changing temperatures, due to a difference of more than 200° Fahr. between melting and brittle points.

The information and advice this company is prepared to furnish, for the use of asphalt for any purpose, represent the most advanced technical knowledge and years of practical experience in refining and using asphalts. Service in this respect comprehends the preparation of plans and specifications. Besides producing the materials, the company operates an Engineering-Contracting Department for performing contract work.

Adaptability and Advantages of Sarco Mineral Rubber Floor.

On account of its resilient, flexible nature it is adapted to any kind of traffic, absorbing all shocks without "grinding" or "dusting." It remains permanently "alive," as the materials do not deteriorate with age. The floor is non-absorbent and contains no joints to accumulate filth. It is easily cleaned by flushing.

It is a scientific combination of abrasion resisting materials (sand and gravel of the proper size and quality) and Sarco mineral rubber mastic and Sarco mineral rubber flux. Being in a plastic state when laid, it can be easily moulded to conform to drainage requirements and fitted closely against walls, pillars and even



continued as a lining for drains and gutters. It is rubbed to a smooth surface, making a desirable, sanitary and waterproof floor. Because of sanitary, quiet, non-dusting qualities it is very desirable for schools, hospitals and sanitariums. On account of excellent wear resisting qualities it is used very extensively

in freight and passenger stations, baggage rooms, machineshops, factories, industrial plants, warehouses, docks, alleys, driveways, packing plants and canning factories.

Specifications for Sarco Mineral Rubber Asphalt Floor Over Concrete.

Foundation shall be clean, dry, smooth and finished true to grade.

Floor shall be laid with Sarco Mineral Rubber Mastic and Sarco Mineral Rubber Flux, as produced by the STANDARD ASPHALT & REFINING COMPANY of Chicago, Ill.

Mastic shall be composed of very fine mineral matter, well graded and saturated with Sarco Asphalt during the process of manufacture. Sarco Flux shall be 99.5% pure asphalt, of a tough, rubbery, quality. Its consistency or degree of hardness shall be suitable for the character of traffic to which the floor is subjected.

Mineral aggregate used in the floor shall be clean, washed torpedo gravel, limestone or granite screenings of well graded sizes from 1/4 in. to fine particles.

Mastic blocks shall be broken into pieces, mixed with a proper amount of Sarco Flux, and cooked to a thin liquid. To this mixture shall then be added a proper amount of dry and heated mineral aggregate, and the mixture agitated with stirring rods to insure all particles being thoroughly coated. During removal of mixture from kettle it shall be agitated by iron stirring rods.

The mixture when deposited on the foundation shall be spread to proper thickness with wooden spreaders and floats. Thickness of floor shall be controlled by strips of the proper height.

Floors 1 in. in thickness shall be laid in one course. Floors 1 1/4 in. and 1 1/2 in. thick may be laid in one or two courses as conditions warrant.

In making joints, hot mastic shall be laid over the cold edge of the joint and allowed to remain until the same is heated and softened. Surplus material shall then be removed and joints made perfectly tight and compact by sufficient rubbing. Finished surface shall be sprinkled with fine sand and rubbed with sufficient pressure to eliminate all voids. If a light color surface is desired, floors shall be dusted with portland cement, to give uniform light color.



SARCO MINERAL RUBBER FLOOR, NASH MOTORS CO., KENOSHA, WIS.



SARCO MINERAL RUBBER FLOOR IN CORRIDORS, TOILETS AND ON STAIRWAYS IN CHICAGO PUBLIC SCHOOLS

STANDARD OIL COMPANY

(INDIANA)

Manufacturers of Paving Asphalt, Road Asphalt Oils and Binders

910 South Michigan Avenue
CHICAGO, ILL.

OFFICES FOR QUOTATIONS, ORDERS AND GENERAL INFORMATION

CHICAGO, ILL.
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DULUTH, MINN.
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SAGINAW, MICH.
DETROIT, MICH.
GRAND RAPIDS, MICH.
LA CROSSE, WIS.
MILWAUKEE, WIS.

Products.

STANOLIND PAVING ASPHALT.
STANDARD PAVING FILLER.
ROOFING ASPHALTS.
SATURATING ASPHALTS.
BRIQUETTING ASPHALTS.
FLUXING ASPHALTUMS.
ASPHALTIC ROAD OILS.
NON-ASPHALTIC ROAD OILS.

Stanolind Paving Asphalts.

GRADE "A"—For heavy traffic sheet asphalt pavements.

GRADE "B"—For sheet asphalt and asphaltic concrete pavements.

GRADE "C"—For asphalt macadam pavements (penetration method).

GRADE "D"—For surface treatment of roads and pavements.

CONSISTENCY—The range of consistency of grades "A," "B," "C" and "D" are ample to cover conditions in work for which they are recommended.

DESCRIPTION—Stanolind paving asphalts are refined from asphaltic petroleum by distillation and steam agitation, by an improved method in one of the largest, if not the largest, and most perfect refinery in the world.

All asphalts come out of the ground, some through crevices or cracks or openings in the earth's surface, or through pipes driven into the earth, and at different degrees of consistency.

It is readily seen that it is important that it should be properly refined and as free from impurities and as near pure bitumen as it is possible to make it.

Its purity in bitumen fixes its value, the main properties being cementing power, ductility, stability, and small loss in volatilization when put to use.

Stanolind paving asphalt has all of the necessary qualities required of a bituminous cement; in fact, it has a greater cementing strength than most of the asphalts on the market, and in its different consistencies gives perfect results in the widest climatic changes over the extensive territory in which it has been used.

Standard Paving Filler.

Stanolind paving filler for brick and granite block pavements.

Briquetting Asphalts.

Stanolind briquetting asphalt is used in the manufacture of briquetting coal; it is absolutely a perfect cement and gives forth no odor when burning.

Roofing Asphalts.

Parolite—soft, medium and hard.
Stanolite—semihard, soft and hard.
Stanolind Saturating Asphalt.
Petroleum Tailings.
Fluxing Asphaltums.

The grades and consistencies of same have ample range to fill all the requirements of the manufacturers of ready made roofing and asphalt shingles.

Fluxing Asphaltum.

Grade 6S for use in tempering paving and roofing asphalts.

Asphaltic Road Oils.

Furnished in grades Nos. 3, 4, 5 and 6.

No. 3 being the lightest, containing not less than 30% asphalt.

No. 6 being the heaviest, containing not less than 60% asphalt at 100 penetration.

No. 3 is recommended for laying and as a dust preventive.

No. 4 and No. 5 are recommended for dust preventive, and waterproofing earth, macadam and gravel roads.

No. 6 is recommended for second or third treatments.

Non-asphaltic Road Oils.

For dust laying purposes on brick roads, bridle paths, park walks, tennis courts, etc.

Use of Asphalt.

In planning for the use of asphaltic cement, we would suggest to engineers and architects that when drawing specifications, they use the following:

Specifications for Asphalt for Asphaltic Cement to be Used in Sheet Asphalt and Asphaltic Concrete.

By the careful distillation of petroleum with steam agitation at a temperature not exceeding 700° Fahr. until the resulting residue has a consistency not harder than 30 penetration, the specific gravity of which shall at 77° Fahr. be not less than 1.0.

(a) The solid residue so obtained shall be soluble in carbon tetrachloride to the extent of 98½%.

(b) If the solubility in carbon tetrachloride of the solid residue is less than 99%, the bitumen shall yield upon ignition not more than 15% of fixed carbon; if the solubility is 99% or more, the bitumen shall yield upon ignition not more than 18% of fixed carbon.

(c) When 50 grams of the material are heated for 5 hours at a temperature of 325° Fahr. in a tin box 2 $\frac{1}{8}$ in. in diameter by 1 $\frac{3}{8}$ in. deep, after the manner officially prescribed, it shall lose not over 5% by weight, nor shall the penetration after such heating be less than one-half the original penetration.

(d) When the refined asphalt is brought to a penetration of 50 by the use of the flux with which it is to be combined in making the asphaltic cement, or by heating at a temperature below 500° Fahr., it shall have a ductility of not less than 100 centimeters, test to be made at the rate of 60 centimeters per minute.

(e) The asphaltic cement shall show a cementing value of .25 of a kilogrammeter at 5° C. when tested at a penetration ranging from 50 to 70; test to be made as described on page 796, Vol. 6, Journal of Industrial and Engineering Chemistry.

(f) Asphaltic cement shall have a ductility of not less than 5 centimeters when tested at 5° C., test to be made at the rate of $\frac{1}{4}$ centimeter per minute.

The penetration of the asphalt used shall range between 40 and 65 and shall be within 5 points of such penetration as is deemed best for the particular work for which the specifications are drawn.

Our recommendations for repair work are from 35 to 45 penetration; for sheet asphalt on medium traffic streets, from 50 to 60 penetration, and for asphaltic concrete on medium traffic streets, from 55 to 65 penetration, when Stanolind paving asphalt is used.

Specifications for Asphaltic Cement to be Used in Asphalt Macadam Pavements (Penetration Method).

(a) The asphaltic cement shall have a specific gravity at 77° Fahr. of not less than 1.0.

(b) The bitumen of the asphaltic cement shall be soluble in carbon tetrachloride to the extent of at least 98 $\frac{1}{2}$ %.

(c) The fixed carbon of the asphaltic cement shall be not less than 8% nor more than 16%.

(d) The melting or softening point of the asphaltic cement shall be not less than 100° Fahr. nor more than 135° Fahr.

(e) The asphaltic cement shall have a penetration of from 80 to 150, which shall be varied within these limits to adapt it to the particular asphalt used, and to conditions of the streets.

(f) When 50 grams of the asphaltic cement of the consistency used in the paving mixture are heated for 5 hours at a temperature of 325° Fahr. in a tin box 2 $\frac{3}{8}$ in. in diameter by 1 $\frac{3}{8}$ in. deep, there must not be volatilized more than 3% of the bitumen, nor shall the penetration after such heating be less than one-half the original penetration.

(g) A briquette of the asphaltic cement of a consistency equivalent to 80 penetration shall have a ductility of at least 100 centimeters, tests made at the rate of 60 centimeters per minute.

(h) The asphaltic cement shall show a cementing value of 0.15 kilogrammeters at 5° C. according to method of test described in Journal of Industrial and Engineering Chemistry, page 796, Vol. 6. Test for cementing value to be made at a penetration ranging from 90 to 110.

(i) Asphaltic cement shall have a ductility of not less than 5 centimeters when tested at 5° C., test to be made at the rate of $\frac{1}{4}$ centimeter per minute.

We recommend the penetration for Stanolind paving asphalt to be used on medium traffic (penetration work) at from 100 to 120.

Specifications for Asphaltic Cement for Surface Treatments on Brick, Concrete, Water Bonded Macadam or Gravel Roads, or Cinder Drives.

SPECIFIC GRAVITY—The specific gravity of the asphaltic cement at 77° Fahr. shall not be less than unity.

LOSS BY VOLATILIZATION—When 50 grams of the asphaltic

cement are heated in a cylindrical vessel (tin box) 2 $\frac{1}{8}$ in. in diameter by 1 $\frac{3}{8}$ in. deep at a temperature of 325° Fahr. for 5 hours, the loss in weight shall not be greater than 5%, nor shall the penetration at 77° Fahr. after heating be less than one-half the original penetration.

PENETRATION—The asphaltic cement shall have a penetration of from 175 to 225 when tested for 5 seconds at 77° Fahr. with a No. 2 needle weighted with 100 grams. Its penetration at 32° Fahr., when tested for one minute with a No. 2 needle under a weight of 200 grams, shall not be less than 20.

FIXED CARBON—The asphaltic cement shall not yield more than 16% of fixed carbon when a 1-gram sample in a platinum crucible 35 millimeters by 35 millimeters is heated for 7 minutes in the full flame of a No. 4 Meker burner, according to the method recommended by the American Society for Testing Materials for the determination of fixed carbon in coal.

FLASH POINT—It shall have a flash point of not less than 350° Fahr.

PARAFFIN SCALE—It shall not contain more than 1.5% of paraffin scale by the Holde method.

DUCTILITY—It shall have a ductility of 77° Fahr. of not less than 100 centimeters when a Dow mould is pulled at the rate of 60 centimeters per minute.

SOLUBLE IN CARBON TETRACHLORIDE—The asphaltic cement shall be soluble in chemically pure carbon tetrachloride to the extent of at least 98 $\frac{1}{2}$ %.

SOLUBLE IN CARBON BISULPHIDE—The asphaltic cement shall be soluble in chemically pure carbon bisulphide to the extent of at least 99%.

VISCOSITY—It shall have a viscosity at 32° Fahr. of not less than 0.55 gram; the viscosity of the asphaltic cement, by the terms of this specification, shall mean the number of grams of asphaltic cement that will in 4 hours be forced through a circular orifice 1 centimeter in diameter by a pressure equal to that exerted by a column of mercury 150 centimeters high. The asphaltic cement during this test shall be contained in an iron cylinder 42 millimeters in diameter, and 100 millimeters high, and the thickness of the plate through which the orifice is made shall not be more than 2 millimeters.

RESIDUE—When 20 cubic centimeters of naphtha solution, obtained by treating 1 gram of the asphaltic cement with 100 cubic centimeters of cold naphtha, and filtering, is evaporated, the residue shall be adhesive, not merely oily.

The penetration we recommend for this class of work in most cases is from 190 to 210.

Booklet of Specifications.

In connection with asphaltic cement in different kinds of pavements, we have published a Stanolind paving asphalt booklet that gives complete specifications for the different kinds of pavements in which asphalt is used, and also the different surface treatments in which asphalts are used, the specifications covering a wide range of treating pavements of all the different kinds, as well as recommendations on paving fillers, expansion joints, etc. The booklet also contains useful tables and general information in regard to asphalts and paving construction. This booklet will be furnished free on request.

Shipments of Asphalt.

The asphalt products are shipped in bulk, tank cars, and also in iron drums. The softer asphalts are shipped in specially heavy, double headed, tightly sealed drums.

Co-operative Service.

Special and prompt attention is given to all requests and inquiries for information regarding the various uses of our asphaltic products.

THOMAS MOULDING BRICK CO.

Fiber Mastic Floor Covering
1206 Chamber of Commerce Building
CHICAGO, ILL.

REPRESENTED BY AGENCIES IN CITIES THROUGHOUT THE UNITED STATES

Product and Service.

T-M-B FLOORING: Fiber Mastic Floor Covering, Mastic Linoleum Floor Covering, Composition Flooring, Rubber Flooring.

Mastic Material sold and Floors installed anywhere.

T-M-B Flooring.

A tough, resilient covering and wearing surface for cement floors. T-M-B flooring is an artificial rubber floor covering built up to a thickness of $\frac{3}{16}$ in. by applying thin coats in plastic form. The finished floor covering is perfectly bonded to and forms an integral part of the underlying floor and is a continuous sheet of rubber-like texture without seams, joints or cracks, and having a soft, resilient, non-slippery tread.

Adaptability.

T-M-B flooring is well suited to use for light manufacturing and warehouse purposes, throughout schools, hospitals, institutions, office buildings, spaces used for gymnasiums, drill halls, toilets, locker rooms, comfort stations, etc.

WORK SPACES—For either entire workrooms or patches in front of workstands and benches. Does away with foot weariness. Eliminates necessity of the dangers of movable platforms for bench and vise hands. Largely increases the efficiency of any workman continuously on his feet.

ELECTRICAL INSULATION—For electric power plants and substations; wherever electric currents are present.

CHEMICAL PROOFING—For laboratories, plating rooms, etc.

STAIRWAYS—For all treads and landings. Gives safety (non-slipperiness) and quiet.

OUTDOOR USE—For porches, terraces, recreation roofs, etc.

AREAS TO BE AVOIDED—T-M-B flooring is *not suited* to use in garages, kitchens, packing houses or any space where the floors are subjected to the continued action of oil, grease, fats, gasoline or other hydrocarbon solvents, such as would affect rubber. It is also inadvisable to install T-M-B flooring for trucking purposes where loads are excessive or where motor tractors are used.

Advantages of T-M-B Flooring.

- (1) Warm, easy and non-slippery under foot.
- (2) Quiet and noiseless.
- (3) Dustless.
- (4) Waterproof and non-absorbent.
- (5) Very durable.
- (6) Easily and cheaply repaired. Can be maintained indefinitely in perfect condition.
- (7) Pleasing in appearance. Colors: green, red, brown and black.
- (8) Sanitary.
- (9) Chemically inert.
- (10) Non-conductor of electricity.
- (11) Will not crack, wrinkle, crawl or come loose from the underlying floor.
- (12) Economical in both first cost and maintenance.



Specification Data, Abbreviated.

T-M-B Flooring, where shown on plans or called for by the specifications, to be furnished and installed by or under supervision of THOMAS MOULDING BRICK Co., of Chicago, Ill.

SUBFLOOR OR BASE REQUIREMENTS—As T-M-B Flooring is not a structural material, but a tough, resilient covering and wearing surface, subfloor should be trowel finished cement, metal or magnesite composition with smooth level surface, sufficiently hard and strong to stand, without failure, the usage to which the finished T-M-B floor will be subjected. Grade to be $\frac{1}{8}$ in. below finished floor level.

COVED BASE—Finished cement, magnesite or metal. Not over 6 in. high.

STAIR TREADS, LANDINGS AND PLATFORMS—Finished cement, magnesite or metal, and provided with metal nosings so set that a $\frac{3}{16}$ -in. thickness T-M-B Flooring applied to tread or platform will finish flush with top of nosing.

GENERAL CONDITIONS—All subfloors to be delivered bone dry, broom clean and free from grease and paint.

Estimates, Co-operative Service and Guarantee.

This company will be pleased to furnish estimates or bids to supply all necessary labor and material to install T-M-B flooring anywhere.

Full detailed specifications, descriptive booklet, references and samples sent on request.

The THOMAS MOULDING BRICK Co. stand squarely back of their products in every way and assure satisfaction by all installations of T-M-B flooring applied by themselves or their authorized agents.

References and Typical Floor Installations.

Most of these are repeat orders:

Marshall Field & Company, Chicago, Ill.
Carson, Pirie, Scott & Company, Chicago, Ill.
Commonwealth Edison Company, Chicago, Ill.
Public Service Company of Northern Illinois
B. F. Goodrich Company, Akron, Ohio
United States Bureau of Standards, Washington, D. C.
United States Navy, Battleships and Destroyers
United States Naval Academy, Annapolis, Md., extensions to Bancroft Hall and other buildings
United States Emergency Fleet Corporation, deck covering throughout the living quarters on over 200 ships
E. I. du Pont de Nemours & Co., Wilmington, Del., Section No. 5
General Chemical Company, Laboratories
Inland Steel Company, Indiana Harbor, Ind.
Western Electric Company, Chicago, Ill.

A Few Architects and Engineers who Specify T-M-B Flooring.

Perkins, Fellows & Hamilton, Chicago, Ill.
Coolidge & Hodgdon, Chicago, Ill.
Richard E. Schmidt, Garden and Martin, Chicago, Ill.
Pond & Pond, Chicago, Ill.
A. S. Alschuler, Chicago, Ill.
Herman J. Gaul, Chicago, Ill.
Arthur Foster, Chicago, Ill.
Geo. B. Prinz, Omaha, Nebr.
H. H. Turner, Grand Rapids, Mich.
Mills, Rhines, Bellman & Nordhoff, Toledo, Ohio
F. A. Carpenter, Rockford, Ill.
Howard H. Hahn, Kenosha, Wis.
Lockwood & Greene, Engineers, Chicago, Ill.
Frank McNally, Structural Engineers, Chicago, Ill.
Walsen Engineering Company, Cleveland, Ohio
Osborn Engineering Company, Cleveland, Ohio

L. SONNEBORN SONS, INC.

Manufacturers of Concrete Floor Hardeners and Technical Paints

262 Pearl Street
NEW YORK, N. Y.

FACTORY: AVONDALE, N. J.

Products.

LAPIDOLITH, the Liquid Hardener for concrete floors and Waterproofers for concrete and stucco walls.

CEMCOAT, a Wall and Floor Coating for concrete and other building materials.

FERMO, an Integral Liquid Chemical for the acceleration of the setting, and for prevention of freezing of concrete mixtures.

LIGNOPHOL, a Preservative for wooden floors.

Hydrocide, for dampproofing foundations and walls; Structural Steel Paints.

Lapidolith.

Lapidolith is an inorganic liquid chemical which renders new concrete floors hard, dustproof, wearproof and watertight. When applied to old concrete floors, Lapidolith will prevent further dusting and disintegration.

LAPIDOLITH
TRADE MARK

Advantages of Lapidolith.

Prevents dusting and wear of floors. This chemical permeates the concrete and renders it as hard as granite.

Lapidolized floors take on a fine surface finish under service and can be easily washed and swept.

Lapidolith prevents the formation of concrete dust, thus saving expensive repairs to machinery, injury to merchandise, etc.

The labor cost of applying Lapidolith is negligible. Only unskilled labor is required, and an average man should be able to cover from 10,000 to 15,000 sq. ft. per day with one application.

Covering Capacity of Lapidolith.

According to porosity, 1 gal. will cover about 70 to 100 sq. ft.

Directions for application furnished in each case.

Lapidolith Specifications for Concrete Floors.

Harden and dustproof all concrete floors with Lapidolith, manufactured by L. SONNEBORN SONS, INC., New York, as per their directions and under their supervision.

Service Work for Lapidolith.

This company itself is prepared to apply Lapidolith under the supervision of a service engineer on areas of 20,000 sq. ft. and over. In New York City and wherever it has branch offices or representatives, or in

localities where its service crew happens to be working, it is able to undertake service work involving smaller areas.

Some Present Users of Lapidolith.

Aluminum Company of America	General Chemical Company
American Woolen Company	B. F. Goodrich Company
American Writing Paper Company	Johns Hopkins University Buildings
Armstrong Cork Company	National Lamp Works
Bethlehem Steel Company	Nordyke & Marmon Company
Canadian Fairbanks-Morse Co.	A. G. Spalding & Bros. Mfg. Co.
Carnegie Steel Company	Three In One Oil Company
Chalmers Knitting Company	U. S. Navy Department
Chevrolet Motor Car Co.	U. S. Steel Corporation
Continental Can Company	Washburn-Crosby Company

Cemcoat for Interior and Exterior Use.

Cemcoat is an ideal, enamellike wall and floor coating, in white and colors. Absolutely free from all poisonous ingredients.

Cemcoat
TRADE-MARK

It forms an even, light reflecting, non-porous surface, which affords no lodgment for dust and can not be injured by soap and water, or even water applied with a hose.

Fermo.

Fermo will:

- (1) Accelerate the setting of concrete.
- (2) Prevent concrete from freezing at low temperatures.
- (3) Densify concrete and reduce its permeability.
- (4) Produce a smooth, workable concrete mass which is much more easily troweled than ordinary cement.

Lignophol, the Preservative of Wooden Floors.

New floors will be protected from splintering and decay; old floors will be revived and their life prolonged.

Lignopholed floors last longer, are dustless, smooth and sanitary.

Further Information.

The following printed matter will be sent on request: Booklet, "Concrete and Lapidolith," and Scientific Test Reports.

Booklet, "Why Lapidolize?"

Specification booklet covering Lapidolith, also Cemcoat, Hydrocide Fermo, Lignophol and other Sonneborn products.

Samples, flask of Lapidolith and hardened block of concrete.

THE MASTER BUILDERS COMPANY

Metallic and Liquid Concrete Floor Hardeners

CLEVELAND, OHIO

SALES OFFICES

NEW YORK CHICAGO PHILADELPHIA DETROIT ATLANTA DALLAS MONTREAL TORONTO
LONDON, ENG. AMSTERDAM, HOLLAND CHRISTIANIA, NORWAY SYDNEY, N. S. W.

Products.

MASTER BUILDERS CONCRETE HARDNER, used in accordance with MASTER BUILDERS METHOD for making concrete floors dust-proof, wearproof and waterproof.

MASTER BUILDERS SANISEAL, a liquid chemical for hardening and dustproofing cement floors.

MASTER MIX (controls concrete) a colorless, odorless liquid chemical used integrally in cement mixtures, stucco, brick mortar, etc.

Master Builders Waterproofing Paste and Powder; Master Builders Technical Paints.



Master Builders Method

TRADE-MARKS

Registered United States
Patent Office

If rock or grit is used in addition to sand, specify as follows, instead of above: 1 part tested portland cement; 1 part crushed rock or grit (not over $\frac{3}{8}$ in. in size), free of dust; 1 part clean, coarse, gritty sand.

MEASURING VOLUMES—These proportions shall be accurately measured by volume, in suitable size boxes. No counting by shovels, or measuring by wheelbarrows or other approximation will be permitted. To determine proper proportions, 1 bag of cement shall equal 1 cu. ft. of sand or grit.

ADDITION OF WATER—Mix thoroughly dry until uniform in color, showing no streaks or patches of the constituents; if mixed by hand, topping aggregate shall be turned over dry three times. Add sufficient water to saturate mixture and mix thoroughly again. Topping shall at no time be made sloppy.

APPLICATION OF TOPPING—Lay and straightedge the topping to a true and even surface; float the surface well with wooden floats to close all voids and hollows.

WEARPROOF FINISH—A dry mixture of 1 part Master Builders Concrete Hardner to 1 part tested portland cement (by weight), mixed to an even color, shall be sprinkled evenly over surface. Not less than 20 lbs. of Master Builders Concrete Hardner and 20 lbs. of portland cement shall be distributed in this manner over each 100 sq. ft. This shall be floated in thoroughly and troweled. A second troweling shall be given surface when it has set sufficiently to finish hard and smooth.

Under no circumstances shall the wearproof finish be applied when there is any surplus water on the floated surface.

SAFEGUARDING THE FLOOR—After topping has set up, contractor shall cover it with a uniform layer of soft wood sawdust, shavings, or other suitable covering. This covering must not be applied until experiment shows surface hard enough to prevent covering from scratching or injuring the finish. Surface shall be kept wet for at least 5 days. Floors, if protected as above, will be ready for light traffic in 1 week, and for heavy traffic in 3 weeks, under favorable weather conditions.

EXCEPTIONS—The foregoing "Standard Specification" is the standard method of procedure for the average building. The 20 lbs. of Master Builders Concrete Hardner recommended per 100 sq. ft. will give a surface which will withstand any average service. However, there are some cases where the quantities should be varied. These exceptions follow:

In buildings where floors are subjected only to light foot traffic, specify 15 lbs. of Master Builders Concrete Hardner to every 100 sq. ft. for the wearproof finish. For floors, piers and loading platforms, etc., which receive extremely heavy wear, specify 25 lbs. of Master Builders Concrete Hardner to every 100 sq. ft. for the wearproof finish. For railroad repair shops, forge shops, etc., specify 30 lbs. of Master Builders Concrete Hardner to every 100 sq. ft. for the wearproof finish.

Description and Advantages of Master Builders Method.

Ordinary concrete floors dust and wear into ruts and holes. The reason for this is their porous structure and lack of proper wearing aggregate. Master Builders Method is a formula for building concrete floor surfaces according to definite, standardized principles which eliminate the defects of ordinary concrete floor construction and produce wearproof, dustproof and waterproof concrete floors.

To accomplish this result, Master Builders Method employs Master Builders Concrete Hardner, a perfectly graded, scientifically treated metallic aggregate, which, when added to the sand and cement when the topping of the floor is installed, eliminates all pores and supplies a hard wearing, permanent, non-abrasive element that withstands the wear and tear under which ordinary concrete floors break down and wear out.

Master Builders Method is the original and standard method for producing concrete floors that will not dust or absorb moisture and that will resist the hardest kind of wear. Over 30,000 users have more than 100,000,000 sq. ft. of surface in use to date.

Master Builders "Standard Specification."

Recommended for making wearproof, dustproof and waterproof concrete floors in every type of building.

Wherever practicable, topping to be laid before base has set.

PROPORTIONS OF TOPPING—Topping (thickness at least full $\frac{3}{4}$ in.) shall consist of the following proportions: 1 part tested portland cement; 2 parts coarse, gritty, clean sand.



BIG FOUR RAILWAY SHOPS, BEACH GROVE, IND.
75,000 sq. ft. Masters Builders Method concrete floors laid in 1912

Master Builders Red or Black Concrete Hardner.

Either of these colors may be obtained, combined with the hardening elements found in the regular Hardner, and are particularly desirable to use where the decorative fitness of the floor is as important as its wearing qualities.

Master Builders Saniseal.

On concrete floors, already laid and not giving satisfactory service, or where it is impossible or impracticable to use a metallic hardener in laying the floor, Saniseal is the ideal material to use. It combines with the lime in the cement, forming a new crystal that is exceedingly hard and wear resisting. It changes the soft, porous surface to a flintlike hardness.

Saniseal is easy to use. No complicated dilutions or applications necessary. Except where a floor is exceptionally porous, 1 gal. of Saniseal will cover approximately 100 sq. ft. Does the work overnight in most cases.

Master Mix.

Master Mix gives the answer to five vital questions in concrete construction:

(1) How to accelerate the final set of the cement, without weakening its tensile strength. (2) How to produce ideal troweling conditions. (3) How to create at low cost a dense, hard surface that will not dust. (4) How to secure waterproof concrete. (5) How to prevent concrete from freezing at ordinary low temperatures.

The scientific explanation of how Master Mix settles these "how" problems requires more space than is available here, but its accomplishments can be touched upon in sufficient detail to show the amazing possibilities and opportunities in this preparation.

Master Mix accelerates the final set of the cement from 2 to 4 hours; increases the tensile strength 71% in the first 24 hours and from 5% to 10% permanently; produces a "fatty" condition of the cement that makes it 100% easier to trowel; hydrates from 40% to 50% more cement than water, thus producing a dense, hard surface that will not dust or crumble; prevents concrete and stucco from freezing at ordinary low temperatures; renders concrete waterproof, through giving it sufficient density to prevent water seeping through.

Every claim made for Master Mix is amply borne out by years of actual use in all types of buildings and

millions of square feet laid in the most important building operations in the country.

Contractors have long been waiting for a material that would produce ideal conditions and results without having to follow complicated instructions. Here it is in Master Mix.

Master Mix Specifications.

FOR ACCELERATING SET OF CEMENT AND HARDENING CONCRETE FLOORS—1-in. topping is recommended, proportioned 2 parts clean, fairly coarse, sharp sand and 1 part fresh tested portland cement. Mix thoroughly dry. Add Master Mix to gauging water gradually in proportion of 1 gal. Master Mix for every barrel of cement used. Pour, float and trowel cement in usual manner. A second troweling when surface is sufficiently set will produce a hard smooth finish. Protect surface from injury and keep it wet until surface is hard. For this purpose use a layer of soft wood sawdust, properly wet down.

FOR WATERPROOFING BRICK MASONRY—Mortar in which bricks are laid should be 1 part cement and 2 parts sand. Mortar to be tempered with water to which has been added Master Mix in proportion of 1 gal. waterproofing to 10 gals. of water. Carefully grout each course of bricks, taking care that all joints are filled with mortar.

FOR WATERPROOFING CONCRETE AND CEMENT MIXTURES—To waterproof 1-2-4 mass concrete add $\frac{3}{4}$ gal. of Master Mix to gauging water to each barrel of cement. To waterproof 1-2-5 mass concrete add 1 gal. of Master Mix gauging water to each barrel of cement.

Concrete walls, floors, etc., can be made waterproof by the application of a cement coat into which Master Mix has been introduced. A mixture of 1 part cement to 2 parts sand should be made and tempered with water and Master Mix in the proportion of 1 gal. of Master Mix to 18 gals. of water.

FOR WATERPROOFING STUCCO—Stucco shall be applied in 2 coats. The straightening coat shall consist of 1 part portland cement and 3 parts sand. This shall be gauged with a solution of 1 part Master Mix to each 18 parts of water.

Wall shall first be thoroughly wetted and the straightening coat applied $\frac{3}{4}$ in. thick. Finish coat shall consist of 1 part portland cement and $2\frac{1}{2}$ parts clean sand, which shall be gauged with the same strength solution of Master Mix and water as the straightening coat and applied $\frac{1}{4}$ in. thick.

TO MAKE MASONRY IMPERVIOUS TO MOISTURE—To a mixture of 1 gal. Master Mix and 3 gals. water gradually stir about $\frac{1}{2}$ bag of portland cement to a creamy consistency. Apply in 3 coats, with a brush or spray.

First coat is a penetrating one, mixture for which should be as thick as the brush will carry, and well embedded, taking particular care to fill all joints and cracks. The second is a further filler. The third is the finish coat to which any color or effect can be given. Above coating also acts as a cold water paint.

TO PREVENT CONCRETE FROM FREEZING—Use the following proportions to hydrate the mixture at indicated temperatures. Add Master Mix to gauging water. Temperature 32°, 1 part Master Mix, 20 parts gauging water; temperature 25°, 1 part Master Mix, 15 parts gauging water; temperature 18°, 1 part Master Mix, 10 parts gauging water; temperature 13°, 2 parts Master Mix, 10 parts gauging water.

Master Mix
CONTROLS CONCRETE

TRADE-MARK



FIELD MUSEUM, CHICAGO, ILL.

GRAHAM, ANDERSON, PROBST & WHITE, Architects THOMPSON-STARRETT COMPANY, General Contractors McNULTY BROS. Co., Subcontractors
Area: 500,000 sq. ft. Master Mix floors. Approximate total cost of project: \$12,000,000.00. One of the finest and costliest buildings for the purpose in the world

THE VITRIFYX COMPANY

Manufacturers of Concrete Hardener, Portland Cements, Hydrolithic and Colored, and Cement Chemicals.

Chamber of Commerce Building, 133 West Washington Street

TELEPHONE:
MAIN 1065

CHICAGO, ILL.

Products.

VITRIFYX, a Liquid Chemical Concrete Hardener for surface application.

VITRIFYX INTEGRAL, a Liquid Chemical Concrete Hardener for incorporating into the cement mix.

Improved Hydrolithic Cement for Integral Waterproofing; Colored Portland Cements for top finish work of Floors and Walls.

Vitrifyx.

DESCRIPTION—Vitrifyx is a liquid chemical concrete hardener which makes concrete as hard as granite; it makes surfaces proof against acid, dust, oil, water and wear. As effective on old as on new concrete floors, walls or stucco. This material hardens and preserves concrete floors permanently, to withstand the heaviest trucking, foot traffic, etc., and prevents all sanding and dusting. Many floors, considered worthless, have been made serviceable by applying Vitrifyx at a total cost of less than one-tenth the expense for installing a new floor topping.

ADVANTAGES—Absolutely no upkeep cost involved, as results are guaranteed to be permanent. The application of this product actually changes the nature of the concrete by acting chemically on the concrete's elements, producing a new component, practically wear-proof. By acting principally on the weakest part of any concrete floor, namely, the cement matrix, Vitrifyx imparts strength where it is most needed, and really makes the surfaces undergoing treatment 100% serviceable, as compared to the practice of adding or substituting metal, granite, or other hard substances in the usual cement and sand topping, which obviously does not harden the cement used, the latter remaining unchanged and comparatively soft.

Satisfactory results insured, because it is only necessary to flow the material over the surface to be treated—Vitrifyx will do the rest.

How to Use—New concrete floors may be treated with Vitrifyx before the skin coat on the surface is badly abraded, thereby preserving the original finish. Vitrifyx may, however, be used successfully on any concrete floor, provided part of topping is still left.

Vitrifyx is not mixed into the concrete before the concrete is laid, but is applied after the concrete has set and dried. The only requirement for a perfect job is that the work to be treated be of ordinarily good construction, properly finished.

COST—Depends on the area to be treated, and the conditions that the treated work must endure. The cost for all labor and all material varies from 2¢ to 5¢ per sq. ft.



TRADE-MARK
(Reg. U. S. Pat. Off.)

TERRITORY—No point too distant. The sun never sets on Vitrifyx-treated buildings.

HOW TO SPECIFY—All concrete floors, stair treads, landings, etc., throughout the building, shall be treated with Vitrifyx, as manufactured by THE VITRIFYX COMPANY, Chamber of Commerce Building, Chicago, in strict accordance with their instructions to render these concrete surfaces [state what is desired—i.e., dustproof; wearproof against heavy trucking; wearproof against foot traffic; acidproof; oilproof; water-

proof, etc.]

Detailed information promptly furnished regarding suitability of this product for any special work.

REFERENCES—A few professional references are given herewith:

Stewart-Warner Speedometer Corporation, Chicago, Ill., L. G. Hallberg & Co., Architects
Central Manufacturing District, Chicago, Ill., S. Scott Joy, Architect
Consolidated Engineering Company, Chicago, Ill., Chatten & Hammond, Architects
Sisson Apartment Hotel, Chicago, Ill., H. R. Wilson & Co., Architects
U. S. Reconstruction Hospital, Chicago, Ill., Schmidt, Garden & Martin, Architects
Corkran Hill Co., Baltimore, Md., Gardner & Lindberg, Architects
Peerless Foundry, Cincinnati, Ohio, Frank D. Chase, Architect
American Linseed Co., Detroit, Mich., Francisco & Jacobus, Architects
Western United Gas & Electric Company, Joliet, Ill., Zimmerman, Saxe & Zimmerman, Architects
Illinois Central Railroad Suburban Stations, Chicago, Ill., O. F. McLaughlin, Architect
International Harvester Company, Toledo, Ohio, W. D. Price, Architect
Four Lakes Ordnance Co., Madison, Wis., Austin Co., Builders
Lakeside Paper Co., Neenah, Wis., Edward Wettengel, Architect
Allis-Chalmers Manufacturing Co., Milwaukee, Wis., Klug & Smith, Architects
L. Teweles Seed Co., Milwaukee, Wis., Fraser Co., Engineers
Youngstown Sheet & Tube Company, Youngstown, Ohio
Excelsior Shoe Company, Portsmouth, Ohio
Central Ohio Paper Company, Columbus and Toledo, Ohio
Selby Shoe Company, Portsmouth, Ohio
La Belle Iron Works, Steubenville, Ohio
Owens Bottle Machine Company, Toledo, Ohio; Clarksburg and Fairmont, W. Va.
American Railway Express Co., Chicago, Ill.
Wm. Wrigley, Jr., Co., Chicago, Ill.
Worthington Pump & Machinery Corp., Cincinnati, Ohio

Vitrifyx Integral.

Vitrifyx Integral, a colorless liquid chemical, is much more than a hardener and waterproofer. It produces vital and permanently beneficial effects on the cement. It is composed of no ingredients at all detrimental, and contains no alum, acid, greases, oils or hydrate of lime.

MAKES A HARD, DENSE, DUSTLESS SURFACE—Vitrifix Integral accelerates the hydration of the cement and provides the necessary amount of dampness to insure perfect curing of the concrete. It permits the cement mortar to be mixed with less water and still be easier to trowel and finish, thus enabling the finisher to produce a harder and denser surface that will eliminate any danger of the cement setting in suspension and insures a dustless and waterproof floor.

MAKES PERFECT TROWELING CONDITIONS—The mortar develops a firmer texture through the expulsion of superfluous water, and stiffens to proper consistency to work most advantageously. In consequence, a much greater surface can be finished per day, and that perfectly dense and smooth.

ACCELERATES FINAL SET OF CEMENT AND INCREASES TENSILE STRENGTH—Final set of cement is accelerated from 2 to 4 hours. At the same time, the tensile strength is greatly increased. Vitrifix Integral produces these results by raising the temperature of the water, effecting more complete hydration of the cement and the rapid evaporation of uncombined surplus water.

RENDERS CONCRETE WATERPROOF—The densest concrete obtainable is effected through the increased hydration produced by Vitrifix Integral. The concrete is thus made lastingly waterproof. As an effectual waterproofing Vitrifix Integral is unsurpassed.

HINDERS FREEZING OF CONCRETE—Vitrifix Integral makes it possible to pour concrete work at much lower than customary temperatures, without providing additional protection. The freezing point is lowered and the set quickened, producing a perfect surface.

SPECIFICATIONS—*For Accelerating Set of Cement and Hardening Concrete Floors*—A 1-in. topping is recommended proportioned 2 parts clean, fairly coarse, sharp sand and 1 part fresh tested portland cement. Mix thoroughly dry. To 10 gals. of gauging water, add 1 gal. Vitrifix Integral for every barrel of cement used. Use this solution to hydrate the mixture. Pour, float and trowel the cement in the usual manner. A second troweling when surface is sufficiently set will produce a hard, smooth finish.

Protect surface from injury and keep it wet until surface is hard. For this purpose use a layer of soft wood sawdust, properly wet down.

For Waterproofing Brick Masonry—The mortar in which the bricks are laid should be of 1 part cement and 2 parts sand. The mortar is to be tempered with water to which has been added Vitrifix Integral in the proportion of 1 gal. waterproofing to 10 gals. of water.

Carefully grout each course of bricks, taking care that all joints are well filled with mortar.

For Waterproofing Concrete and Cement Mixtures—To waterproof 1-2-4 mass concrete add $\frac{3}{4}$ gal. of Vitrifix Integral to gauging water to each barrel of cement.

To waterproof 1-2-5 mass concrete add 1 gal. of Vitrifix Integral to gauging water to each barrel of cement.

Concrete walls, floors, etc., can be made waterproof by the application of a cement coat into which Vitrifix Integral has been introduced. A mixture of 1 part cement to 2 parts sand should be made and tempered with water and Vitrifix Integral in the proportion of 1 gal. of Vitrifix Integral to 18 gals. of water.

For Waterproofing Stucco—The stucco shall be applied in 2 coats. The straightening coat shall consist of 1 part portland cement and 3 parts sand. This shall be gauged with a solution of 1 part Vitrifix Integral to each 18 parts of water. The wall shall first be thoroughly wetted and the straightening coat applied $\frac{3}{4}$ in. thick. The finish coat shall consist of 1 part portland cement and $2\frac{1}{2}$ parts clean sand which shall be gauged with the same strength solution of Vitrifix Integral and water as the straightening coat and applied $\frac{1}{4}$ in. thick.

To Make Masonry Impervious to Moisture, etc.—To a mixture of 1 gal. Vitrifix Integral and 3 gals. water gradually stir about $\frac{1}{2}$ bag of portland cement to a creamy consistency. Apply in 3 coats, with a brush or spray.

The first coat is a penetrating one, the mixture for which should be as thick as the brush will carry, and well rubbed in, taking particular care to fill all joints and cracks. The second



STEWART-WARNER SPEEDOMETER CORPORATION, CHICAGO
Floors in these buildings treated with Vitrifix Integral

is a further filler. The third is the finish coat, to which any color or effect can be given.

The above coating also acts as a cold water paint.

To Prevent Concrete from Freezing—Use the following proportions to hydrate the mixture at indicated temperatures when aggregate and water are heated. Add Vitrifix Integral to gauging water.

TEMPERATURE	PARTS OF VITRIFIX INTEGRAL	PARTS GAUGING WATER
32°	1	20
25°	1	15
18°	1	10
13°	2	10

REFERENCES—The following constitute a few of the numerous concerns that have used Vitrifix products:

Crompton Co., Crompton, R. I.
Sears, Roebuck & Co., Chicago, Ill.; Seattle, Wash.; Stockton, Cal.
New York Dock Co., Brooklyn, N. Y.
E. I. du Pont de Nemours Co., Wilmington, Del.
Standard Oil Co., Detroit, Mich.; El Dorado, Kans.; El Segunda, Cal.; Richmond, Cal.
Texas Co., Houston, Tex.; Atlanta, Ga.; Port Arthur, Tex.; Port Smith, Ark.
Hotel Statler, St. Louis, Mo.
Crane Co., Minneapolis, Minn.; Indianapolis, Ind.; Spokane, Wash.; Seattle, Wash.
John V. Farwell Co., Chicago, Ill.
Montgomery Ward & Co., Chicago, Ill.; Kansas City, Mo.
Libby, McNeil & Libby, Chicago, Ill.
Cudahy Packing Co., East Chicago, Ind.
Bartlett Hayward Co., Baltimore, Md.
Owens Bottle Machine Co., Toledo, Ohio; Fairmount, W. Va.; Clarksburg, W. Va.
Timken Detroit Axel Co., Detroit, Mich.
Ford Motor Co., Detroit, Mich.
Hupmobile Motor Co., Detroit, Mich.
Fisher Body Co., Detroit, Mich.
Buick Motor Car Co., Flint, Mich.
Chevrolet Motor Car Co., Flint, Mich.; Oshawa, Ont.
General Motors Co., Walkerville, Ont.
Stewart-Warner Speedometer Corporation, Chicago, Ill.
Universal Motor Co., New Orleans, La.
Coco-Cola Co., Dallas, Tex.
Gulf Sinclair Refining Co., Houston, Tex.
Humble Oil & Refining Co., Houston, Tex.
American Can Co., Fruitville, Cal.
Detroit Edison Co., Detroit, Mich.
American Sugar Refining Co., New Orleans, La.
Bemis Bros. Bag Co., New Orleans, La.
Henderson Sugar Refining Co., New Orleans, La.
Central Ohio Paper Co., Columbus, Ohio; Toledo, Ohio
Aluminum Co. of America, New Kensington, Pa.
National Lead & Oil Co., New Kensington, Pa.
Utah Copper Company, Arthur, Utah; Bingham, Utah
W. H. Harris Grocery Company, Richmond, Va.
Exposition Cotton Mills, Atlanta, Ga.
City of Tulsa, Tulsa, Okla.
Blackwood Tire Company, Nashville, Tenn.
James Deering Estate, Miami, Fla.
Carnation Milk Products Co., San Francisco, Cal.; Sedro Woolley, Wash.
Clyde Cars Company, Clyde, Ohio
Cheek-Neal Coffee Company, Houston, Tex.
Morgan Lumber & Mfg. Company, Charleston, W. Va.

IRVING IRON WORKS COMPANY

Manufacturers of Grating Flooring and Safety Steps

TELEPHONE:
HUNTERS POINT, 3342

Dutchkills Creek and Third Street
LONG ISLAND CITY, CITY OF NEW YORK

Products.

Sole manufacturers of "IRVING SUBWAY" GRATING-FLOORING.

Also, of "Sunway," "Reticuline," "Eggcrate" and other forms of Grating, Grating-Flooring, and Grating-Flooring Accessories; Irving "Safstep" Stair and Ladder Steps; Irving Walkways; Metal Accessories for mining, power, pumping and industrial plants.

Trade-marks.

The trade-marks "Subway," "Sunway" and "Reticuline," as registered in the United States Patent Office, are the exclusive property of this company, and can not legally be used in connection with any other grating or grating-flooring product made by any other company.

Construction.

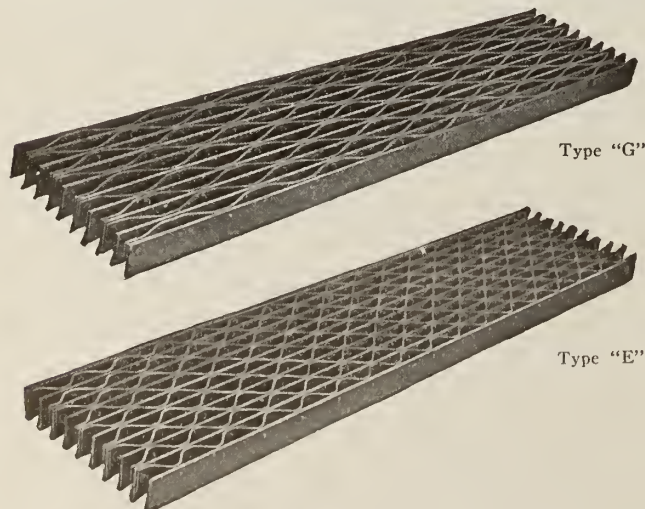
"Irving Subway" consists of a series of light steel bars placed on edge, between each pair of which a reticuline bar is placed and firmly riveted in position. The finished section is a light but inflexible panel embodying the well-known truss principle of construction, by which a load applied at any point is at once distributed over a wide area. Maximum strength is thus secured with the minimum weight of material. When riveted up, each section of "Irving Subway" is, in all essentials, a solid unit, in which there is, and can be, no looseness, no play, no rattling.

Types.

There are two standard types of "Irving Subway" as illustrated below, differing in appearance and in price, but not in strength or general merit. The rated load capacity is the same for both Type "G" and Type "E." Choice between them in any case is to be determined by the factor of size of mesh.

Exclusive Advantages.

Maximum strength per unit of weight; minimum weight per unit of load and span; uniform distribution



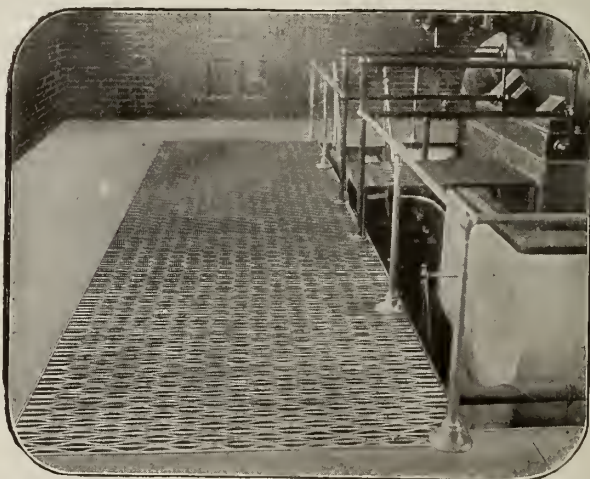
TWO STANDARD TYPES OF "IRVING SUBWAY" GRATING

IRVING SUBWAY
TRADE MARK
(PATENTED)
THE FIREPROOF VENTILATING FLOORING

IRVING SAFSTEP
TRADE MARK
(PATENTED)
ABSOLUTELY NON-SLIPPING ALWAYS

of load by truss construction; minimum deflection per unit of load and span; maximum lighting and ventilation area (80% of panel area); absolutely non-slipping surface; can not become loose and rattly; oil or grease, ice or snow, age or wear does not impair its non-slipping qualities; mini-

mum lodgment for dirt or solid objects; small size of individual openings (mesh) prevents passage of tools, etc.; wheels or rib-hooped barrels can be rolled over it in any direction without going through; its light weight permits minimum weight and cost of the supporting structure; safe, comfortable and noiseless to walk or work upon; safe to work under because nothing large or heavy can fall through it; openings for pipes, columns, etc., can be cut out without seriously impairing the strength of the panel; easily fitted into corners or formed in irregular shapes without impairment of strength; easily mounted or attached to any type of construction by means of specially devised fasteners—no drilling, no tapping, no bolts nor screws needed.



"IRVING SUBWAY" GRATING INSTALLED IN AN ENGINE ROOM

Applications.

Floors, walkways, and galleries in power plants; boiler room floors in oil-fired plants; pump platforms; coverings for turbine pits, pipe trenches, and drainage sumps; floors for mine cages, freight elevators, elevator pent houses, shaft houses; floors and platforms around tanks or vats; charging floors; floors of gas plants and retort houses; a substitute for water cooled plates, affording maximum area; armoring of concrete surfaces; stair and ladder steps, etc.

As a removable mat over a floor in laboratories or other places where sand or plaster might fall or be ground under foot and be tracked about, it offers peculiar advantages.

Catalogue.

Catalogue No. 2A17, sent on request, gives complete description, load rating, sizes, spans, weights and all other data, together with a list of representative users, reports of tests, and details of various applications.

AMERICAN ABRASIVE METALS CO.

Manufacturers of Antislip Treads

TELEPHONE:
CORTLANDT 7444, 7445

Hudson Terminal Building, 50 Church Street
NEW YORK, N. Y.

Products.

FERALUN and VULCALUN ANTISLIP TREADS.

Feralun.

Feralun is non-porous metal with abrasive grit embedded in the wearing surface to provide an approved durable and effective antislip tread.

This grit, embedded at the time of casting, projects slightly and bites, so that slipping is prevented, and in hardness is excelled only by the diamond. Being firmly held by the metal partly surrounding each grain the abrasive grit gives to Feralun its extreme durability.



FERALUN ANTISLIP TREAD

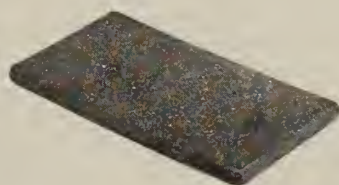
Note the antislip nosing and absence of grooves parallel to it

Feralun treads are more durable than treads having lead, cement or asphalt as the body. They do not deteriorate through corrosion, as they do not have a steel base.

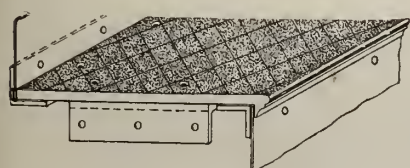
Vulcalun.

A mixture of rubber and abrasive grit vulcanized to a steel reinforcing plate contained entirely within a pure rubber base.

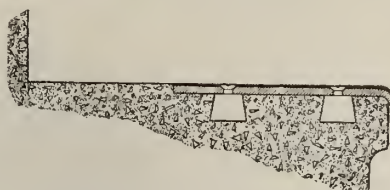
Its outstanding advantages are: (1) High dielectric strength showing no leakage up to 7500 volts and flash over not occurring until 20,000 volts. It is therefore desirable for walkway surfaces around switchboards, etc. (2) Light weight—about $3\frac{1}{2}$ lbs. per sq. ft., making it desirable for elevator car floors, automobile running boards, car steps, etc. (3) Does not corrode and therefore can be used on marble and elsewhere. Is not absorbent and does not disintegrate nor discolor. (4) Is not brittle and therefore does not shatter when struck. (5) Is obtainable in any size sheets up to 48 by 24 in.



VULCALUN WALKWAY SURFACE



STYLE "O" FERALUN ONE-PIECE ANTISLIP TREAD, REQUIRING NO SUBTREAD



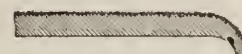
APPROVED CONCRETE STEP CONSTRUCTION, WITH STYLE "A" FERALUN INSERT 6 IN. WIDE



APPROVED METHOD OF REPAIRING WORN STEPS

Antislip Stair Treads.

Feralun and Vulcalun antislip stair treads are fireproof and slipproof, lasting much longer than iron, steel, slate or marble. They have no dangerous, slippery nosing edge or heel catching grooves. A plain or hatched abrasive surface, with the antislip element carried down over the nosing, makes these stair treads unequaled as a preventive of stair accidents.



Style "A" (Lipped)



Style "B" (Rounded)



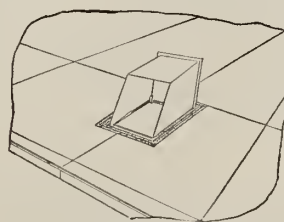
Style "C" (Ornamental)
FERALUN TREAD NOSINGS

Sizes and Designs of Feralun.

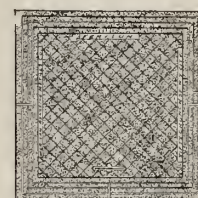
Made in any form in which it is possible to cast metal. Styles "A" and "B" are $\frac{5}{16}$ in. thick. Other designs are made $\frac{3}{8}$ in. thick, but are generally $\frac{1}{2}$ in. or $\frac{5}{8}$ in. thick.

Feralun Approved Coalhole Cover.

The Feralun cover conforms to the new requirements in New York City, and is being rapidly adopted as standard by other municipalities.



Open



Closed

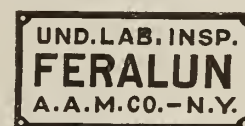
FERALUN SAFETY COALHOLE COVER

Other Forms.

Floor plates, door saddles, trench covers, drainage gratings, and other walkway surfaces, where steel and cast iron have proved unsatisfactory and dangerous by becoming slippery, are made of Feralun and Vulcalun. Slippery sidewalks, ramps and vault lights are made slipproof by Feralun strips, crosses or buttons.

Awards and Approval.

Feralun antislip treads are approved without qualifications as a fire safe and antislip tread by the Underwriters' Laboratories, Inc.



UNDERWRITERS' LABEL

AMERICAN MASON SAFETY TREAD CO.

LOWELL, MASS.

BRANCH OFFICES

BOSTON, MASS., 813 Old South Building

NEW YORK, N. Y., Grand Central Palace, 480 Lexington Avenue

CHICAGO, ILL., and ST. LOUIS, MO., JOSEPH T. RYERSON & SON, General Western Distributors

KANSAS CITY, MO., 604 Ridge Building

PHILADELPHIA, PA., 900 Widener Building

Products.

MASON SAFETY TREAD (lead or carborundum filled); MASON BLACK DIAMOND SAFETY TREAD; MASON SAFETY TREAD and CORK COMPOSITION; STANWOOD TREAD; STANWOOD-MASON TREAD; STANWOOD STEP; KARBOLITH FLOORING.

Mason Safety Sidewalk or Vault Lights, Mason Safety Coalhole and Ash Lift Covers, Mason Non-slip Ladder Shoes.

Uses of Mason Safety Treads.

These are adaptable to all of the many situations, inside and outside of a building, where the surface with which the foot comes in contact is liable to become slippery.

Manufacturing concerns and others employing labor should equip the stairs of mills, factories and other buildings with Mason safety treads; thresholds of doors and elevators, elevator floors, fire door thresholds, inclined passageways, vestibules, floors around engines or machinery, and elsewhere where there is likelihood of grease or oil deposits. This practice has been observed in many hundred instances.

They are adaptable to granite, marble, slate, cement, iron or wood; to old, partly worn or new surfaces; to straight or curved lines; and can be installed in a building already completed or during the course of construction.

Insurance.

Accident insurance companies expect and demand reasonable endeavor on the policy holder's part toward making the plant safe.

The Accident and Liability Department of the Aetna Life Insurance Co., in their book "Safeguards," refers to Mason safety tread as the proper device for dangerous stairs.

The AMERICAN MASON SAFETY TREAD CO. knows of no case where damages have been claimed for injuries from slipping that has been lost to the defendant when Mason safety treads have been used as a preventive, and the company has a long record of such cases decided in the defendants' favor.

90% of the safety treads in use are Mason make. Mason safety treads have been used constantly for many years.

Description of Mason Safety Treads.

Metal surfaces devised to provide an absolutely sure footing, to prevent accidents caused by slipping. Not superficial safety surfaces, but of a protective quality coextensive with the life of the tread, and continuously effective during the wearing down process.

Types of Mason Safety Treads.

Made in various types and in standard sizes as follows:

LEAD OR CARBORUNDUM FILLED MASON SAFETY TREAD—Made of rolled steel or extruded hard brass of

substantial thickness ($\frac{1}{4}$ in.) with alternate dovetailed and U-shaped grooves. The dovetailed grooves are filled either with lead or a mixture containing a large proportion of carborundum and other abrasive substances as is desired, and in combination with the open U-shaped grooves produce a surface, the continuous supports of which wear evenly, that can be readily swept or washed out, and whose slip resisting parts remain intact during the entire life of the tread.

With this tread there can be no filling of open grooves from mushrooming or creeping lead, no jagged edges for the retention of filth or germs and no abrasive top dressing to wear off, leaving a polished, dangerous, slip inviting surface.

The efficiency always equals the life in the lead or in the carborundum filled treads.



MASON SAFETY TREAD
Lead or carborundum filled

Standard Sizes—Steel Base: Width, $2\frac{1}{2}$, $3\frac{3}{4}$, 4, $4\frac{3}{4}$ and 6 ins. flat; 3 ins. with nosing or overhang and square back and $3\frac{1}{2}$ ins. with nosing and beveled back. These sizes in combination (with the exception of the 3-in. width with nosing having a square back) will produce any desired width. Cut to order with necessary countersunk holes and with anchors when used in connection with cement.

Hard Brass Base: Width, 2, $2\frac{1}{4}$, $2\frac{1}{2}$, $2\frac{3}{4}$, 3, $3\frac{1}{2}$, 4, and 6 ins. flat; with nosings similar to that of steel base in widths of $2\frac{1}{8}$ and $3\frac{1}{2}$ ins. and with deep nosings in widths of 2 and $2\frac{3}{4}$ ins. See details on following page.

MASON BLACK DIAMOND SAFETY TREAD—A non-slip tread with a deformed surface for the catching of foreign substances and with open end grooves for drainage. The non-slip, diamond shaped units are of an abrasive mixture, containing a large proportion of carborundum, surrounded by a frame of metal on edge, assuring durability. Particularly useful for door thresholds and elevator sills, on account of beveled edges and generally trim appearance. Furnished in brass or steel.



MASON BLACK DIAMOND SAFETY TREAD

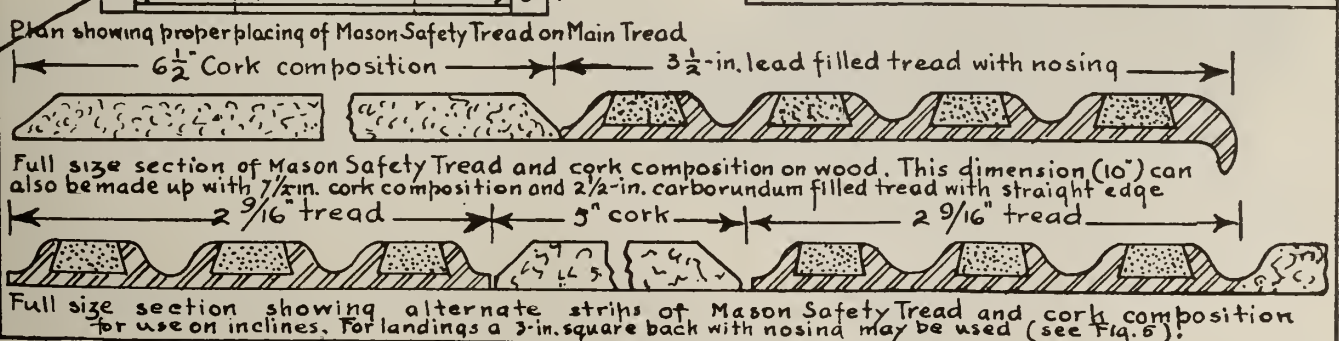
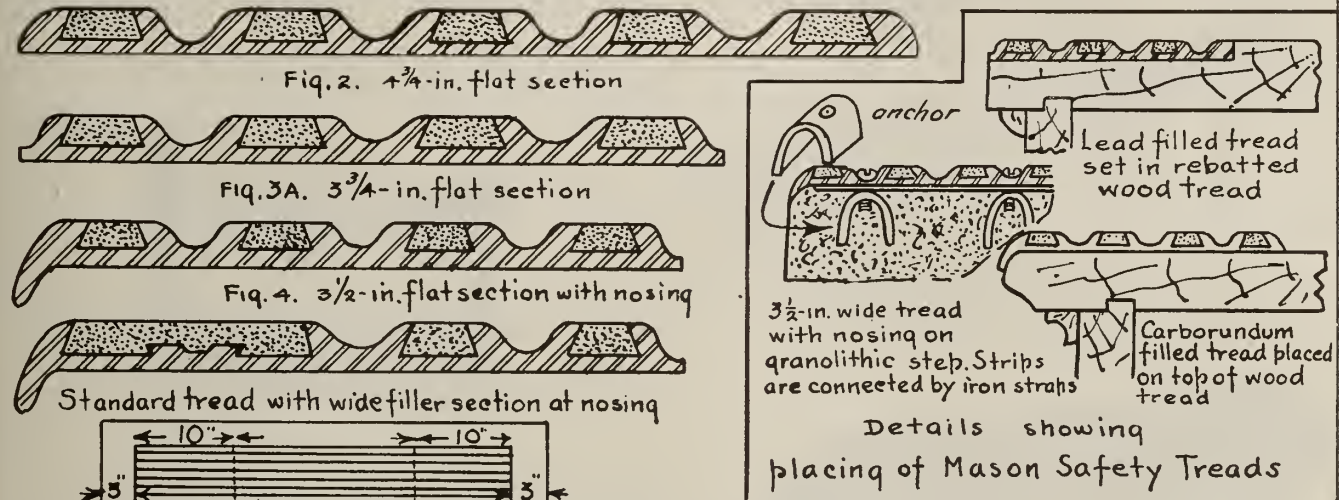
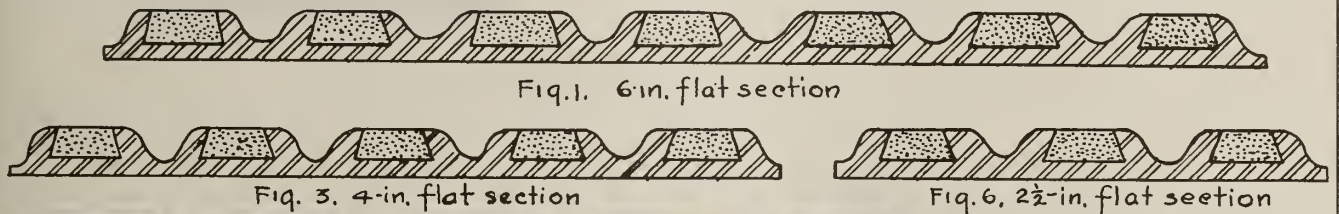
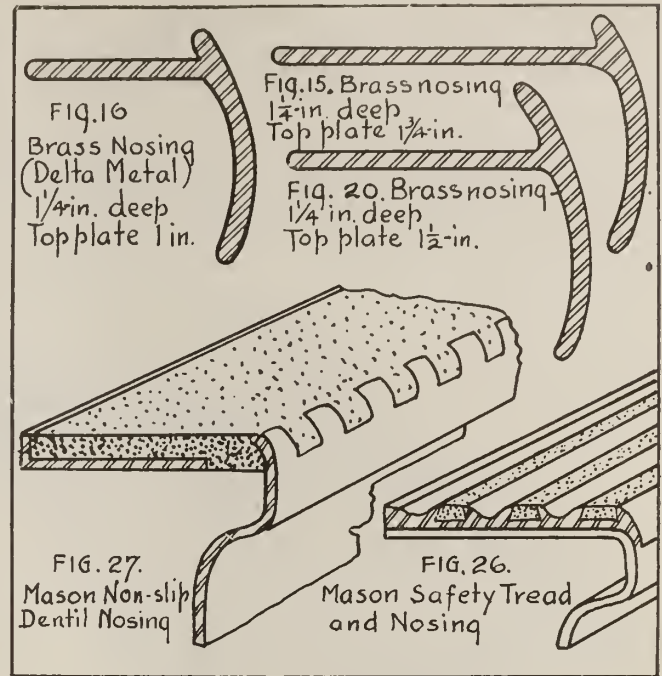
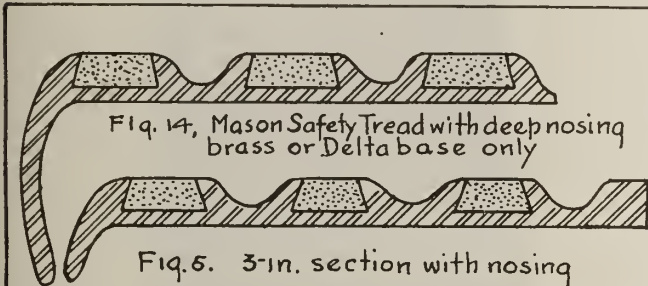
Brass Nosings.

For use in connection with flat strips on Mason safety tread (Figs. 15 and 16). They have also been used in connection with cork composition. Brass nosing (Fig. 20) has a deeper top flange and is used for tile, concrete, Karbolith or other composition treads.

Dentil Nosings.

Furnished in the combination Mason tread and nosing (Fig. 26) the safety tread being welded to a steel plate, or as in Fig. 27, where a carborundum cement filling is firmly secured to a base plate.

The construction of this nosing prevents the foot slipping forward over the extreme edge of the nosing, and sidewise as well, for which anchors are attached as shown in detail below. Both types are especially suited for use with concrete, asphalt, or composition filling.



DETAILS OF MASON SAFETY TREADS
(Lead or Carborundum Filled)

Mason Safety Tread and Cork Composition.

A combination suited to many interior conditions, particularly to long inclines and corridors. The cork composition is especially tough and springy and has long life under constant traffic.

Strips of cork composition are alternated with strips of lead or carborundum filled Mason safety tread as shown in details on preceding page.

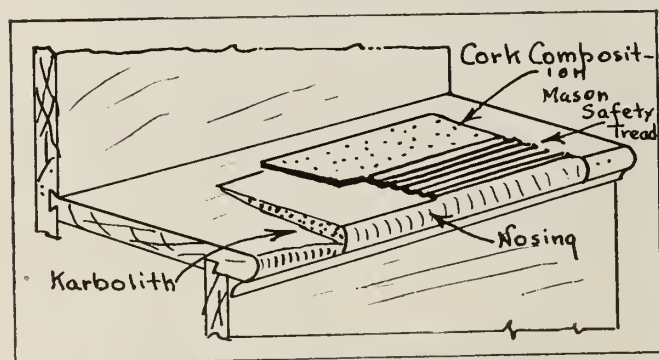
COMBINATION MATS—Mason safety treads and cork composition in movable sections. These are particularly adaptable to floors under revolving doors receiving a concentrated traffic which show wear quickly. This is particularly unsightly when the doors are removed during the summer.

The sections of these combination mats are interchangeable so that the wear may be equally distributed. Alternate strips are fastened to a heavy backing and the mats are fastened in place by screws.

Repairing Worn Stairs.

Badly worn stairs are brought to a finished condition by the use of Karbolith filling which forms a bed for Mason safety tread and cork composition. The width of the safety tread is determined by the worn condition of the step. The 3-in. piece with square back is made expressly for this condition.

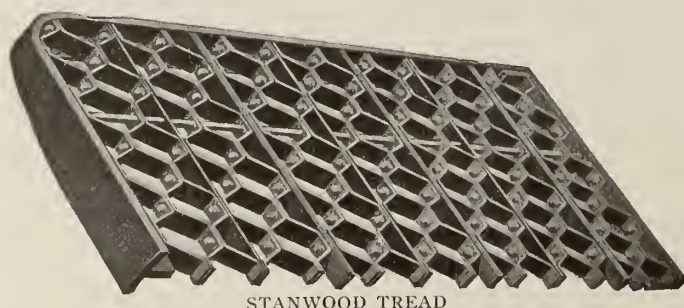
All evidence of repair is concealed by the use of hard brass nosings (Fig. 16) which may be of hard brass "copper" or rustproof steel.



REPAIRING WORN STAIRS

Stanwood Tread.

Very strong, and suitable for hard service where cleanliness and safety are important on stairways to engine rooms, areaways and similar conditions. These were originally designed for cars.



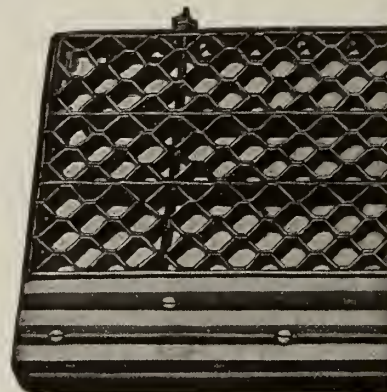
STANWOOD TREAD

Made up of a number of thin strips ($\frac{1}{2}$ and $\frac{7}{8}$ in.) high carbon steel, bent so that when assembled they form a series of openings in the surface of the tread. These strips are assembled and interlocked so that movement is impossible.

Frames, of rolled steel, are provided with a ledge to carry the strips, and rods pass through the frame and steel strips firmly tying them together. Additional straight strips of steel run lengthwise with the tread for extra support and sagging is impossible.

Stanwood-Mason Tread.

The regular Stanwood tread with a strip of Mason safety tread along the front edge.



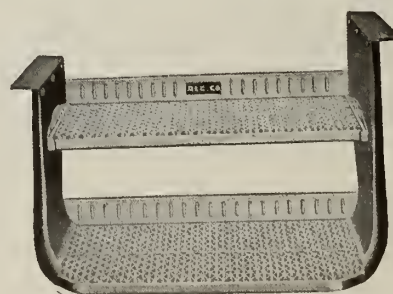
STANWOOD-MASON TREAD

Stanwood Step and Tread.

Toe guards are secured to tie rods and riveted to hangers. Hangers are of pressed steel and made in four styles of top suitable for various attachments.

Surface of tread is $\frac{3}{8}$ in. above upper edge of frame and beveled slightly, producing a non-slipping edge.

Made single, double, triple, quadruple or any other style, to order in any size and shape desired.



STANWOOD-MASON TREAD
Double step type

Karbolith Flooring.

A composition with a base largely of magnesium that produces a hard, durable surface, proof against rats, fires and germs. It is impervious to heat, cold and dampness and will not chip, crack, tear loose nor disintegrate. It can be laid over cement, iron or wood, and binds firmly to the base.

UNIVERSAL SAFETY TREAD COMPANY

NEW YORK OFFICE
120 Liberty Street

40 Court Street
BOSTON, MASS.

FACTORY
WALTHAM, MASS.

REPRESENTATIVES

PHILADELPHIA, PA., R. R. HAMMOND & Co., 417 Widener Building

DETROIT, MICH., HETTS COMPANY, 913 Dime Bank Building

CINCINNATI, OHIO, DURBROW & OTTE, 613 Elm Street

SEATTLE, WASH., S. W. R. DALEY, 332 Pioneer Building
CHICAGO, ILL., RAY P. LEE, 711 First National Bank Building
SAN FRANCISCO, CAL., G. H. TRASK, 76 Sacramento Street

Products.

UNIVERSAL SAFETY TREAD; UNIVERSAL SAFETY LADDER STEP; UNIVERSAL ANTI-SLIP METAL TREAD.

Universal Safety Tread.

USES—It may be used on wood, iron, concrete or stone; on stairs and inclines in all kinds of buildings; on car-steps and ladders.

CONSTRUCTION—The baseplate is of steel or brass, punched to receive the lead inserts, which are firmly interlocked. By this construction a continuous non-slip wearing surface of lead is presented, reinforced by the steel teeth to insure durability. The baseplate can be extended to form a nosing of any depth required, and the tread made in any widths up to 12 in. in one section.

RUBBER ALUMINUM TREADS—This Universal Tread is also manufactured with hard aluminum baseplate and rubber inserts, especially suitable for hotel stairs, car steps and vestibules, elevator platforms, and automobile step plates.

NAVAL WORK—The baseplate can be furnished of special *alloy-coated* or *galvanized* iron to resist the action of salt water; or of *brass* if desired, thereby rendering the tread *rust-proof*.

ANCHORS—In concrete work special anchors for attaching the treads are furnished.

Universal Safety Ladder Step.

USES—This step is designed for all types of vessels wherever an all-metal, *self-supporting* safety tread step is required; as well as for industrial purposes, engine room and powerhouse stairs, etc.

CONSTRUCTION—It is made of Universal Safety Tread plate, galvanized if desired, and stamped from one piece. The front and back edges are flanged down for the purpose of developing great rigidity, and are braced on the inside by iron straps riveted thereto. The ends are folded over, forming a double thickness of metal, through which holes are punched for the bolts that attach the steps to the supporting framework.

This step combines four essential features: non-slip efficiency, strength, light weight and rustproof advantages.

Universal Anti-slip Metal Tread.

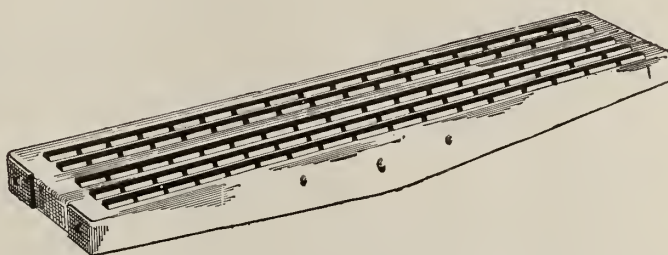
USES—This tread is designed for exceptionally severe wear, as on stairs in subways, sidewalks, etc.

CONSTRUCTION—It is made of *Alundum* grains, held to the metal base by a binder of lead composition. These abrasive grains give it the highest efficiency as a non-slip surface; and on account of the extraordinary hardness of the mineral, permanence and durability are assured. It can be made with *flat* or *corrugated* surface.

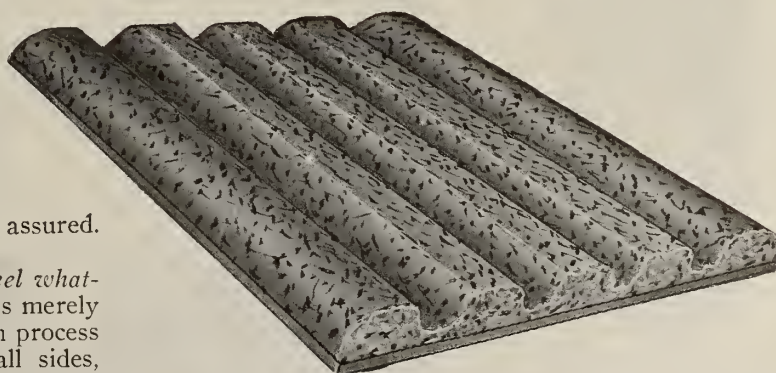
ADVANTAGES—The surface presents *no steel whatever* to become slippery, as the steel baseplate is merely used as a stiffener for the abrasive material. In process of manufacture the tread is lead-coated on all sides, which renders it absolutely *rustproof*, equal in all respects to a galvanized product.



UNIVERSAL SAFETY TREAD BEFORE AND AFTER LEAD IS ROLLED IN



UNIVERSAL SAFETY LADDER STEP
Tested to 1000 lbs. center load without deflection



UNIVERSAL ANTI-SLIP METAL TREAD
The most effective and durable safety tread on the market

THE PHILIP CAREY COMPANY.

Expansion Joint

GENERAL OFFICES AND FACTORIES
LOCKLAND, CINCINNATI, OHIO

BRANCHES AND DISTRIBUTING POINTS

ATLANTA
CHATTANOOGA
HAVANA, CUBA
LOS ANGELES
NEW ORLEANS
SAN ANTONIO
WASHINGTON
LINCOLN

BALTIMORE
CHICAGO
HOUSTON
LOUISVILLE
NEW YORK
SAN FRANCISCO
SIOUX CITY
SPOKANE

BIRMINGHAM
CLEVELAND
JACKSONVILLE
MEMPHIS
OKLAHOMA CITY
ST. LOUIS
VANCOUVER

BOSTON
DALLAS
KANSAS CITY
MINNEAPOLIS
OMAHA
SEATTLE
PORTLAND, ORE

TACOMA
BUFFALO
DETROIT
KNOXVILLE
MONTREAL
PHILADELPHIA
TAMPA
SALT LAKE CITY

CHARLOTTE
DENVER
LITTLE ROCK
NASHVILLE
PITTSBURGH
TORONTO
WHEELING
WINNIPEG

Products.

CAREY ELASTITE EXPANSION JOINT.

Also, Carey Flexible Cement Roofing, Asphalt Slate Shingles, Pipe Covering, Waterproofing and Asbestos Products.

Adaptability.

The Carey Elastite expansion joint is installed in all classes of street paving, and in any construction work where provision must be made for the expansion of materials: (1) In brick pavements, used longitudinally between gutter or curb and paving; (2) in wood block and granite block streets, concrete roads, cement sidewalk construction, it is laid down both longitudinally and transversely; (3) its application is universal in concrete bridges, walls, piers, viaducts, reservoirs, dams, etc.

Description.

It consists of a heavy body of special asphalt compound "sandwiched" between two layers of a special grade asphalt-saturated wool felt, the whole being firmly bonded together by the Carey combining process.

Thickness is uniform. Compound is evenly distributed between outside wool felts from top to bottom and end to end. Its melting point is high, and the material readily responds to any expansion.

Features.

Carey Elastite expansion joints provide for all temperature changes. They do not melt or ooze out in hot weather, retain their elasticity in the coldest weather, and keep cracks filled watertight when paving surface is contracted.

They take up all expansion stresses; prevent buckling and cracking of paving surface; absorb longitudinal and transverse stresses in cement sidewalks, and insure absolute perfection

and uniformity in every joint, from surface of pavement to base.

They make a better job than a poured joint.

They cost less to install and nothing to maintain.

They save labor and material; no tar or kettle gang, or spacing strips are required.

They save time, being installed by same man who lays pavement.

SPECIAL FEATURES—The asphalt used in joint meets the following requirements:

Melting point.....	250°F
Penetration (100 grams weight No. 2 needle, 5 seconds).....	38
Solubility in carbon bi-sulphide.....	100%
Solubility in carbon tetrachloride.....	99.6%
Solubility in carbon 74° naphtha.....	67%

Form.

Joints are sectional in form, or, when desired, are furnished cut to crown. They extend through entire thickness of pavement (perpendicular to its surface).

Width and Location.

Where joint is 1 in. thick or less, filler is provided in single thickness; if joint is over 1 in. thick, filler consists of several layers of equal thickness, a single layer in any case not exceeding 1 in. in thickness.

In concrete pavements (Fig. 2), transverse joints are not less than $\frac{1}{4}$ in. nor more than $\frac{3}{8}$ to $\frac{3}{4}$ in. in width, and are placed across pavement (perpendicular to center line), not more than 30 to 35 ft. apart; and longitudinal joint (between curb and pavement) is not less than $\frac{1}{4}$ in. wide, nor more than $\frac{1}{2}$ to 1 in. in width.

Thickness and depth of joint in all cases made to correspond with required dimensions shown on engineers' plans or specifications.

References.

List of engineers and contractors who have installed Carey Elastite expansion joints, throughout the United States, sent on request.

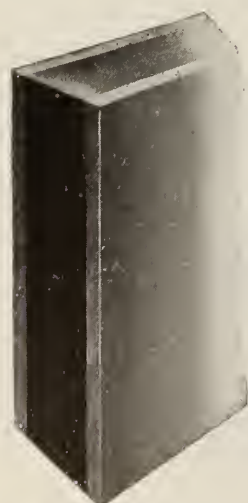


FIG. 1. CAREY ELASTITE EXPANSION JOINT

"The Sandwich Joint"

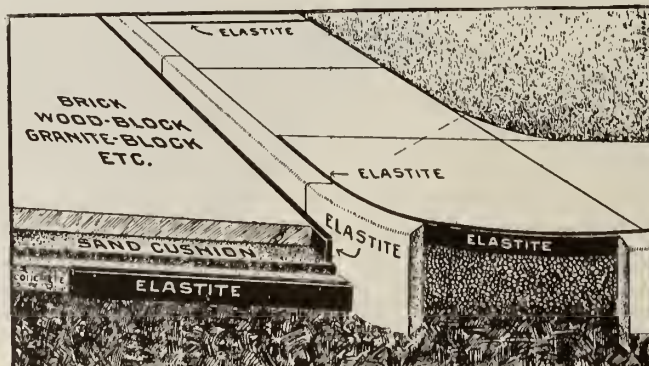


FIG. 2. CAREY ELASTITE EXPANSION JOINT SHOWING INSTALLATION



THE WARING-UNDERWOOD COMPANY

Manufacturers of Expansion Paving Joint and Sewer Joint Compound

MAIN OFFICE

Commercial Trust Building
PHILADELPHIA, PA.

FACTORY, FERNWOOD, PA.

Products.

"IDEAL EXPANSION JOINT."

"IDEAL" SEWER JOINT COMPOUND.

"Ideal Expansion Joint."

DESCRIPTION AND USES—The "Ideal Expansion Joint" is a premoulded strip of asphalt, especially designed to take care of the expansion in brick, wood block, granite block and concrete paving, and also to act as a protection against expansion in concrete foundations, walls, etc. The strips are made in standard lengths of 5 ft., having the width and thickness according to requirements of specifications.

Special lengths and shapes are made to meet any particular type of construction.

ADVANTAGES—(1) The use of the "Ideal Expansion Joint" insures a perfect expansion joint, as there is no chance of foreign matter getting into space which should be completely taken up by "joint filler."

(2) It is easy to install, and saves the investment in heating equipment, pouring pots, wooden strips and labor required when the pouring method is followed.

(3) The joint is laid as the paving progresses, and there is nothing to require going back over the work to fill joints after grouting of paving has been finished.

(4) It makes a cleaner and better job than the old method and effects a saving in the cost of the work.

SPECIFICATIONS—The material used in the expansion joint shall be an asphalt which will pass the following tests:

Specific gravity.....1.025 Penetration 32° Fahr.....15
Bit. sol. 76° Naphtha.....64% Penetration 77° Fahr.....25
Bit. sol. car. disulphide...99.8% Penetration 115° Fahr.....45
Melting point 250° Fahr. Ductility 2 cm.

REFERENCES—This product has been approved for use by numerous city engineers, state highway departments and officials of the U. S. Government.

Samples and further information will be submitted on request.

"Ideal" Sewer Joint Compound.

DESCRIPTION—A specially prepared bituminous compound, having a specific gravity of 1.45, a melting point of 200° Fahr. and becoming liquid at a temperature of approximately 400° Fahr.

Compound to provide a perfectly tight joint in sewer construction, thereby reducing the leakage and infiltration, and destruction by roots, which is sometimes a very serious problem to be considered.

APPLICATION—The compound is melted and poured into joint space at 400° Fahr. in the same manner that a lead joint would be poured except that the "snake" should be coated with oil to prevent the compound from sticking. Joint space must first be calked with a light packing of jute or oakum.

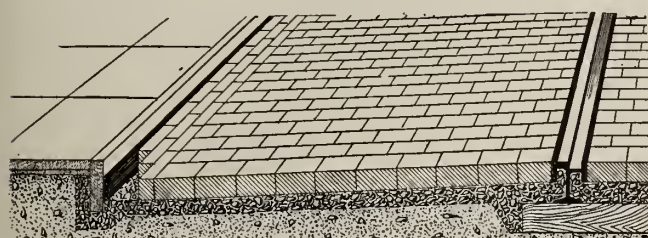
As the material has a certain flexibility it is possible to make joint outside of trench and lay pipes in double lengths. The presence of water in trench will not destroy sticking qualities of the compound.

ADVANTAGES—Reduces leakage from joints to a minimum and allows severe tests to be readily met. Material is easily handled, is inexpensive, and dependable.

REFERENCES—This material has been used and approved by leading sanitary engineers and also by U. S. Government officials.

NUMBER OF POUNDS OF "IDEAL" COMPOUND IN ONE JOINT, FOR VARIOUS DEPTHS OF JOINT

	Size of pipe, in.	Depth of socket, in.	Depth of joint, in.							
			¾	1	1½	1¾	2	2½	3	3½
Standard	4	1½	0.260	0.346	0.553	0.615	0.939	1.200	1.870	2.182
	6	1½	0.379	0.492	0.704	0.782	1.200	1.870	2.182	2.637
	8	2	0.470	0.626	0.900	1.000	1.200	1.870	2.182	3.014
	10	2½	0.800	1.000	1.200	1.400	1.870	2.182	3.014	3.564
	12	2½	1.247	1.403	1.559	1.870	2.182	3.014	3.564	4.925
	15	2½	1.507	1.693	1.879	2.260	2.637	3.014	3.564	4.925
	18	2¾	1.782	2.007	2.232	2.673	3.118	3.564	4.925	6.045
	20	3	1.970	2.216	2.462	2.955	3.448	3.940	4.925	6.045
	24	3½	3.218	3.620	4.022	4.827	5.631	6.436	8.045	
D. & W. Sockets	4	2	0.348	0.464	0.522	0.580	0.696	1.046	1.464	1.674
	6	2½	0.628	0.837	0.942	1.046	1.255	1.464	1.674	2.186
	8	2¾	0.826	1.093	1.230	1.366	1.640	1.913	2.186	2.636
	10	2¾	1.318	1.483	1.647	1.977	2.307	2.636	3.110	3.888
	12	3	1.555	1.750	1.944	2.333	2.722	3.110	3.888	4.737
	15	3	1.895	2.132	2.369	2.842	3.316	3.790	4.477	5.590
	18	3½	2.236	2.516	2.795	3.354	3.914	4.477	5.590	6.305
	20	3½	2.522	2.837	3.152	3.783	4.414	5.044	6.305	7.412
	24	4	2.965	3.336	3.707	4.447	5.188	5.930	7.412	



APPLICATION OF "IDEAL EXPANSION JOINT" TO STREET PAVING WORK



PACKAGES IN WHICH JOINTS ARE SHIPPED

AMERICAN CEMENT TILE MFG. CO.

INCORPORATED 1902

Manufacturers of Cement Tile Roofing

Oliver Building
PITTSBURGH, PA.

BRANCH OFFICES

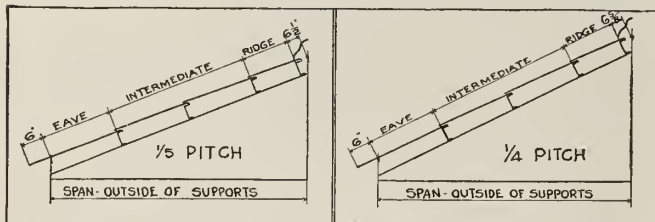
NEW YORK, N. Y., 50 Church Street BIRMINGHAM, ALA., Brown Marx Building PHILADELPHIA, PA., Otis Building
WORKS: WAMPUM, PA.; LINCOLN, N. J.; FAIRFIELD, ALA.

Products and Services.

Manufacturers and erectors of AMERICAN, formerly BONANZA, REINFORCED CEMENT INTERLOCKING TILE, FLAT TILE, GUTTER and WALL PLATES.

Construction.

Tile are made of best grade of portland cement and clean, sharp sand, reinforced with expanded metal which is thoroughly embedded and protected. The exposed surface of the interlocking tile is Indian red in color, thoroughly waterproof, and the undersurface has a smooth, white finish.



DIMENSIONS OF PURLIN SPACING

Span	1/5 PITCH			1/4 PITCH		
	Eave	Intermediate	Ridge	Eave	Intermediate	Ridge
35'	3'-7"	3 @ 4'-0 1/4"	2'-8"	3'-7"	3 @ 4'-0 1/4"	3'-4 3/8"
36'	3'-7"	3 @ 3'-11 3/4"	3'-4"	3'-7"	3 @ 4'-0"	3'-11 7/8"
37'	3'-7"	3 @ 3'-11 1/8"	3'-11 1/8"	4'-3"	3 @ 3'-11 3/4"	3'-11 3/8"
38'	3'-11"	3 @ 4'-0"	4'-0"	4'-3"	1 @ 4'-8 3/4"	3 @ 3'-11"
39'	4'-3"	1 @ 4'-4 1/8"	3 @ 3'-11 1/2"	3'-7"	4 @ 4'-0"	1'-8"
40'	4'-3"	1 @ 4'-8 3/8"	3 @ 4'-0 1/4"	3'-7"	4 @ 3'-11 3/4"	2'-33/4"
41'	3'-7"	4 @ 4'-0"	1'-11 1/2"	3'-7"	4 @ 4'-0 1/4"	2'-81/2"
42'	3'-7"	4 @ 3'-11 1/2"	2'-8"	3'-7"	4 @ 4'-0"	3'-4 3/8"
43'	3'-7"	4 @ 4'-0"	3'-0 1/2"	3'-7"	4 @ 3'-11 3/4"	3'-11 7/8"
44'	3'-7"	4 @ 3'-11"	3'-11"	4'-3"	4 @ 3'-11 1/2"	3'-11 5/8"
45'	3'-7"	4 @ 4'-0 1/4"	4'-0 1/4"	4'-3"	1 @ 4'-4 1/4"	4 @ 4'-0"
46'	4'-3"	4 @ 4'-0"	4'-0"	3'-7"	5 @ 3'-11 1/2"	1'-75/8"
47'	4'-3"	1 @ 4'-4 3/8"	4 @ 4'-0 1/2"	3'-7"	5 @ 3'-11 1/2"	2'-41/4"
48'	3'-7"	5 @ 4'-0 1/8"	1'-8 1/2"	3'-7"	5 @ 4'-0 1/8"	2'-8 1/2"
49'	3'-7"	5 @ 4'-0"	2'-3 1/4"	3'-7"	5 @ 3'-11 7/8"	3'-33/4"
50'	3'-7"	5 @ 4'-0 3/4"	2'-8 1/2"	3'-7"	5 @ 3'-11 5/8"	3'-11 3/4"
51'	3'-7"	5 @ 4'-0"	3'-4 1/2"	3'-11"	5 @ 4'-0 1/8"	4'-0 1/4"
52'	3'-7"	5 @ 3'-11 3/4"	3'-11 3/4"	4'-3"	1 @ 4'-4"	5 @ 3'-11 7/8"
53'	3'-11"	5 @ 4'-0 3/8"	4'-0 1/4"	3'-7"	6 @ 3'-11 3/4"	1'-71/2"
54'	4'-3"	1 @ 4'-3 3/8"	5 @ 4'-0"	3'-7"	6 @ 4'-0 1/8"	2'-0 1/4"
55'	3'-7"	6 @ 3'-11 1/8"	1'-8"	3'-7"	6 @ 4'-0"	2'-75/8"
56'	3'-7"	6 @ 4'-0"	2'-0 1/2"	3'-7"	6 @ 3'-11 1/8"	3'-35/8"
57'	3'-7"	6 @ 3'-11 7/8"	2'-7 3/4"	3'-7"	6 @ 4'-0 1/8"	3'-8"
58'	3'-7"	6 @ 4'-0 1/4"	3'-0"	3'-11"	6 @ 3'-11 1/8"	3'-11 1/8"
59'	3'-7"	6 @ 4'-0"	3'-8"	4'-3"	6 @ 4'-0 3/8"	4'-0 1/8"
60'	3'-11"	6 @ 3'-11 3/4"	3'-11 3/4"	3'-7"	7 @ 3'-11 1/8"	1'-7 1/8"
61'	4'-3"	6 @ 4'-0 3/8"	4'-0 1/2"	3'-7"	7 @ 4'-0"	1'-11 5/8"
62'	4'-3"	1 @ 4'-8"	6 @ 3'-11 1/2"	3'-7"	7 @ 3'-11 3/4"	2'-8"
63'	3'-7"	7 @ 3'-11 3/4"	1'-11 1/2"	3'-7"	7 @ 4'-0 1/8"	3'-0 1/8"
64'	3'-7"	7 @ 4'-0"	2'-4 1/4"	3'-7"	7 @ 4'-0"	3'-7 3/4"
65'	3'-7"	7 @ 3'-11 7/8"	2'-11 5/8"	3'-7"	7 @ 4'-0 1/8"	4'-0 1/8"
66'	3'-7"	7 @ 4'-0 3/8"	3'-4"	4'-3"	7 @ 4'-0 1/8"	4'-0 1/4"
67'	3'-7"	7 @ 4'-0"	3'-11 5/8"	4'-3"	1 @ 4'-7 7/8"	7 @ 4'-0"
68'	4'-3"	7 @ 3'-11 3/4"	3'-11 3/4"	3'-7"	8 @ 3'-11 3/8"	1'-11 5/8"
69'	4'-3"	1 @ 4'-4 3/8"	7 @ 4'-0 1/8"	3'-7"	8 @ 4'-0 1/8"	2'-4 1/4"
70'	3'-7"	8 @ 3'-11 1/8"	1'-8"	3'-8"	8 @ 4'-0"	3'-0"
71'	3'-7"	8 @ 4'-0 1/8"	2'-0"	3'-7"	8 @ 3'-11 3/8"	3'-7 5/8"
72'	3'-7"	8 @ 4'-0"	2'-8"	3'-7"	8 @ 4'-0 1/8"	3'-11 7/8"
73'	3'-7"	8 @ 3'-11 7/8"	3'-3 1/2"	4'-3"	8 @ 4'-0"	4'-0 1/8"
74'	3'-7"	8 @ 4'-0 3/8"	3'-8"	4'-3"	1 @ 4'-7 7/8"	8 @ 3'-11 7/8"
75'	3'-11"	8 @ 4'-0"	3'-11 3/4"	3'-7"	9 @ 4'-0 1/8"	1'-8 3/8"

Dimensions and Weights of Interlocking Tile.

Exposed area, 24 by 48 in.
Over all measurement, 26 by 52 in.
Thickness, 1 in.
Weight per square foot, 16 lbs.
Purlin spacing, 4 ft.
Safe carrying load per square foot, 100 lbs.

Dimensions and Weights of Flat Tile.

Exposed area, 24 by 60 in.
Size, 24 by 60 in.
Thickness, 1 1/2 in.
Weight per square foot, 17 lbs.
Safe carrying load per square foot, 100 lbs.

Cost.

American tile is the lowest priced permanent roofing on the market. Eliminates maintenance expense and fire insurance.

All installations backed by written guarantee. Estimates and services of Engineering Department furnished without charge.

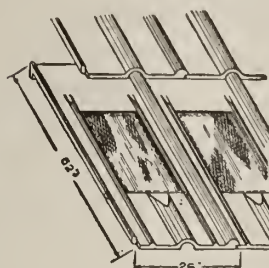
Details.

Send for illustrated catalogue and engineering data sheets showing full details of tile and necessary structural supports.

References.

A partial list of installations of American reinforced tile roofing:

Alpha Portland Cement Co., Alsen, N. Y.; Martins Creek, Pa.;
Manheim, W. Va.; Easton, Pa.
Aluminum Co. of America, Maryville, Tenn.; Whitney, N. C.;
Massena, N. Y.
American Locomotive Co., Schenectady, N. Y.; Richmond, Va.
Bethlehem Steel Co., Bethlehem, Pa.; Sparrows Point, Md.
E. W. Bliss Co., Brooklyn, N. Y.
Brooklyn Edison Co., Brooklyn, N. Y.
Crucible Steel Co., Pittsburgh, Pa.; Midland, Pa.; Harrison,
N. J.; Syracuse, N. Y.
Carnegie Steel Co., Pittsburgh, Pa.
Corning Glass Works, Corning, N. Y.
Edgewater Steel Co., Pittsburgh, Pa.
Erie Foundry Co., Erie, Pa.
Ford Motor Co., Detroit, Mich.; Walkerville, Ont.; Kearney, N. J.
General Chemical Co., Marcus Hook, Pa.; Baltimore, Md.;
Undercliff, N. J.; Laurel Hill, L. I., N. Y.; Willow, Ohio;
Newell, Pa.; Pulaski, Va.; Easton, Pa.
General Electric Co., West Lynn, Mass.; Schenectady, N. Y.;
Harrison, N. J.; West Everett, Mass.
Goodyear Tire & Rubber Co., Akron, Ohio
Ingersoll-Rand Co., Phillipsburg, N. J.
National Aniline & Chemical Co., Marcus Hook, Pa.
National Malleable Castings Co., Sharon, Pa.
New York Air Brake Co., Watertown, N. Y.
Peerless Motor Car Co., Cleveland, Ohio
Pittsburgh Seamless Tube Co., Beaver Falls, Pa.
Pittsburgh Steel Products Co., Pittsburgh, Pa.
Raritan Copper Co., Perth Amboy, N. J.
Republic Iron & Steel Co., Youngstown, Ohio
Simonds Mfg. Co., Lockport, N. Y.
Tennessee Coal, Iron & Railroad Co., Fairfield, Ala.
Texas Co., Marcus Hook, Pa.
Tide Water Pipe Co., New York, N. Y.
United Drug Co., Boston, Mass.
U. S. Government, Panama Canal, Shops and Piers—Panama
U. S. Nitrate Plant, Muscle Shoals, Ala.
Westinghouse Electric Co., Essington, Pa.

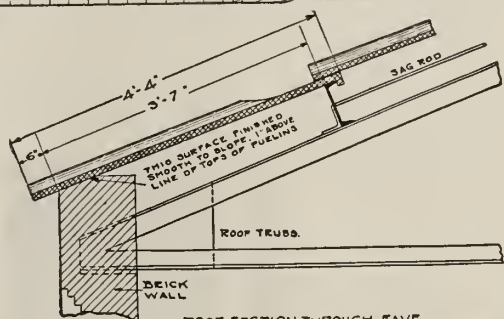
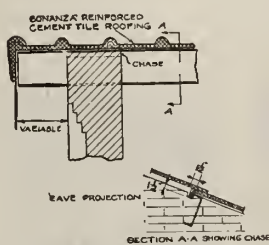
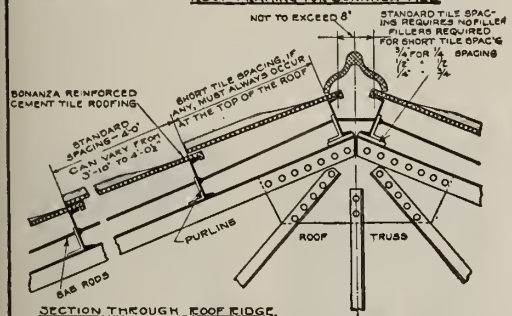


TILES WITH GLASS INSERTION ARE USED FOR SKY-LIGHT EFFECTS
THE GLASS USED IS 3/4-INCH EMBEDDED WIRE GLASS
SIZE OF GLASS 14" X 26"
THESE TILES FURNISHED ONLY IN STANDARD
*LENGTH FOR PURLIN SPACING 3'-0" to 4'-0"

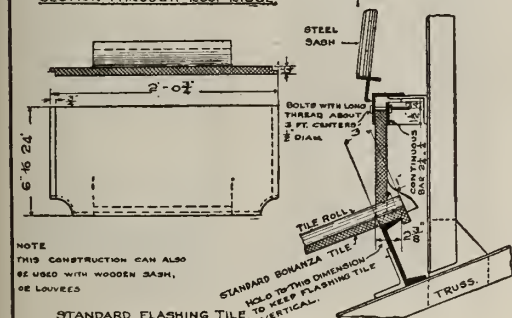
The diagram consists of two parts. The top part is a cross-section labeled "SECTION 'AA' THRU SIDE ROLL". It shows a semi-circular roof profile with a smaller semi-circular roll on the right side. The roll is secured with "ELASTIC CEMENT". The bottom part is a perspective view of a roof slope showing the "METHOD OF LAYING TILE". It illustrates the arrangement of tiles in rows, with labels for "PURLIN", "STANDARD", "OPEN", "TILE", "HALF RIBBON", and "HALF RIGHT CLOSED RIDGE". The roof is supported by a brick wall on the right, labeled "LEFT END". A note at the bottom right says "FOR SECTION A/A SEE PLATE NO. 4".

NOT TO EXCEED 8"

STANDARD TILE SPACING REQUIRES NO FILLER
FILLERS REQUIRED FOR SHORT TILE SPACING
 $\frac{3}{4}$ " FOR $\frac{1}{4}$ " SPACING

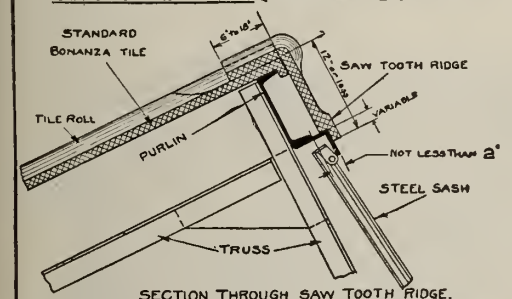


ROOF SECTION THROUGH EAVE

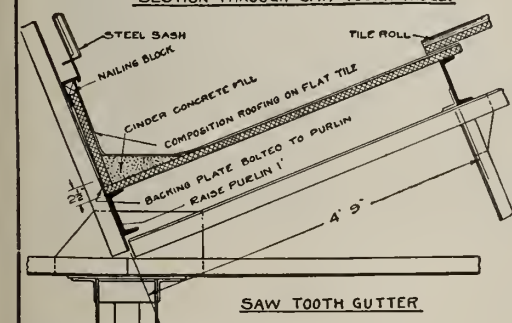


NOTE
THIS CONSTRUCTION CAN ALSO
BE USED WITH WOODEN SASH,
OR LOUVRES.

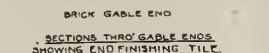
STANDARD FLASHING TILE



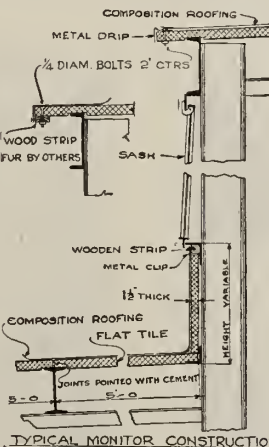
SECTION THROUGH SAW TOOTH RIDGE.



SAW TOOTH GUTTER

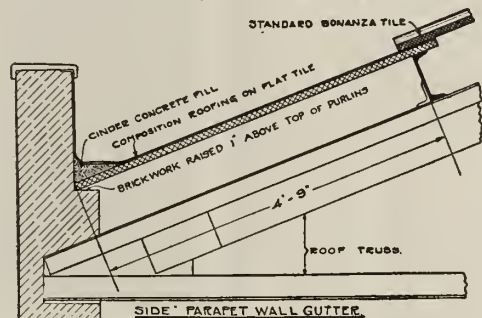


SECTIONS THRO' GABLE ENDS
SHOWING END FINISHING TILE

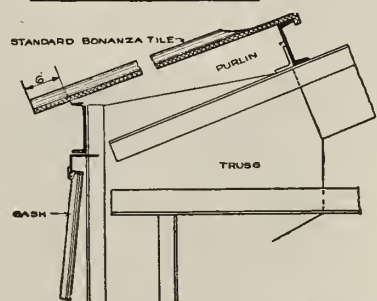


TYPICAL MONITOR CONSTRUCTION

DETAILS AND APPLICATION OF AMERICAN CEMENT TILE ROOFING



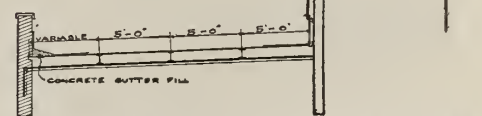
DE' PARAPET WALL GUTTER



SECTION THROUGH LAVER

PURLINS FOR TOTAL ROOF LOAD OF 30[#] PER SQ. FT.

14 FT SPAN.	5" I - 9 3/4"
17 " "	6" I - 12 1/4"
20 " "	7" I - 15"
23 " "	8" I - 18"
25 " "	9" I - 21"



PART CROSS SECTION SHOWING PURLIN SPACING FOR FLAT TILE
FOR DETAILS OF FLAT TILE SEE PLATES NO 40 and 41

FEDERAL CEMENT TILE CO.

Westminster Building
CHICAGO, ILL.

WORKS
HAMMOND, IND.
DETROIT, MICH.

Products and Services.

"FEDERAL" REINFORCED CEMENT ROOF SLABS.

Our sales department, together with our engineering department, will assist engineers in effecting the most economical distribution of structural steel for carrying "Federal" cement slabs.

"Federal" Reinforced Cement Slabs for Flat and Pitched Roofs.

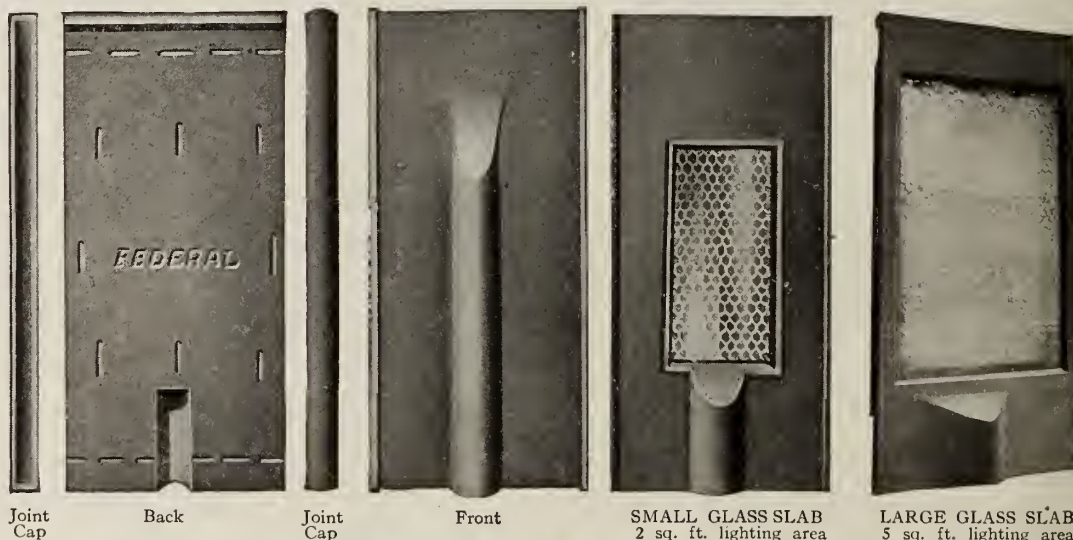
Impervious to severest elements. Not affected by heat, cold, fire or water; strengthen with time. Laid directly on steel purlins, making a fireproof construction. All pitched tile joints interlock and overlap. Require no painting, repairing, or other maintenance. Where flat slabs and composition covering are used, the joints are buttet.

"FEDERAL" SLAB DATA FOR STANDARD PITCHED ROOFS

Covers 24 by 48 in.	Purlin spacing, 4 ft. 0 in.
Over all length, 52 in.	Least allowable slope, 1/5 pitch
12½ tile per square (100 sq. ft.)	Safe carrying load, 100 lbs. per sq. ft.
16 lbs. weight per sq. ft.	Breaking load, 300 lbs. per sq. ft.
Thickness, 1⅞ in.	
Wire reinforcement	

Cost.

"Federal" slabs make the best and cheapest roof on the market, because they are indestructible and everlasting; no expense for maintenance; cut the rates if fire insurance is carried; save steel in the building frame; eliminate wood sheathing, also repairs and renewals.



"FEDERAL" INTERLOCKING SLAB



FACTORY WHERE "FEDERAL" REINFORCED SLABS ARE MADE

Two main buildings, each 100 by 600 ft. "Federal" slabs cover roofs. "Federal" glass slab light factories. Strictly fireproof; no fire insurance required or carried



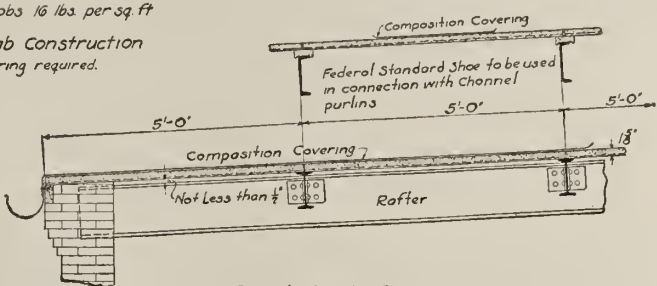
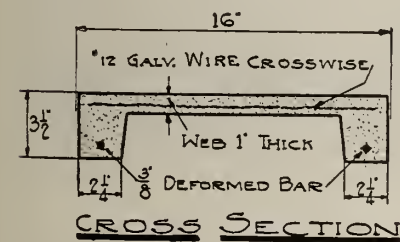
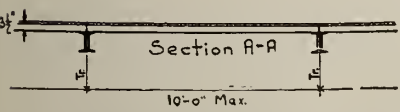
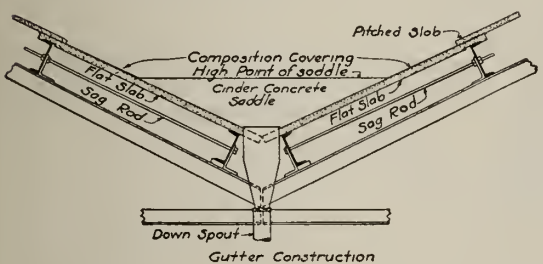
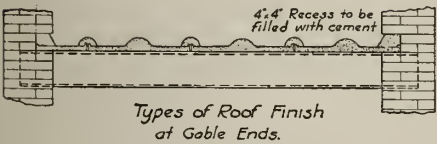
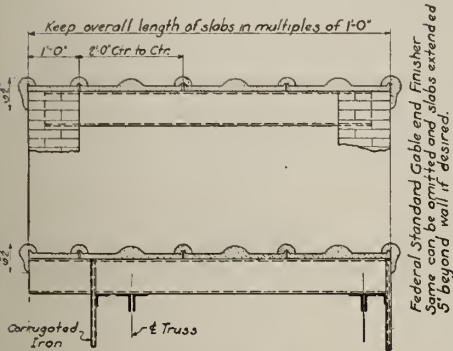
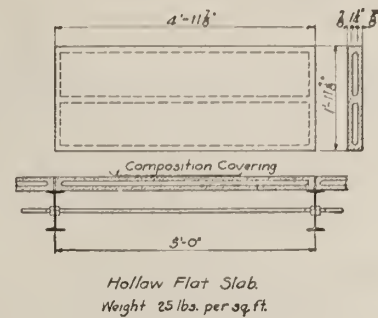
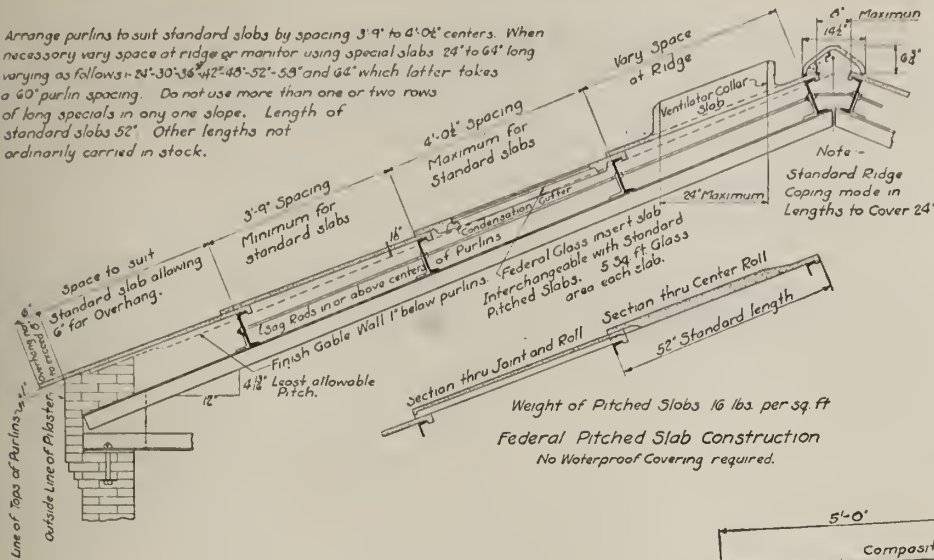
"FEDERAL" ALL-GLASS SLAB ROOF
Great Western Smelting and Refining Co., Chicago, Ill.

References.

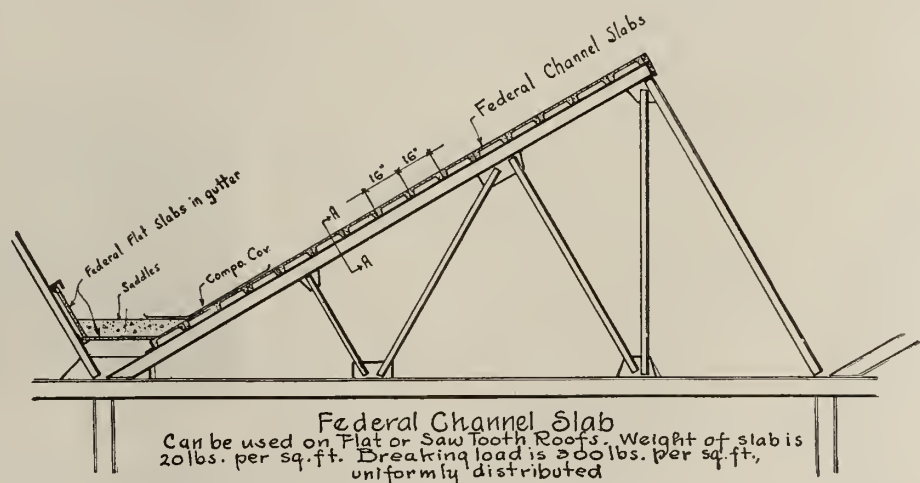
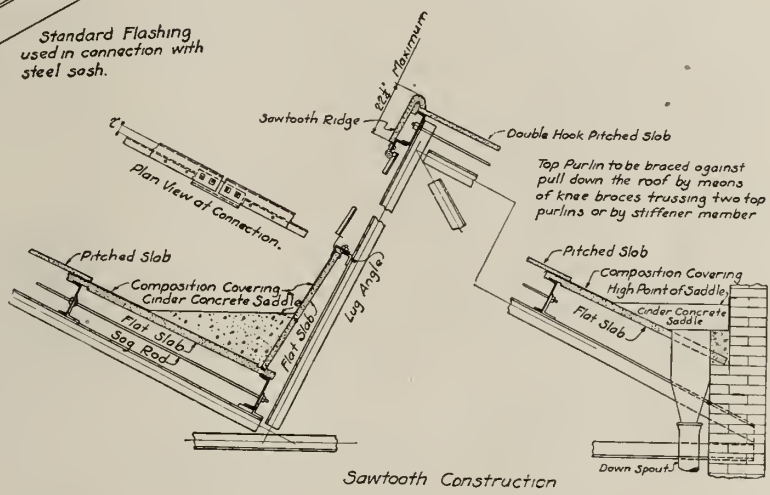
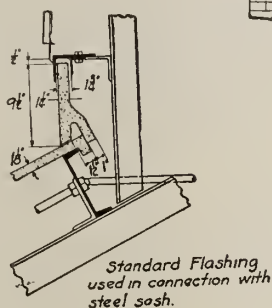
"Federal" slabs cover a large variety of structures, as shown by the following partial list of contracts:

United States Steel Corporation, 6 plants
International Harvester Co., 5 plants
Studebaker Corp., South Bend, Ind., and Detroit, Mich.
Crane Co., Chicago, Ill.
National Malleable Castings Co., Chicago, Ill.
American Steel Foundries Co., Indiana Harbor, Ind.; Granite City, Ill., Alliance, Ohio
New Kansas City Station and Train Sheds
Illinois Central Railroad, Memphis, Tenn.
Pennsylvania Railroad, Chicago Ill.; Indianapolis, Ind.
Ford Motor Co., Detroit and Dearborn, Mich.
General Motors, Flint and Detroit, Mich., and Janesville, Wis.
Willys-Overland Company, Toledo, Ohio
Maxwell Motor Co., Detroit, Mich.
Packard Motor Car Co., Detroit, Mich.
Haynes Automobile Co., Kokomo, Ind.
Texas Co., Texas City, Tex.
Gulf Refining Co., Port Arthur, Tex.
Standard Oil Co., Tulsa, Okla.
Pawling & Harnischfeger Co., Milwaukee, Wis.

Arrange purlins to suit standard slabs by spacing 3'-9" to 4'-0 1/2" centers. When necessary vary space at ridge or manitor using special slabs 24" to 64" long varying as follows: 24"-30"-36"-42"-48"-52"-58" and 64" which latter takes a 60" purlin spacing. Do not use more than one or two rows of long specials in any one slope. Length of standard slabs 52". Other lengths not ordinarily carried in stock.



Data for flat Slab Roof.
Width of slab 24" Length of standard slab 60"
Special lengths to order.
Weight per sq. ft. 18 lbs. Thickness 1 1/2"
Reinforcing Metal No. 10 wire longitudinal, No. 17 wire crossways.
Safe carrying load 150 lbs. per sq. ft.



E. N. BIEGLER MFG. CO.

Manufacturers of Roofing, Waterproofing, Technical Paints, Oils, Paving and Insulating Compounds

TELEPHONE:

HUMBOLDT 135

2734 North Rockwell Street
CHICAGO, ILL.

Products and Services.

ROOFINGS: BUILT-UP ASPHALT, BUILT-UP ASBESTOS, BUILT-UP TAR and GRAVEL (BARRETT SPECIFICATION), BUILT-UP PLASTIC; BIEGLER'S ASPHALT PREPARED ROOFING; PROMENADE TILE and MASTIC FINISH.

High grade WATERPROOFING MATERIALS for basements, subbasements, tunnels, reservoirs, subways, bridges, sidewalks, floors, cisterns, pits, silos and roofs; TECHNICAL PAINTS for steel and metal; JAP-O-LENE PAINT OIL; INDUSTRIAL WHITE.

Acidproof and Alkaliproof Paints, Asphalt Paints; Insulating Compounds; Paving, Rock Mastic Floors, Asphalt Products and Metallic Floor Hardener; full line of Enamels; Insulating Varnish.

Contracts for high class ROOFING or MEMBRANE WATERPROOFING executed anywhere in the United States.

For Mas-Oleum (Mastic Linoleum) and Almada Cork Composition Floors, see page 237.

Roofing.

The roof for a building is one of the most important branches of construction. In the selection of the proper roofing, the construction of the building ought to be taken into consideration, and while the materials to be used are of importance, the installation of the work is equally important.

It has been the business of the E. N. BIEGLER MFG. Co. for the past twenty years to install the proper roof, and by this experience it is able and pleased to recommend specifications according to work. The contracting department will furnish estimate on work in this line anywhere in the United States.

Built-up Tar and Gravel Roofing.

Barrett Specification 20-year Guaranty Bond roofs are executed by E. N. BIEGLER MFG. Co.

Built-up Asphalt Roofing.

Especially adapted for manufacturing plants, warehouses, etc., for either flat or steep surfaces. This roofing is built up at the building, usually consisting of three plies or more of asphalt saturated felt cemented together with hot asphalt and finished with hot asphalt, or if desired, gravel or slag embedded as a wearing surface or trowelled mastic finish.

Built-up Asbestos Roofing.

Installed the same as the built-up asphalt roofing. Gives the added feature of fire resistance, and is especially suitable on foundries or buildings subjected to flying sparks or extensive heat. Manufactured from rock minerals it gives greater durability.

Built-up Plastic Roofing.

Biegler's Ever-Tite plastic cement can be trowelled over any old or new roof surface. Put up in packages ready for use. Also practical for repairing old felt, composition and metal roofs.

Biegler's Asphalt Prepared Roofing.

Put up in rolls containing 108 sq. ft. ready to lay. Practical for steep work only.



TRADE-MARK

Promenade Tile and Mastic Finish.

Where roof is desired for recreation purposes or traffic, the company recommends, in addition to one of the above roofs, laying promenade tile or mastic finish.

Biegler's Reinforced Membraneous Waterproof Construction.

Where there is considerable water pressure to contend with, this construction is recommended. To secure best results each job should be executed according to existing conditions, and, therefore, this company prefers having clients advise nature of work to be waterproofed, stating water pressure, etc. Recommendation and method of construction will then be submitted.

Duro-Carbo Paint.

A durable, carbon metal preservative paint of high quality made with pure linseed oil and suitable dryers which prevent corrosion, and when properly applied protects all metals to which a metal surface is generally subjected. It should be used on all structural steel work, bridge and truss work, viaducts, fire escapes, metal lath, tanks, boilers, etc.

Jap-O-Lene Paint Oil.

Composed of China wood oil chemically treated, high grade gum, linseed oil, and reduced to consistency of a paint oil with volatile spirits (naphtha or turpentine). Jap-O-Lene can be used in any kind of paint material, either dry, ground in oil or japan, with or without addition of linseed oil. If linseed oil is to be used, raw oil in proportion suitable for the work in hand is recommended.

Industrial White.

A white coating for interior walls in factories, hospitals or public buildings where a sanitary finish is desired. Can be had in either flat, eggshell or high gloss, the latter being a high class enamel.

Co-operative Service.

Descriptive circulars on any of the products furnished on request.



NEW ARMOUR ABATTOIR, SOUTH ST. PAUL, MINN.

R. C. CLARK, Architect

BLOME-SINEK Co., General Contractors

Waterproofing, floors and roofing, amounting to 1,250,000 sq. ft., furnished and executed in the above plant by E. N. BIEGLER MFG. Co.

H. H. ROBERTSON COMPANY

FORMERLY ASBESTOS PROTECTED METAL CO. (A. P. M.)

PITTSBURGH, PA.

FACTORIES: AMBRIDGE, PA.; WALTHAM, MASS.; AKRON, N. Y.; SARNIA, ONT.

BRANCH OFFICES

BALTIMORE, MD.
BIRMINGHAM, ALA.
BOSTON, MASS.
BUFFALO, N. Y.
CHICAGO, ILL.
CLEVELAND, OHIO
CINCINNATI, OHIO

ALLENTOWN, PA.
EASTON, PA.
SCRANTON, PA.
TRENTON, N. J.
DETROIT, MICH.
NEW YORK, N. Y.
PHILADELPHIA, PA.

ST. LOUIS, MO.
SAN FRANCISCO, CAL.
INDIANAPOLIS, IND.
DENVER, COLO.
SALT LAKE CITY, UTAH
HOUSTON, TEX.
KANSAS CITY, MO.

MINNEAPOLIS, MINN.
NASHVILLE, TENN.
NEW ORLEANS, LA.
SEATTLE, WASH.
PORTLAND, ORE.
HONOLULU, T. H.
HILO, T. H.

FOR CANADA: H. H. ROBERTSON Co., LIMITED, SARNIA, TORONTO, MONTREAL, VANCOUVER

FOREIGN OFFICES

HAVANA, CUBA, LAMBORN & Co., Royal Bank of Canada Building

LONDON, E. C., ENGLAND, EDW. LE BAS & Co., Dock House, Billiter Street

PARIS, FRANCE, L. MESSINESI, 19 Avenue Dusquesne

Products.

ROBERTSON PROCESS METAL: Flat, Corrugated, Beaded and Mansard Sheets and Bars for Roofing and Siding, Flashings, Ridge Caps, Louvers, Gutters, Downspouts, Ventilators, Skylights and Lath.

ROBERTSON PROCESS GYPSUM: Poured-in-place Roofs and Floors; Pre-cast Roof Slabs.

ROBERTSON PROCESS ASPHALT: Built-up Roofing, Roll Roofing, Slate Surfaced Roofing, Slate Surfaced Shingles, Protective Coatings, Paving Expansion Joints, Plastic Cements, Saturation Compounds, Insulation Compounds, Mineral Rubber Battery Sealing Compounds.

ROBERTSON PROCESS SPECIALTIES: Road Fabric (welded) Curb Reinforcement, and Wallbrite, an interior paint.

Robertson Process Metal.

A metal building material which is fully protected from the most severe weather conditions, smoke, gases, fumes, condensation and salt sea air, by means of three impervious coatings—(1) asphalt, (2) asbestos, (3) waterproofing. It is made in sheets and bars for use in industrial buildings on roofing, siding, downspouts, gutters, general building trim, skylights and ventilators.

Robertson Process Metal is low in first cost and involves no maintenance or depreciation charges. It is a metal that *does not rust*, *needs no painting* and is at the same time fire resisting.

ROBERTSON PROCESS—The body or core is special annealed steel which has been thoroughly cleansed so as to be free from grease, moisture, oxide and every other surface impurity. The metal is heated to a uniform and definite temperature and, while hot, thoroughly cleaned, and, with a receptive surface, is immersed in a bath of special asphaltic compound. The asphalt is in turn protected by a tough, opaque and insulating covering of asphalt saturated pure asbestos felt, which completely covers every surface of the metal and is applied while the asphalt is hot. The asphalt coat provides permanent pro-



TRADE-MARK

tection to the metal against corrosive influences of moisture and fumes and the asbestos protects the asphalt from mechanical abrasion and prevents evaporation and carbonization of the natural, life-preserving asphalt.

Finally, the asbestos itself is protected from the softening action of moisture by a new and original process of waterproofing which

imparts to the asbestos a tough, smooth, repellant surface. This waterproofing treatment also provides power of resistance to mechanical abrasion, permitting the sheets to be handled freely in shipment and erection without damage to the protective coating.

FORMS, COLOR AND SIZES—Robertson Process Metal is made in a variety of standard forms and sizes which good practice has demonstrated to be the most useful, economical and attractive. It is made in corrugated, beaded and mansard roofing and siding sheets as well as in flat sheets. It is also made in various forms for building purposes, such as ridge caps, downspouts, gutters, flashing, louvers, etc. Robertson Process Metal forms an important part of Robertson ventilators and Robertson skylights, both of which are more fully described below.

Robertson Process Metal is supplied in black and red. Sizes and weights will be given upon application. All necessary materials needed in fastening, such as nails, rivets, hooks, straps, bolts, etc., can be supplied.

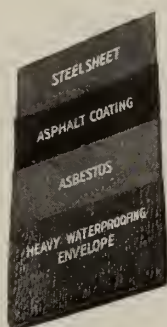
ADVANTAGES—Robertson Process Metal is both light and strong. It weighs practically the same per square foot as corrugated iron and at all times retains the strength of the original metal, since it suffers no loss of efficiency by corrosion or other forms of deterioration.

It is corrosionproof and rustproof. It has stood every test on all kinds of industrial buildings and is used and endorsed by engineers throughout the country. The fact that it is immune to the corroding action of gases, acid and alkali fumes, all weather conditions and even salt sea air, makes it exceptionally well suited to permanent building construction.

Robertson Process Metal has insulating qualities that greatly reduce the tendency toward condensation of mois-



ROBERTSON
PROCESS
METAL CORRUGATED SHEET



ROBERTSON
PROCESS OF
METAL PROTECTION



ROBERTSON PROCESS METAL RIDGE CAP



ROBERTSON
PROCESS MANSARD SHEET

ture. Buildings in which it is used are, therefore, drier, easier to heat in winter and remain cooler and more comfortable in summer.

The light weight, strength and permanency of Robertson Process Metal render construction as a whole less costly by comparison with other building material. Furthermore, first cost is the total cost. There is no upkeep, no repairs. Robertson Process Metal *does not need painting*.

Robertson Ventilator.

This Robertson product is built completely of Robertson Process Metal and it will, therefore, withstand the most severe gases, fumes, smoke, etc., from the inside and all weather conditions from the outside. All upkeep expense is saved. It does not need painting and can not get out of order.

The Robertson ventilator is a stationary type of ventilator, designed to provide the greatest development of air current under all conditions. It does not rely upon mechanical adjustment or moving parts which are not permanently operative and can not continue to function efficiently. It gives an exceptionally large, definite and reliable exhaust capacity under the most adverse conditions.

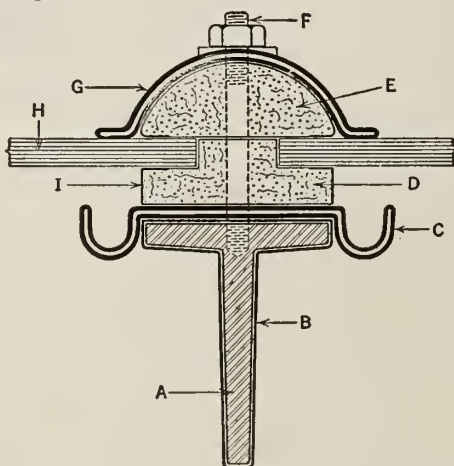
Robertson ventilator is made in a variety of sizes with special bases to meet all requirements. Complete information sent upon request.



ROBERTSON
PROCESS METAL
VENTILATOR

Robertson Skylight.

Robertson skylight is a patent type of skylight construction, the long life of which is due to the use of Robertson Process Metal and Robertson Process Asphalt. It is a form of skylight construction that can not corrode or rust and *does not require painting*. The danger from broken glass through corrosion and deflection of supporting bars and the expense of such breakage are entirely eliminated. All of the defects of ordinary skylight construction can be avoided by the use of this Robertson product.



CROSS SECTION OF ROBERTSON PROCESS METAL SKYLIGHT
CONSTRUCTION

The bar, condensation gutter and cap are made of Robertson Process Metal. It is readily apparent that skylight construction made of metal, so fully protected, will have many years added to its life. It is equally apparent that much upkeep expense will be saved during that time.

Robertson Process Asphalt is used for the skylight

cushion and fillers. This special asphalt provides a non-absorbent, resilient, permanent, and insulating bed for the glass. It positively keeps the glass from contact with hard substances and prevents all destructive strain.

A special bulletin covering this Robertson product will be sent upon request. This bulletin contains complete description with cross sections, installation illustrations, and complete specifications.

Robertson Process Gypsum for Roof Construction.

This Robertson product represents a noteworthy contribution to the building of roofs for commercial structures and the more substantial type of industrial building. Robertson Process Gypsum consists of a



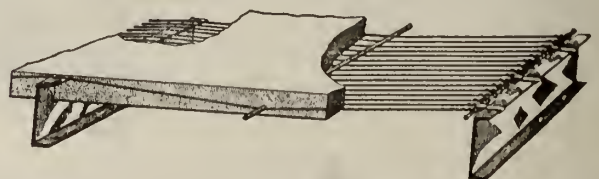
PRE-CAST TYPE OF ROBERTSON GYPSUM ROOF CONSTRUCTION

scientific reinforcement of an improved gypsum composition. Robertson gypsum roofs are built in both the poured-in-place and pre-cast form—a process by which roof construction has been both strengthened and lightened at the same time. Robertson Process permits of strength computation just as accurate as that of steel girders or truss construction; yet its weight has been reduced to the point that great savings can be made in the construction of foundation and superstructure.

Both the poured-in-place process and the pre-cast process have been technically illustrated and described in separate Robertson bulletins. Since these processes represent such noteworthy contributions to better roof construction they should be in the hands of engineers, architects, plant executives and officials, contractors and builders. Although containing technical descriptions and illustrations, they are of value to anyone interested in roof or building construction.

Robertson Process Gypsum for Floor Construction.

For the floor construction of commercial building, Robertson Process Gypsum provides maximum strength with minimum weight. It is a type of floor construction which makes possible great savings in both foundation and superstructure. The Robertson Process Gypsum floor is a poured-in-place monolithic type of construction. Robertson Process Gypsum is more than fireproof. It possesses a degree of non-conductivity of heat that will successfully protect the incased structural steel work from injury under the most severe conditions of fire that can possibly obtain in the building. It does not expand or contract under high temperatures, and thus prevents serious injury both during the progress of a severe fire



CONSTRUCTION DETAILS OF ROBERTSON POURED-IN-PLACE
GYPSUM ROOF

and under subsequent application of a stream of water at high pressure.

There are many other good qualities of Robertson Process Gypsum, all of which are fully described and illustrated in a special bulletin, which will be sent free upon request.

Robertson Process Built-up Roofing.

This product was developed to meet the demand for a high grade permanent waterproofing for use on Robertson Process Gypsum roofs. It is composed of 2 or 3 plies of tough woven felt, specially manufactured for this purpose, which retains the asphalt waterproofing compound to a greater degree than any other type of felt.

This felt is thoroughly saturated with a special asphalt compound which renders it permanently water repellent and immune to attack of acid or alkali fumes.

Asphalt is the waterproofer, and over this roof proper is placed a heavy ply of saturated asbestos felt, which, being opaque, inert, and not subject to injury through exposure to acids and alkali fumes, permanently protects the underlying layers.

The asbestos shield is further protected by a super-treatment of Robertson Roof Coating, which gives a gritty, hard and resilient wearing surface, capable of withstanding extremes of exposure.

This type of built-up roofing is equally suitable for the covering of ordinary wooden roofs and is the logical waterproofing for the flat roof of fireproof buildings. Special literature regarding this product will be sent upon request.

Robertson Process Roll Roofing.

This is another economical product especially adapted for use on buildings of light construction where a low first cost is desired. It has as a base a heavy thoroughly waterproofed felt, especially treated with a pure asphaltic saturant which binds itself together into a wonderfully tough mass. Both sides of the felt then receive a coating of Robertson Process asphalt cement.

Robertson Process roll roofing is put up in rolls of one and two squares, each roll containing sufficient galvanized roofing nails and liquid lap cement for proper applications together with complete instructions for laying.

Robertson Process Slate Surfaced Roll Roofing.

This product possesses all of the good qualities of Robertson Process roll roofing and, in addition, has em-

bedded into its outer surface a heavy coating of crushed, natural slate.

Its constituents and process of manufacture render it absolutely waterproof and fire resisting to a very high degree. It is made in two colors, green and red, and put up in rolls containing sufficient material to cover 100 sq. ft. of finished roof area.

The Robertson Process of Protective Coating.

The Robertson Process of protective coating has been developed by long and thorough experimental work and its reliability proved by extensive practical service under the exact condition that each product is intended to withstand. Roofing presents one problem, sidewall coating another, structural steel another, smokestacks another, etc.

The Robertson Process involves the use of pure asphalts, refined under improved methods. The universally recognized qualities of asphalts to resist the action of acids, alkalis and natural elements are, by this process of refinement, made available for protective coating to a most efficient and practical degree.

Following is a list of these products, complete descriptions of which will be gladly furnished upon application:

Robertson Structural Steel Coating, Robertson Structural Coating, Robertson Stack Coating, Robertson Acid Resisting Coating, Robertson Rubber Coat for Roofs, Robertson Rubber Coat for Siding, Robertson Cement Fiber, Robertson Semi-Cement Fiber, Robertson Process Wallbrite.

Robertson Policy.

In order to insure the proper use of Robertson Process building materials we have at times found it necessary to undertake the erection of the material where competent workmen are not available. We are equally as well prepared to contract for the construction of Robertson Process Gypsum roofs and floors in either poured-in-place or pre-cast form. On this type of work responsibility for the completed roofs or floors is assumed.

A corps of engineers is maintained, which is at all times prepared to assist manufacturers, builders, and contractors, architects and plant officials. With offices in all important cities in the United States, as well as in Canada and other foreign countries, prompt and adequate service can be given. Many special bulletins have been published covering the various Robertson products. These bulletins as well as a general book entitled "Robertson Process Metal Gypsum Asphalt" will be gladly sent upon request.



A TYPICAL ROBERTSON PROCESS METAL INSTALLATION, HUDSON COAL CO.'S BREAKER, PLYMOUTH, PA.

THE LEHON COMPANY

Roofings, Waterproof Papers, Compounds and Flooring Materials

TELEPHONE:

McKINLEY 700

West 44th to 45th Streets and Oakley Avenue
CHICAGO, ILL.

Products.

Manufacturers of MULE-HIDE BUILT-UP ASPHALT ROOFING; MULE-HIDE ASPHALT SHINGLES; MULE-HIDE ROLL ROOFINGS; MULE-HIDE WATERPROOF INSULATING PAPER; MULE-HIDE WATERPROOF INSULATING FABRIC; MULE-HIDE HOUSE LINING; SEALSKIN AND BLACK-BEAR WATERPROOF SHEATHING PAPERS; MULE-HIDE PORCH DECK CANVAS; CONCRETE WATERPROOFING MEMBRANES.

DAMP-TITE WATERPROOFING COMPOUND; ASPHALT PAINTS AND CEMENTS; MULE-HIDE MASTIC FLOORING MATERIALS; LEHON'S WATERPROOFING ASPHALT; EXPANSION JOINTS for concrete pavements.

Built-up Asphalt Roofing.

Asphalt is admittedly superior to tar as roofing material, softening at a much higher melt point.



KANSAS CITY TERMINAL RE-ROOFED WITH MULE-HIDE ASPHALT BUILT-UP ROOFING

SPECIFICATIONS—On Wooden Roof Deck—First, a dry course of red rosin sized paper should be laid in order to prevent drip into the building from the first mopping. If a 4-ply roof is desired, apply 2 layers of Mule-Hide Asphalt Felt, weighing 15 lbs. per 100 sq. ft., lapped 17 in., mopping between courses with hot asphalt so that felt does not touch felt. Use about 30 lbs. of Lehon's Waterproofing Asphalt for each mopping. Felt should be thoroughly rolled and pressed into hot asphalt so as to be quite flat. Top course to be 2-ply Mule-Hide Cap Sheet, weighing 40 lbs. per 100 sq. ft. Cement well between laps, roll down securely and mop entire surface with hot asphalt in smooth, uniform, workmanlike manner. All flashings, gutters, and valleys to be reinforced with an extra thickness of cap felt.

Where a 5-ply roofing is desired, use 3 layers of asphalt felt, lap 22 in., otherwise to be laid as above.

Over Concrete, Pyrobar, or Gypsum—When applied over concrete, pyrobar, or gypsum, omit dry course. First thoroughly brush and clean surface of roof deck, then apply a brush coat of Mule-Hide Primer to penetrate pores of roof deck surface and secure a good bond. When dry, mop with hot Lehon's Waterproofing Asphalt and roll in asphalt felt as specified over wooden roof deck. Lap 17 in. for 4-ply and 22 in. for 5-ply.

Waterproof Building Papers.

Furnished in 3 different weights. Each put up in rolls containing 500 sq. ft.

SEALSKIN WATERPROOF PAPER—Width, 36 in.; weight, 40 to 45 lbs.

BLACK-BEAR WATERPROOF PAPER—Width, 32 or 36 in.; weight, 30 to 35 lbs.

Concrete Waterproofing Membranes.

Mule-Hide cotton membranes and Mule-Hide saturated burlap. Used extensively to reinforce concrete waterproofing on important engineering undertakings, such as tunnels, subways, bridges, reservoirs, etc.



TRADE-MARK
Registered

Damp-Tite Waterproofing Compound.

For dampproofing basements, foundation walls, etc. In 5- or 10-gal. jacketed cans and barrels. May be applied cold to the outside of foundation walls.

Asphalt Paints and Cements.

MULE-HIDE LAP CEMENT and ROOF COATING—For re-coating felt or composition roofing. Furnished in pint, 1-, 5-, and 10-gal. cans; also in barrels.

STAY-LASTIC METAL PAINT—Suitable for use on exposed metal work. Furnished in 1-, 5-, and 10-gal. jacketed cans; also barrel lots.

STAY-TITE FLEXIBLE ASBESTOS CEMENT—An asbestos fiber cement. For flashing around skylights, etc. In 10-, 50-, and 100-lb. pails; also in barrel lots.

Mastic Flooring Materials.

Details on application.

Lehon's Waterproofing Asphalt.

Furnished in metal drums weighing 500 lbs.

Expansion Joints for Concrete Pavements.

Mushroom type. Particulars on application.

House Lining.

An excellent protection in cold climates, also suitable as roofing on temporary buildings.

Put up in rolls containing 200 sq. ft., without nails or cement; 36 in. wide; weight, 50 lbs. If desired, this material can be furnished in rolls containing 108 sq. ft. with nails and cement included; weight 30 lbs.

Porch Deck Canvas.

Put up in rolls containing 108 sq. ft., complete with galvanized roofing nails and cement; 36 in. wide; weight, 25 lbs. per square.

Insulating Paper.

A waterproof insulating paper used in refrigerators, coolers, butcher boxes, refrigerator cars, etc.

In widths up to and including 112 in., in weights of 70, 80, 90, 110, 125, and 160 lbs. per 1000 sq. ft.

Waterproof Insulating Fabric.

Represents the latest and most efficient form of waterproof insulating. Furnished in rolls containing approximately 100 lin. yds., 35 in. wide; weighs approximately 100 lbs. per 100 lin. yds.

Roll Roofings (Smooth Surface).

MULE-HIDE ROLL ROOFING—Made 32 in. wide, in rolls containing 108 sq. ft. 1-ply weighs 40 lbs., 2-ply 50 lbs., 3-ply 60 lbs.

MULE-HIDE SLATE-KOTE ROLL ROOFING—Surfaced with either red or gray-green crushed slate, 32 in. wide, put up in rolls containing 108 sq. ft. In two weights: 85 lbs.; extra heavy 110 lbs.

Asphalt Shingles.

Individual or four-in-one style, in permanent Slate-Kote colors, red or gray-green.

THE NATIONAL ROOFING CO.

Manufacturers of Asphalt Roofing and Industrial Paints

FACTORIES AND GENERAL OFFICES

185 Fillmore Avenue
TONAWANDA, N. Y.

BRANCH OFFICES

PITTSBURGH, PA., 607 Publication Building

BALTIMORE, MD., 1048 West Baltimore Street

DISTRIBUTERS

BALTIMORE, MD., CLARKE ASPHALT ROOFING & PAINT CO.,
1048 West Baltimore Street

BINGHAMTON, N. Y., GILLET-BARNES CO., 91 State Street

BUFFALO, N. Y., CORDES, AYRAULT & CO., INC., 51 Broadway

CLEVELAND, OHIO, NATIONAL ROOFING & SUPPLY CO., 6318
Kinsman Road

DETROIT, MICH., NATIONAL ROOFING & PAINT CO., 395 Michi-
gan Avenue

LOCKPORT, N. Y., CORDES, AYRAULT & CO., 13 Cottage Street

LOUISVILLE, KY., CENTRAL PAINT & ROOFING CO., 314
West Main Street

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Co., 219 Eighth Street

NEW ORLEANS, LA., KRACKE & FLANDERS CO., 819 Julia
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Street

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Street

SYRACUSE, N. Y., ONONDAGA BUILDERS SUPPLY CO., 569
South Clinton Street

TONAWANDA, N. Y., CORDES, AYRAULT & CO., Fillmore
Avenue

Products.

SECURITY WIDE-WELD ASPHALT ROOFING.
INDUSTRIAL PAINTS.

Security Wide-Weld Asphalt Roofing.

A heavy, built-up, mineral surfaced asphalt roofing made in 4 surfaces, with a patented 6-in. joint that can not leak, which welds the whole roof into one piece and covers all nail heads with the full thickness of the roofing.

Surfaces.

Sea gravel, red or green crushed slate, fine feldspar rock.

Construction.

Security roofing is built up of pure mineral asphalt and special high grade, long fibered asphalt saturated wool felt, with the best grade of perfectly embedded mineral surfacing. Not a particle of coal tar or pitch enters into the composition of any of the roofings.

How the Patented Cement Weld is Made.

The illustration shows the patented 6-in. cement



TRADE-MARK

welded joint, covering the nail heads and making a continuous one-piece waterproof roof.

A—Lap construction of lower sheet of roofing.

B—Upper sheet of roofing.

A1—Bottom layer of saturated felt in lower sheet, 36 in. wide and extending 4 in. beyond other layers.

A2—Full thickness of 2 layers of saturated felt and 2 of heavy mineral asphalt, 32 in. wide, extending 2 in. beyond the mineral surfacing; and covered with fine tissue paper to prevent sticking in the roll. The nails are driven through this full thickness of the roofing as shown.

A3—The mineral surfaced portion of sheet A, 30 in. wide, and the full thickness of the complete sheet of roofing.

C—The completed joint appearance, showing the continuous one-piece, leakproof feature.

Laying Specifications.

The welded joint, as above described, is made with a thick layer of hard asphalt cement, into which the upper sheet is firmly pressed.

In cold weather, warm the rolls before unrolling them.

Always unroll the roofing and lay flat on roof for a short time before applying, to prevent wrinkles and buckling.

On concrete roofs, a priming layer (National Asphalt Primer) should be applied before laying.

Proper and adequate flashings must be built around chimneys and skylights to insure a satisfactory roof.

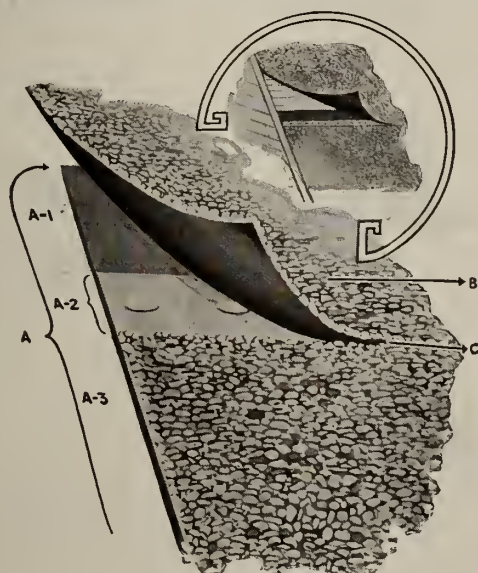
Specification sheets for engineers and architects mailed on request.

Industrial Paints.

This company owns and operates the Natroco Paint & Varnish Works and is prepared to supply all industrial paint requirements.

An excellent line of protective paints, concrete paints, and waterproofing specialties are manufactured at these works. This company also makes Natroco Factory White, the best factory white it is possible to produce.

Special literature and information furnished upon request.



6-INCH CEMENT WELD

THE STARK ROLLING MILL CO.

Manufacturers of Toncan Metal Rust and Corrosion Resisting Sheets,
Roofing, Siding and Accessories

MILLS AND MAIN OFFICE

CANTON, OHIO

Products.

TONCAN METAL BLACK and GALVANIZED RUST and CORROSION RESISTING SHEETS, used extensively for Roofing, Siding, Cornice, Eaves Trough, Conductor Pipe, Lath, Shingles, Window Frames, Blower Systems, Ventilators, Skylights, Reinforcing, Tanks, Refrigerators, Expanded Metal Lath, Culverts and all other purposes where durable sheet metal is needed.

Description.

Toncan Metal is a rust and corrosion resisting sheet metal made from iron ore. Its reputation for thorough durability and efficiency is firmly established. For more detailed information, send for and read "Corrosion—The Cause—The Effect—The Remedy."

Sources of Supply.

Jobbers and tinnerns everywhere sell Toncan Metal sheets and products.

Specification Data.

Complete data necessary for specifying and estimating Toncan Metal will gladly be mailed on request. Our sheet metal book gives convenient tables for use in specifying Toncan Metal for siding and for roofing—corrugated, V-crimp and pressed standing seam; also bundling weights, standard sizes and gauges, comparative weights of roofing materials, etc. Send for it.

Dimensions of Toncan Metal Corrugated Sheets.

2½-IN. CORRUGATIONS

Width, 26 or 27½ in. Lays 24 in. center to center.

All gauges 10 and lighter.

Lengths, 5, 6, 7, 8, 9, 10, 11 and 12 ft.

2-IN. CORRUGATIONS

Width, 26 in. Lays 24 in. center to center.

All gauges 18 and lighter.

Lengths, 5, 6, 7, 8, 9, 10, 11 and 12 ft.

1¼-IN. CORRUGATIONS

Width, 25 in. Lays 24 in. center to center.

All gauges 20 and lighter.

Lengths, 5, 6, 7, 8, 9, 10, 11 and 12 ft.

Also made with ⅝-in. and 3-in. corrugations.

Note—26 gauge Black and 28 Galvanized are lightest Toncan Metal sheets made.



TONCAN METAL CORRUGATED SHEETS
Painted or galvanized.
Suitable for roofing and siding



STANDING SEAM ROOFING

Painted or galvanized. Suitable for sloping roofs. Covering width, 24 in. Lengths, 5, 6, 7, 8, 9, 10 or 12 ft. Gauges, 20 or lighter



ROLL ROOFING

Painted or galvanized. Suitable for slightly sloping roofs. Covering width, 24 in. Each roll lays 100 sq. ft. on the building



Expanded Metal Lath.

Toncan Metal Expanded Metal Lath should always be used where the construction is subject to excessive moisture or other corrosive conditions. Its use as

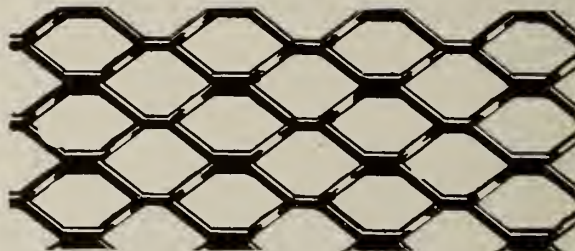
backing for all exterior stucco is an extra assurance of permanence.

References.

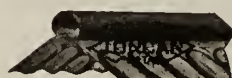
Thousands of installations in all parts of the country are proving the lasting qualities of Toncan Metal. A few are mentioned below; others will be supplied on request.

Logan Iron and Steel Co., Pittsburgh, Pa.—Roofs
Arlington Building, Washington, D. C.—Window frames
Government Observatory, Victoria, B. C.—Dome, doors, windows

New York Dock Co. Piers, Brooklyn, N. Y.—Siding
Grand Trunk Railway Elevator, Chicago, Ill.—Siding
Owens Bottle Machine Co., Charleston, W. Va.—Ventilators
Statler Hotel, St. Louis, Mo.—Cornices
Savage Arms Co., Utica, N. Y.—Skylights
Museum of Art, Cleveland, Ohio—Expanded metal lath
Olympia Club Building, San Francisco, Cal.—All sheet metal work
Hotel El Torar, Grand Canyon, Ariz.—All sheet metal work



TONCAN METAL EXPANDED METAL LATH



CORRUGATED RIDGE ROLL

2½-in or 1¼-in. corrugations. Lengths, 27 and 96 in.



PLAIN (ROUND) RIDGE ROLL

With or without nailing flange. Lengths, 8 and 10 ft. Girths, 6, 7, 8, 10, 12 and 14 in.



CORRUGATED END WALL FLASHING

Flat side on wall, 2 in. Corrugated apron, 4 in. Lengths, 27 and 96 in.



TONCAN METAL CONDUCTOR PIPE

Round corrugated, square corrugated, and plain round conductor pipe. Lengths, 8 and 10 ft. All diameters. Elbows, miters and cut-offs to match



CORRUGATED SIDE WALL FLASHING

2½-in or 1¼-in. corrugations. Any length up to 96 in. Corrugated apron, 8 in. Flat side, 5½ in.



TONCAN METAL EAVES TROUGH

Length, 10 ft. All widths; and gauges 28, 26, and 24

UNITED STATES GYPSUM CO.

Reinforced Gypsum Roof Tile

205 West Monroe Street

CHICAGO ILL.

SALES OFFICES

NEW YORK, N. Y., 1170 Broadway
BOSTON, MASS., 166 Devonshire Street
BUFFALO, N. Y., Ellicott Square
WASHINGTON, D. C., 219 Woodward Building
CLEVELAND, OHIO, Schofield Building
PHILADELPHIA, PA., 401 Franklin Building
PITTSBURGH, PA., 1226 Oliver Building
ST. LOUIS, MO., 2192 Railway Exchange

DETROIT, MICH., Penobscot Building
MILWAUKEE, WIS., Grove and Oregon Streets
MINNEAPOLIS, MINN., 650 Builders Exchange
KANSAS CITY, MO., 513 Railway Exchange Building
DENVER, COLO., 1820 West 13th Avenue
LOS ANGELES, CAL., 902 Citizens' National Bank Building
OMAHA, NEBR., 422 Bee Building
CINCINNATI, OHIO, 405 Builders' Exchange

Products.

Manufacturers and erectors of PYROBAR REINFORCED GYPSUM ROOF TILE (made of Structolite), for Roof Decks.

Engineering Service.

An Engineering and Construction Department is maintained for the purpose of assisting engineers and architects in designs and estimates, and it is desirous of submitting erection bids on Pyrobar roof tile. The UNITED STATES GYPSUM CO. maintains possibly the largest and most skilled organization for the erection of this kind of work.

Sixteen producing mills, located at advantageous points, assure prompt delivery of any quantity.

Pyrobar Reinforced Gypsum Roof Tile.

Pyrobar gypsum roof tile are made of Structolite, a specially prepared, hard, dense gypsum, reinforced with steel and designed to carry the full required roof load. These tile are manufactured in two general types: long span (either hollow or channel sections), and 30-in. type (solid and hollow).

All types are machine moulded, assuring true and even faces and straight edges.

The tile are laid directly on steel purlins or trusses and the joints are filled with gypsum grout which bonds the tile, forming a gypsum surface, to which any type of roof covering can be immediately applied, after the tile are set in place.

ADVANTAGES—Strength—Pyrobar roof tile are designed to carry 50 lbs. live load per sq. ft., uniformly distributed, with a factor of safety of 4.

Fireproof—Gypsum is acknowledged to be one of the best fire resisting materials known. Gypsum will not support combustion, and has no appreciable contraction nor expansion; consequently it will not warp, buckle nor spall under severe fire.

Minimizes Condensation—Superior heat insulation is a salient feature of Pyrobar tile. Tests give the following values of B.t.u.'s transmitted per sq. ft. per degree Fahrenheit difference in temperature, per hour, for various roof deck materials:

	B.t.u.
1½-in. solid cement tile.....	0.990
3-in. solid concrete slab (1-2-4).....	0.750
2-in. yellow pine plank.....	0.385
3-in. solid Pyrobar roof tile.....	0.250
4-in. hollow Pyrobar roof tile.....	0.200

This proves that less heat is transmitted through gypsum than any of the other materials. This is the reason why the undersurface of Pyrobar roof deck remains at practically the same temperature as the air of the interior of the building regardless of changes of ex-



STEEL FRAME READY FOR
PYROBAR



PYROBAR APPLIED TO
STEEL

ternal temperature. Under these conditions no "sweating" or "dripping" can occur and condensation of moisture is minimized.

Heat Saving—The superior heat insulation value shows a decided saving compared both in tons of fuel used for heating purposes and first cost of heating plant.

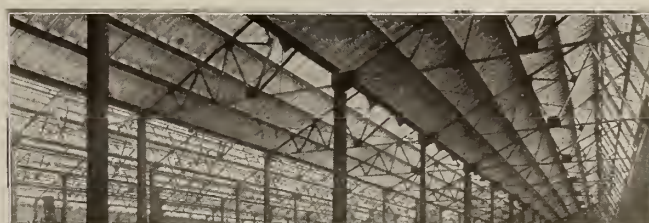
Light Weight—Pyrobar tile are 50% lighter than concrete per square foot of surface for equal thicknesses, thereby affording a material saving in steel framing and, consequently, in steel columns.

Adaptable—Suited to any form of roof design, flat or peaked, and easily cut and fitted. Any form of roof covering, built up or composition, may be directly applied. Nailing strips are entirely eliminated. By use of extra thick nailing deck, for the "channel" type, and extra dense material for the 30-in. type, slate, baked clay, Ludowici and similar roof coverings are nailed directly to the tile.

Quickly Erected—The large light weight units are very quickly installed during any weather conditions, including freezing temperature. Their erection does not interfere with plant operations going on below.

Light Diffusive—The undersurface of the roof is white, uniformly smooth and light reflecting, assisting in the solution of the lighting problem.

Permanency—The permanency of Pyrobar gypsum tile has been established through many years of use. The tile are not affected by the chemical action of smoke or the deteriorating action of sulphuric acid fumes; thus maintenance cost is eliminated.



PYROBAR LONG SPAN TILE
Spanning from purlin to purlin

Long Span Gypsum Roof Tile.

The "channel" type tile are made in lengths from 4 to 10 ft. The table below gives design dimensions and weights of the various lengths.

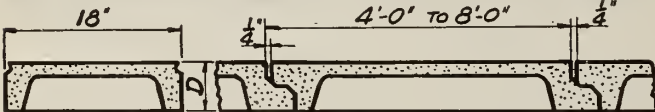


LONG SPAN "CHANNEL" TYPE GYPSUM ROOF TILE



DETAIL LONG SPAN "CHANNEL" TYPE GYPSUM ROOF TILE

Special long span lap joint tile, similar to the "channel" type, are manufactured for general roofing construction and reroofing purposes, and are designed to take care of conditions where the purlins are not always in alignment. This condition often exists where Pyrobar tile are to replace clay tile, concrete or wood roof.



DETAIL LONG SPAN "CHANNEL" TYPE WITH LAP JOINT SPANS FROM FOUR TO TEN FEET

Safe live load, 50 lbs. per sq. ft.; factor of safety, 4

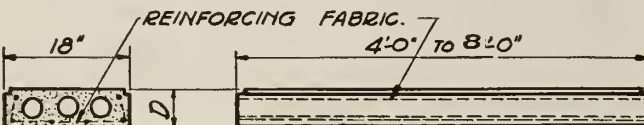
Span in ft.	4	5	6	7	8	9	10
Depth, "D" in.	5	5	5	6	6	7	8
Weight, lbs. per sq. ft.	16.5	16.5	16.5	18.5	18.5	20.5	25

In general, all tile on one continuous roof deck to be of depth required for maximum span.

The "hollow" type are manufactured in the same lengths as the "channel" type up to 8 ft.; the hollow type, however, provides a flat and better light reflecting ceiling, with maximum insulation.



LONG SPAN "HOLLOW" TYPE ROOF TILE



DETAIL LONG SPAN "HOLLOW" TYPE ROOF TILE SPANS FROM FOUR TO EIGHT FEET

Safe dead load, 50 lbs. per sq. ft.; factor of safety, 4

Span in ft.	4	5	6	7	8
Depth, "D" in.	6	6	6	6	6
Wt., lbs. per sq. ft.	25	25	25	25	25

NOTE—Purlin table for long span channel or hollow type tile and construction details are shown at head of following column.

30-Inch Type Pyrobar Roof Tile.

The hollow and solid types are designed to withstand the same loads. Their surface measurements are 12 by 30 in., with thickness of 3 in. for the solid tile and 4 in. for the hollow or cored tile. They are especially adaptable for curved and other intricate roof designs and are easily cut to fit any requirements. The tile are

PURLIN TABLE FOR LONG SPAN CHANNEL OR HOLLOW TYPE TILE

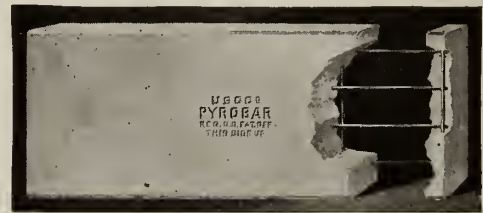
Total uniform load of 50 lbs. per sq. ft.

PURLIN SPAN - FT.	8	10	12	14	16	18	20	22	24
SHAPE	I	C	I	C	I	C	I	C	I
DEPTH - INS.	3	4	4	4	5	6	7	8	10
WGT. PER FT.-LB.	5½	7½	5½	7½	6½	9½	8	9½	15
DEPTH - INS.	3	4	5	5	6	7	8	9	10
WGT. PER FT.-LB.	5½	5½	7½	6½	9½	8	9½	12½	15
DEPTH - INS.	4	4	5	5	6	7	8	9	10
WGT. PER FT.-LB.	7½	5½	7½	6½	9½	8	12½	9½	15
DEPTH - INS.	4	5	6	5	7	6	8	9	10
WGT. PER FT.-LB.	7½	6½	9½	8	9½	12½	11½	15	21
DEPTH - INS.	4	5	6	7	6	8	7	9	10
WGT. PER FT.-LB.	7½	6½	9½	12½	9½	12½	11½	15	21
DEPTH - INS.	4	5	6	7	7	9	8	10	12
WGT. PER FT.-LB.	7½	6½	9½	12½	15	13½	18	21	25
DEPTH - INS.	4	5	6	7	8	9	10	12	15
WGT. PER FT.-LB.	7½	6½	9½	12½	15	18	21	25	33

placed on T-iron purlins spaced 30½ in. on centers, their weight being 16 lbs. per sq. ft.

Curbs or walls on the monitor or sawtooth sash are built of 3- or 4-in. solid Pyrobar tile; the end walls of monitors and sawteeth are similarly built—the roof covering being extended to cover curbs and end walls.

Where it is necessary to build up roof for drainage purposes, a "drainage fill" is supplied, which is a combination of gypsum and cinders or wood chips that sets within 30 minutes after being placed, permitting application of roof covering without delay.



DESIGNING DATA

	Solid	Hollow
Depth ..	3 in.	4 in.
Length..	30 in.	30 in.
Wt.,sq.ft.	16 lbs.	16 lbs.
Wt. of 3 in. extra dense.	18 lbs.	



Spans for various T-irons spaced 30½ in. on centers

Span.....	Up to 5' 3"	5' 3" to 5' 10½"	5' 10½" to 6' 5½"	6' 5½" to 8'
Size T-iron.	2¼"x2¼"-4.1 lbs.	2¼"x2¼"-5 lbs.	2¼"x2¼"-5.6 lbs.	3"x3"-6.8 lbs.



SECTIONS OF TILE SHOWING JOINTS OF GYPSUM GROUT

SIZE OF CHANNEL PURLINS FOR 30-INCH TILE

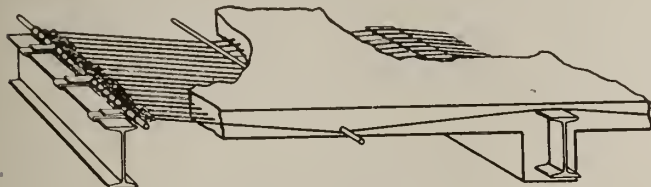
Total dead load of 50 lbs. per sq. ft.

PURLIN C TO C IN FEET	10	12	14	16	18	20	22	24
4'-0"	4'-5½"	5'-6½"	6'-8"	7'-9½"	7'-9½"	8'-11½"	9'-13½"	10'-15"
4'-6"	5'-6½"	5'-6½"	6'-8"	7'-9½"	8'-11½"	9'-13½"	9'-13½"	10'-15"
5'-0"	5'-6½"	6'-8"	7'-9½"	7'-9½"	8'-11½"	9'-13½"	10'-15"	12'-20½"
5'-6"	5'-6½"	6'-8"	7'-9½"	8'-11½"	9'-13½"	10'-15"	12'-20½"	12'-20½"
6'-0"	5'-6½"	6'-8"	7'-9½"	8'-11½"	9'-13½"	10'-15"	12'-20½"	12'-20½"
6'-6"	6'-8"	7'-9½"	7'-9½"	8'-11½"	9'-13½"	10'-15"	12'-20½"	12'-20½"
7'-0"	6'-8"	7'-9½"	8'-11½"	9'-13½"	10'-15"	10'-15"	12'-20½"	12'-20½"
7'-6"	6'-8"	7'-9½"	8'-11½"	9'-13½"	10'-15"	10'-20"	12'-20½"	12'-20½"
8'-0"	6'-8"	7'-9½"	8'-11½"	9'-13½"	10'-15"	10'-20"	12'-20½"	12'-25"

Pyrofill Monolithic Gypsum Roof Deck.

This is an economical form of poured-in-place construction. Formwork is provided the same as required for concrete slab; steel cables are laid across the purlins and securely fastened. The principles in its design are the same mathematically as that of a suspension bridge, and its strength can be calculated with the same accuracy. A transverse steel rod is laid across the cables at the center of each span, so as to secure uniform deflection. This type of roof is made of Pyrofill, a specially calcined gypsum mixed before shipment with a definite proportion of wood shavings.

Pyrofill requires only addition of water to make it the required consistency. It is poured on the reinforcing and leveled off to the specified thickness of slab.



PYROFILL FOR ROOFS

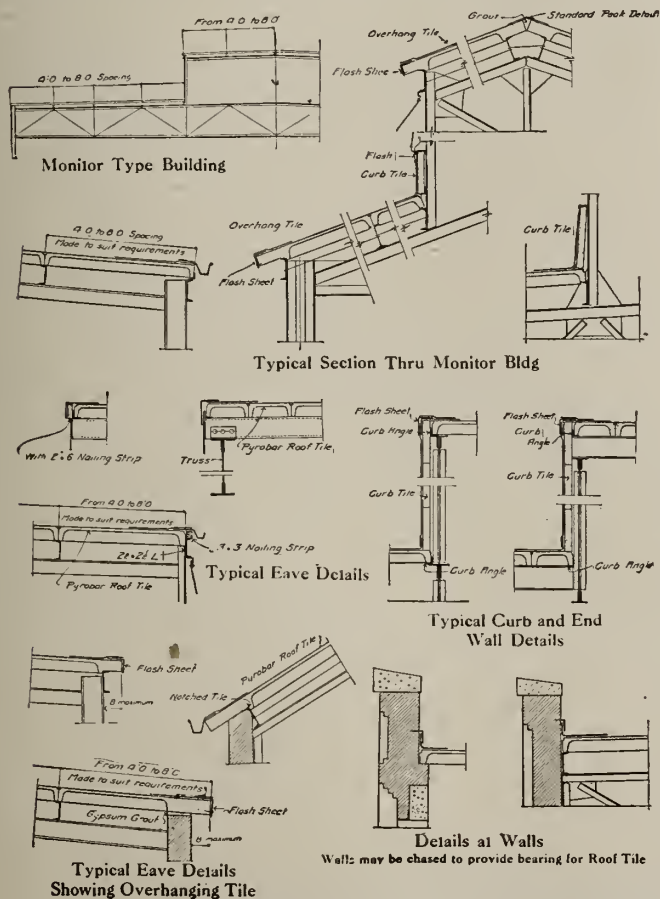
Specifications for Pyrofill Monolithic Gypsum Roof Deck.

Unless otherwise noted, all roof slabs shall be constructed of poured gypsum, using the system of the UNITED STATES GYPSUM Co. known as Pyrofill Monolithic Gypsum Roof. The contractor shall provide necessary forms, reinforcing cables, Pyrofill and all labor required.

All cantilever construction, such as eaves, etc., shall be properly reinforced and anchored to the adjoining slab. All curb walls, ends of monitors, etc., shall be constructed of 3- or 4-in. Pyrobar Gypsum Tile, neatly laid up in gypsum mortar.

Specifications for Pyrobar Long Span Roof Tile.

(1) All roofs as shown on plans, unless otherwise noted,



CONSTRUCTION DETAILS SHOWING TYPICAL DESIGNS OF PYROBAR GYPSUM ROOF TILE

shall be constructed of Pyrobar Long Span Reinforced Roof Tile [specify whether "Channel" Type, Lap Joint or "Hollow" Type shall be used], manufactured by the UNITED STATES GYPSUM Co. The tile shall be placed directly upon [steel or wood] roof framing without mortar and with sides close together. All "routing joints" of the tile shall be filled with gypsum grout, composed of 1 part unfibered gypsum cement plaster and 3 parts of clean, sharp sand.

(2) Curbs under monitor or sawtooth sash, also the end walls of monitors or sawteeth, shall be constructed of 3- or 4-in. solid Pyrobar Tile set in gypsum cement mortar, joints to be well bedded and struck.

(3) Where it is desired to nail roof coverings directly to the roof deck, the above specifications should read: "to be constructed of Pyrobar Long Span Reinforced Gypsum Roof Tile, ["Channel" Type] [Lap-Joint] with extra thick nailing deck."

(4) Cut nails or barbed slater's nails shall be used to fasten roof covering, and nails shall have at least 1½-in. penetration into gypsum nailing tile.

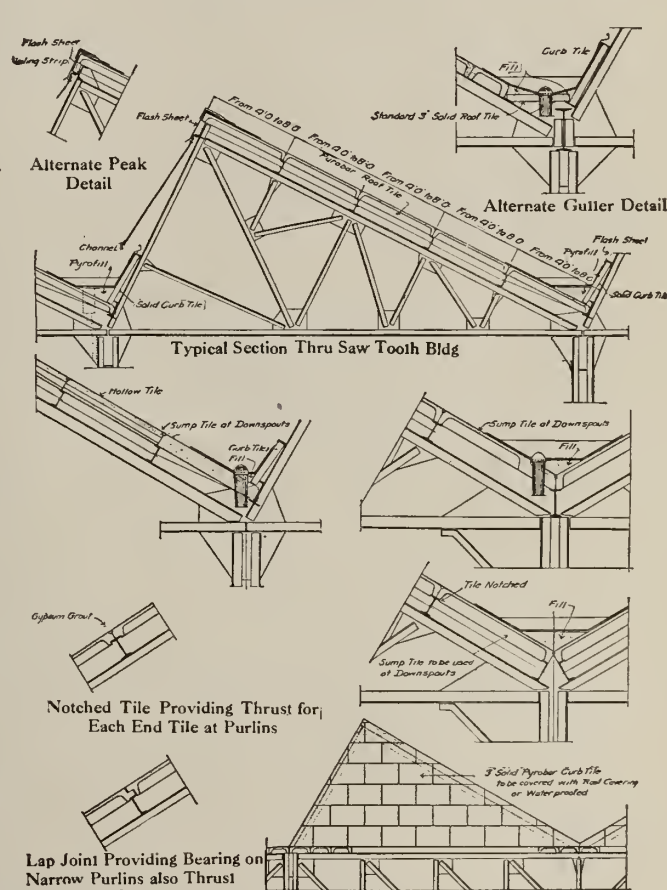
Specifications for Pyrobar 30-inch Roof Tile.

(1) All roofs as shown on plans, unless otherwise noted, shall be constructed of [30-in. solid or hollow] Pyrobar Reinforced Gypsum Roof Tile, manufactured by the UNITED STATES GYPSUM Co. The tile shall be laid close together on "T" irons without mortar, but the space at and above the flange of the "T's" and the grouting joints of the tile shall be filled with grout composed of 1 part of gypsum cement plaster and 3 parts clean, sharp sand.

(2) Curbs under monitor or sawtooth sash, also the end walls of monitors and sawteeth, shall be constructed of 3- or 4-in. Solid Pyrobar Tile set in gypsum cement mortar, joints to be well bedded and struck.

(3) Where it is desired to nail roof covering directly to the roof deck, specification above should read: "to be constructed of 3- by 12- by 30-in. Pyrobar Reinforced Extra Dense Nailing Roof Tile."

(4) Cut nails or barbed slater's nails shall be used to fasten roof covering, and nails shall have at least 1½-in. penetration into gypsum nailing tile.



UNITED STATES CEMENT TILE COMPANY

Farmers Bank Building
PITTSBURGH, PA.

WORKS:
NEW CASTLE, PA.

Product.

REINFORCED CEMENT ROOFING TILE.

"Flatlock" Cement Tile.

"Flatlock" reinforced cement roofing tile is adaptable to any kind of roof construction, whether flat or pitched. It provides a fireproof concrete base for the application of a built-up or composition roofing, affording the maximum strength with the minimum use of steel, making a durable and absolutely safe construction.

Salient Features of "Flatlock."

(1) A side elevation of the tile, shows it tapering from end to end, with an offset recess at its thicker end of a depth corresponding to the thin end of the tile, whereby a flush upper surface is obtained and a 4-in. end lap; also a depending hook that engages with the purlin, in this manner developing the novel and simple flat lock joint over each purlin, whereby the individual courses of tile are safely anchored.

(2) With this type of tile, channel purlins are used throughout, with a consequent saving of steel.

(3) Purlin spaces can be varied to accommodate the length of roof slope.

(4) The overhang at the eaves is not dependent on a cut-out recess which weakens the tile at that point.

(5) The simple and efficient manner of supporting flashing tile in any position.

(6) The ability to nail the waterproofing at overlapping joints on steep surfaces.

The above features provide a highly efficient, eco-

nomical and safely anchored fireproof base made absolutely weathertight and waterproof by the application of a built-up or composition roofing.

Composition.

Flatlock tile is made of portland cement and clean coarse aggregate. It is suitably reinforced, the reinforcing being thoroughly embedded and protected.

The tile is manufactured in a modernly equipped factory, by experienced men, under expert supervision. The materials are accurately proportioned, thoroughly mixed and rammed into place, forming a homogeneous and dense mass. The results obtained closely resemble those secured by laboratory methods, insuring a uniform product.

The top surface is free from any oil or other substance detrimental to the successful application of waterproofing. The bottom presents a pleasing, smooth and light surface.

Roof Design.

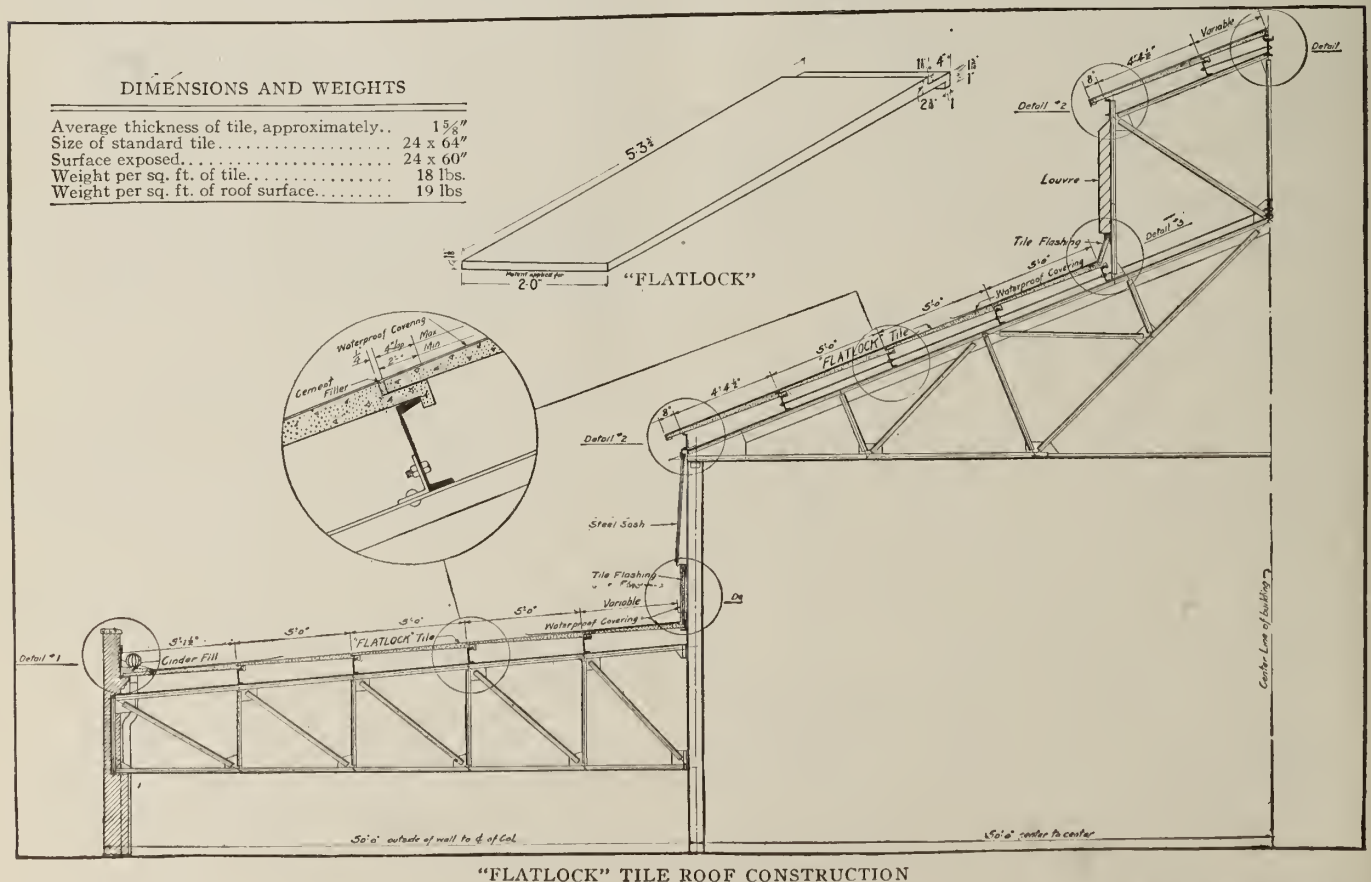
Flatlock tile is laid directly on channel purlins. If desired, I-beams can be used.

Standard spacing is 5 ft. back to back of purlins, which allows for 4-in. end lap.

Spaces can be stretched not exceeding 5 ft. 2 in. to compensate for variations in the length of roof.

Special tile is furnished for short courses, where stretched spaces will not suffice. See detail No. 4.

All eave purlins must be raised 1 1/4 in. above top line of other purlins.



"FLATLOCK" TILE ROOF CONSTRUCTION

Erection.

Flatlock tile is erected by this company's own experienced erection crews.

The open spaces at overlapping joints are afterwards pointed with a lean cement mix, the abutting sides are thoroughly pointed with elastic cement, leaving the entire roof surface ready for the application of waterproofing.

Load Test.

Flatlock tile is guaranteed to carry a uniformly distributed load of 100 lbs. per sq. ft. over a span of 5 ft.

Service.

The engineers connected with the UNITED STATES CEMENT TILE COMPANY have had long experience in the

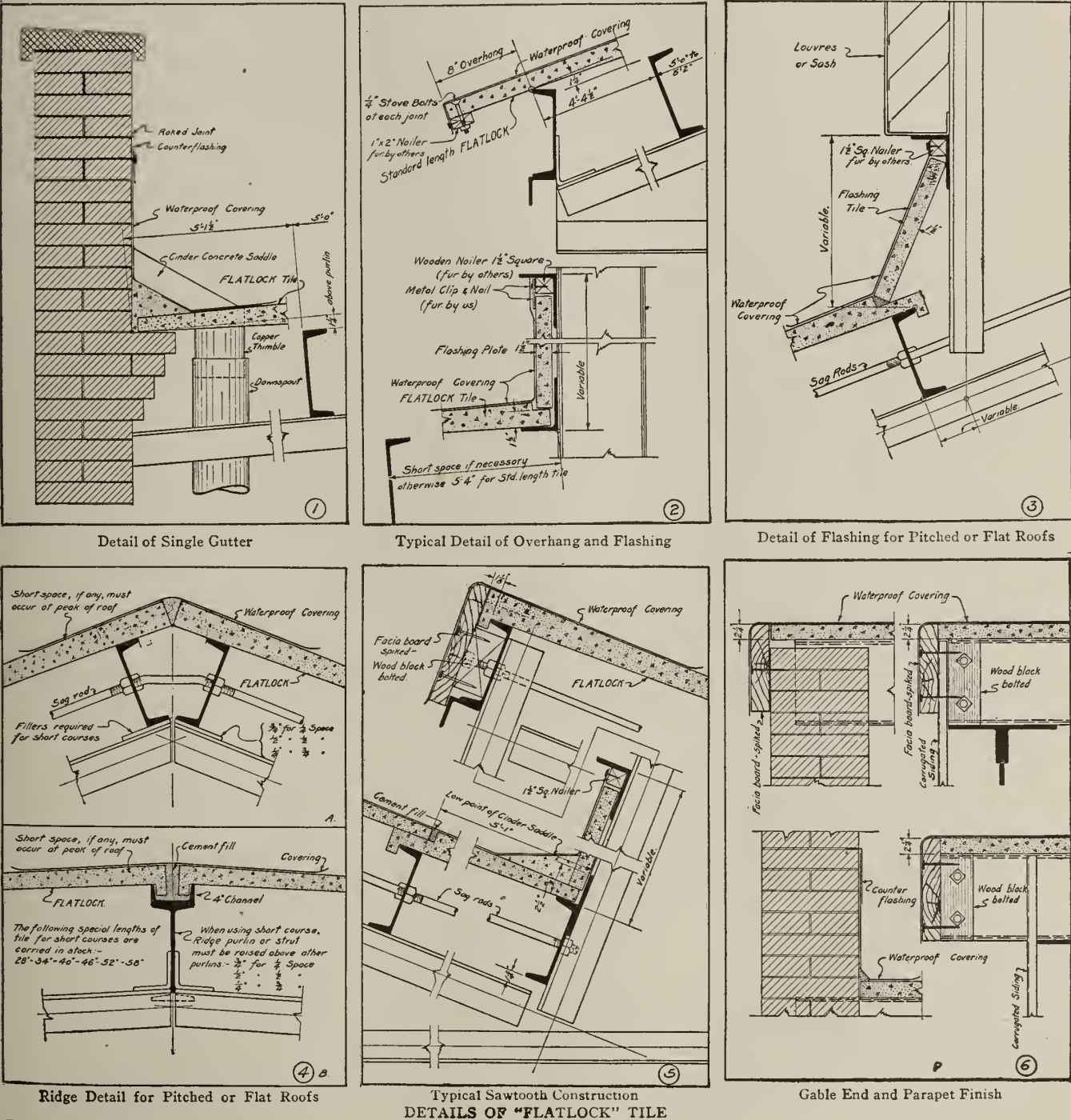
cement roofing tile industry and their services, without charge, are at the disposal of patrons.

Prices.

When furnished plans, the company will be pleased to make estimates for roofs erected and guaranteed.

SIZE OF CHANNEL PURLINS RECOMMENDED		
Bay	Flat construction	1/5 pitch
14 ft.	7"—9¾ lbs.	6"—8 lbs.
15 ft.	8"—11¼ lbs.	7"—9¾ lbs.
16 ft.	"	8"—11¼ lbs.
17 ft.	9"—13¼ lbs.	"
18 ft.	10"—15 lbs.	9"—13¼ lbs.
19 ft.	"	10"—15 lbs.
20 ft.	12"—20½ lbs.	"
21 ft.	"	12"—20½ lbs.
22 ft.	"	"
23 ft.	"	"
24 ft.	"	"
25 ft.	"	"

Sections underscored are within safe limits for deflection. All others deflect in excess of 1/360 of span.



ESTATE OF J. G. HETZEL

CHAS. E. HETZEL, PROPRIETOR

Manufacturers of Roofing Cement and Paints

CABLE ADDRESS:

"HETZEL, NEWARK"

67 Maine Street

NEWARK, N. J.

Products.

HETZEL'S ELASTIC RUBBER ROOF CEMENT for all kinds of roofs, glass skylights, coping stones, etc.

HETZEL'S ASBESTOS PLASTIC COMPOUND for spreading over old roofs.

HETZEL'S "R. O. P." CEMENT COATING.

HETZEL'S PIPE JOINT COMPOUND.

HETZEL'S DAMP RESISTING PAINT for brick walls.

Hetzel's Asphalt Paints; Hetzel's Asbestos-Roof-Kote, a liquid asbestos roof paint; Hetzel's "Rub-on" Roofing Paint; Hetzel's Enamel Paints (black and green) for boiler fronts and steam pipes; and Hetzel's Acidproof Paint for metal work, ammonia tanks and gas tanks.

Hetzel's Rubber Roof Cement.

Hetzel's rubber roof cement, which has been in general use throughout the United States and Europe for many years, is especially valuable for covering and repairing all holes, cracked joints, breaks, or leaks in roofs of all kinds. It is also used for pointing around chimneys, skylights, and dormer windows; for repairing coping stones, gutters, wood and stone work which require to be made watertight; and for laying and bedding slate and tile roofs.

Supplied in the following colors: brown, gray, black, green and red. It is also made to order to suit every purpose, and is the only slaters', tanners' and tile roofers' cement.

Hetzel's rubber roof cement is equally well adapted for use on slate, tin, asbestos, glass, wood and metal roofs; is permanent; does not run or loosen from joints or cracks, and is not affected by any extreme of temperature or climatic changes. It does not harden, but preserves its complete elasticity even when exposed to extreme heat, cold, dryness or humidity.

Hetzel's Asbestos Plastic Compound.

A specially prepared compound for spreading over old wood, tin, iron, or felt roofing; for repairing leaky chimneys; for waterproofing walls below and above grade, etc. Applied with a plasterer's trowel.

Hetzel's "R. O. P." Cement Coating.

A specially prepared material for stucco, brick and concrete surfaces.

Impervious to moisture, and positively unaffected by any of the alkalis in cement and brick materials.

As a cement floor coating, it dries hard and is proof against oil, grease or water.

Made in 8 different colors.

Pipe Joint Compound (Red, Gray and Black).

This compound adheres to metal, and is used for joints of gas, steam, water, and air pipes. It will not harden, and prevents joints from rusting. It will make absolutely tight joints, which can be disconnected at any time, without injury to fittings.



TRADE-MARK

Hetzel's Damp Resisting Paint.

A compound black paint for dampproofing foundations and walls above and below grade. When applied to inner side of exterior walls, forms a good damp-proof surface for direct application of plaster, rendering plaster stainproof, and saving cost of furring and lathing.

Specifications for the Use of Hetzel's Elastic Rubber Roof Cement.

All nailholes and joints between the slates shall be sealed with Hetzel's Elastic Rubber Roof Cement as manufactured by the ESTATE of J. G. HETZEL, Newark, N. J., in such quantities as to hold the slates in position should they break, or the nails rust away. (Fig. 1.)

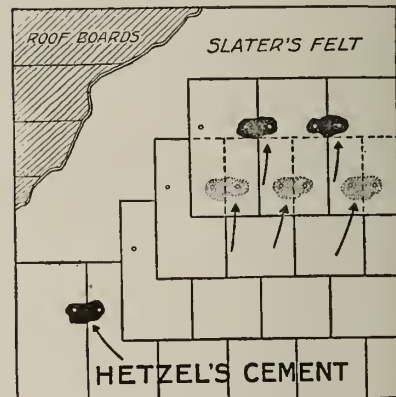


FIG. 1. For Slate Roofs

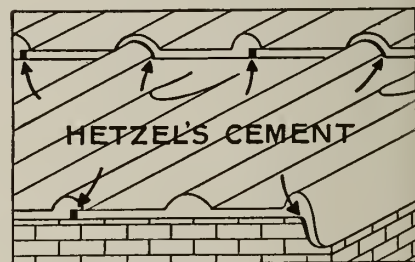


FIG. 2. For Spanish and Flat Tile Roofs

The joints of all tiles shall be sealed with Hetzel's Elastic Rubber Roof Cement as manufactured by the ESTATE of J. G. HETZEL, Newark, N. J. To prevent leaking, the hip and ridge rolls shall be sealed in a like manner. (Fig. 2.)

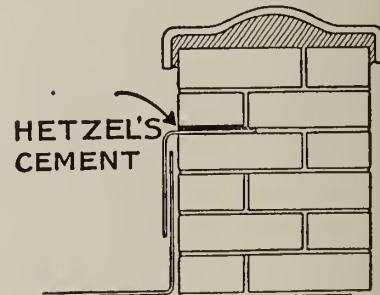


FIG. 3. For Pointing up Cap Flashings

All cap flashings shall be carefully pointed up with Hetzel's Elastic Rubber Roof Cement as manufactured by the ESTATE of J. G. HETZEL, Newark, N. J. (Fig. 3.)

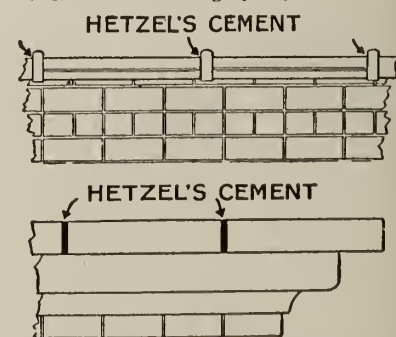


FIG. 4. For Tile and Stone Copings
APPLICATIONS OF HETZEL'S ELASTIC RUBBER ROOF CEMENT

The joints of all copings shall be set and sealed with Hetzel's Elastic Rubber Roof Cement as manufactured by the ESTATE of J. G. HETZEL, Newark, N. J. (Fig. 4.)

NATIONAL VENTILATING COMPANY

Manufacturers of Puttyless Skylights

GENERAL OFFICE AND FACTORY

337-339 East 26th Street
NEW YORK, N. Y.

TELEPHONE:

MADISON SQUARE, 387-388

Products.

MULTI-UNIT PUTTYLESS SKYLIGHTS.

Also, Side Lights, Operating Sash, and National Ventilating Devices.

Adaptability.

Skylights for railway terminals, power stations, machinestops, factories, foundries, libraries, museums, art galleries, and all other buildings whereon permanent watertight skylights of large area are required.

Advantages and Distinctive Features.

Referring to illustration, the bar and upper lights are supported in a fixed manner by the purlin thereunder; while the lower bar, supporting the lower lights, is secured by the same purlin in a loose manner, permitting it to expand freely.

This construction, being repeated at each purlin, permits movement, all in same direction, due to expansion, contraction, or vibration (along the slope of the skylight) of the cap, glass and bar of each unit or tier of glass, independently of every other unit or tier.

Along the longitudinal line of the skylight the steel frame of the building and the entire length of the glass are each taken as separate units, and the difference, nearly 100%, in the expansion and contraction of these materials (glass and steel) is likewise thoroughly taken care of by the copper spreader clips shown in transverse section at supporting bar. These spreader clips are placed over each cap bolt, spaced about 12 in. along each skylight bar, and incidentally they serve also to better secure in place the copper bolts for holding the caps.

The cap is strong and yet resilient. Its upper half is of an inverted "U" shape, which provides strength and rigidity; while the lower half, especially at the lower extremities, is resilient, so as to conform thoroughly, when secured in position, to the surface of the glass.

All gutters and parts that are non-accessible, without removing the glass, are of non-corrosive material. The entire top of the bar is covered with 8-oz. copper, the same being applied while the last coat of bar-paint is still wet; and a flexible bearing for the glass is formed, which adjusts itself to any warps or irregularities of the glass along its bearing line.

The company is equipped to cover the bottom of the bar also. Both the top and bottom bar covers

are made by special dies and both fit the bar snugly.

No packing or filling substance of any kind is required, and no material is used other than glass and metal.

Installations.

The Pennsylvania Railroad Co. adopted this construction for its new New York City Passenger Station, on which building 83,000 sq. ft. of skylight were installed, embracing every known variety of construction.

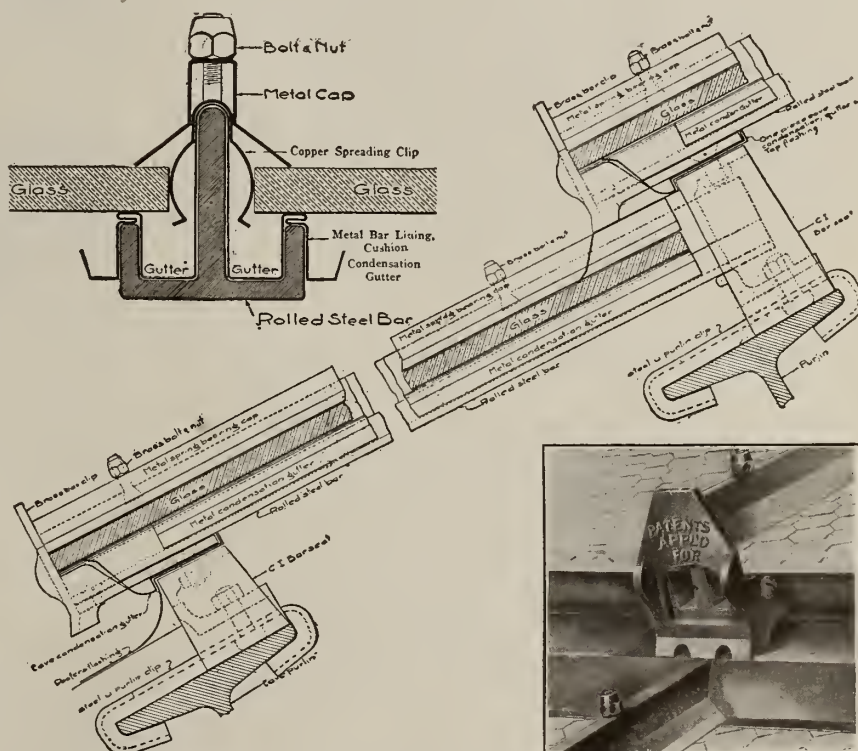
The Central Railroad of New Jersey also adopted this system for its new Terminal at Jersey City, where 116,000 sq. ft. were installed.

The New York Central Railroad Co. has this construction on its Grand Central Terminal at 42nd Street, and on Powerhouses and Passenger Stations at various points.

Installations have been made on a number of large buildings in the United States Navy Yard at Washington, D. C., and Norfolk, Va.

A large number of industrial plants have also adopted this system as it has been found the most economical and satisfactory.

The Standard Arcade at 50 Broadway, New York, N. Y., has a curved roof skylight of this construction, which is a splendid example of its peculiar adaptability to any condition.



DETAILS OF MULTI-UNIT PUTTYLESS SKYLIGHTS

(Patents applied for)

Construction shown on the right side is repeated at each purlin between the eave and the ridge

AMERICAN 3 WAY-LUXFER PRISM CO.

Distributers of Daylight

1305-55th Court
CICERO, ILL.

NEW YORK OFFICE, 94-98 Wooster Street

REPRESENTATIVES IN ALL LARGE CITIES THROUGHOUT THE COUNTRY

Products.

3 WAY-LUXFER SIMPLEX SKYLIGHTS.

TYTE-LITE, a calking preparation.

3 Way-Luxfer Simplex Sidewalk, Vault Lights and Floor Lights.

Prism Glass, Flush Watertite Sidewalk Doors, Coalhole Covers, Vent Doors, Sidewalk Grating, and other Cast Iron Paving and Sidewalk Specialties.

3 Way-Luxfer Simplex Skylights.

ADAPTABILITY AND ADVANTAGES—Skylights of this construction, made with $6\frac{1}{8}$ -in. square glasses, are ideal for large surface installations, such as depot train sheds, light wells and floor lights. The large light area, great strength, economy of installation, absence of upkeep cost, freedom from fire risk, and their everlastingness, combined with the neat appearance of glass and concrete surface on both sides, make Simplex skylights all that can be desired.

Once installed, the Simplex skylight needs almost no attention and no repairs except in case of extraordinary accidents. It requires no protecting screen, needs no transverse supporting beams, and withstands all kinds of weather without leaking.

CONSTRUCTION—First is made a grid of steel, in itself capable of supporting a big load. We punch $1\frac{1}{2}$ -in. I-bars every $7\frac{1}{2}$ in., and through these holes are forced $\frac{3}{8}$ -in. reinforcing rods.

This grid is then embedded in concrete. With the grid in the forms, each mould for the glass is carefully centered in each square of the grid. A special mix of concrete is then filled in till all the steel is covered but the heads of bars.

When constructed on the job, or for complete slab, this same construction is followed, but all the concrete is poured at one time, with the glasses in place.

Reground Cement Used—Nothing but reground cement is employed, 95% of which must pass through a 200-mesh screen.

Coarse ordinary cement *never all gets wet clear through*. So in concrete there is always a certain per cent of "raw" cement. Successive rains, melting snows, etc., penetrate the concrete, wet this raw cement and chemical action begins—expanding and causing great pressure on the surface. That is the reason that reinforced concrete walks always buckle up and not down.

But the very fine grain of the reground cement is wet clear through, in the first mix, so that there can be no after crystallization; hence no undue expansion, causing surface cracking and shaling of glass in skylights. And because of its added density this concrete is naturally waterproof, although, if desired, waterproofing can be added.

Lazalite Glass Only Employed—The space for glass is $6\frac{1}{8}$ in. square, surrounded with concrete $1\frac{3}{8}$ in. width. The glass is pressed to exact size, $6\frac{1}{8}$ in. square, and tempered and annealed just like the side-



SIMPLEX SKYLIGHT OVER SWITCHBOARD IN CALUMET EXCHANGE, CHICAGO TELEPHONE CO.

Ideal construction—great strength, large daylight area. One of two gable skylights on this building which have never leaked or given any trouble



GRID REINFORCING STEEL



LAZALITE LENS

walk glass. This large glass will resist any ordinary blow, and can be walked on with perfect safety.

The famous Lazalite glass contains no manganese, so does not turn pink or purple under action of the elements. And every piece is absolutely perfect, free from hidden stresses and strains because each is tested under the polariscope before it leaves the factory, and is guaranteed by the manufacturer.

After perfect lenses are selected, the edges are covered with a plastic coating to provide a cushion to

take up the pressure of the heat expansion of the glass and concrete.

Finishing the Skylight—Most installations are of the gable or "dog house" type. Flat installations are discouraged except where raised on coping. The difference of expansion between the solid roof and the skylight makes it almost impossible to keep the joint waterproof; while if the skylight is raised on its own coping, it is easy to provide for the variation and make the joints absolutely tight.

The preformed slabs are set and glazed on the job.

No Cross Beams Required—Cross beams are not necessary for the support of Simplex skylights. The longitudinal I-bars buried in concrete and laced together make such a strong construction that it will carry many times the load any snow storm might put on it. Send for our Engineer's Test Report on Strength.

The Joints—As the preformed slabs are set in place a "U" formed metal expansion joint is inserted between every two slabs. The flanges rest on the edge of the preformed part of the slab and so are buried on the top dressing. When the top is "set" the space is filled with Tyte-Lite calking compound. When complete slabs are supplied they are made with a groove to take the expansion joint.

SPECIFICATIONS—Skylights, where shown on plans to be reinforced concrete type with no exposed metal, using 1½-in. channel flats with ¾-in. reinforcing rods at right angles to channel flats. It shall have a tested carrying capacity of not less than 250 lbs. per sq. ft. on a 5-ft. clear span, supported on two ends only, figuring on a factor of safety of 4.

Glass to be Lazalite quality, as manufactured by the Jeanette Glass Company, guaranteed by the manufacturers to be free of manganese and without stresses and strains, each piece having stood polariscope test.

Side walls to have a plastic malleable coating to form a cushion protection for expansion. Glass to be of replaceable type, so as to permit of any replacement without defacing the surface of concrete.

All glass to be 6½ in. square, spaced on not more than 7½-in. centers.

Cement must be reground to the extent of permitting 95% to pass through a 200-mesh sieve.

Calk all joints around and between prismatic skylights with Tyte-Lite.

Work to be set by manufacturers' own experienced workmen.

All as furnished by AMERICAN 3 WAY-LUXFER PRISM CO., or other approved equal.

3 Way-Luxfer Simplex Skylight Slabs.

Complete skylight slabs ready for slipping into place and calking joints supplied for small installations.

Replaceable Lens.

The glass in the original installation is made with a bead and so shaped that if a glass becomes broken from any cause it can be easily replaced without chipping the concrete. By using our new replaceable lens, which is made slightly smaller, a new glass is simply slipped into the old opening and the space filled with clear cement and plastic coating.

Tyte-Lite.

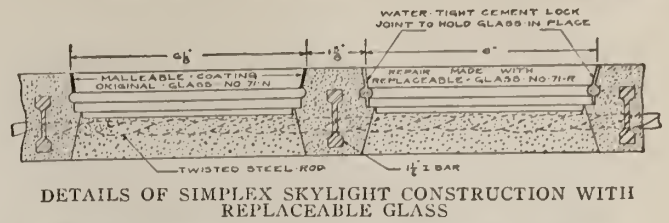
Tyte-Lite is a compound made especially for waterproofing joints in skylights. Jobs several years old calked with Tyte-Lite upon investigation by us have been found in perfect condition.

Sold in any quantity. Write for further information.

Typical Drawings and Details.

Our skylight construction experts have prepared several drawings of different forms of skylights.

Upon receipt of information regarding skylight installations considered, these complete working drawings will be furnished together with details.



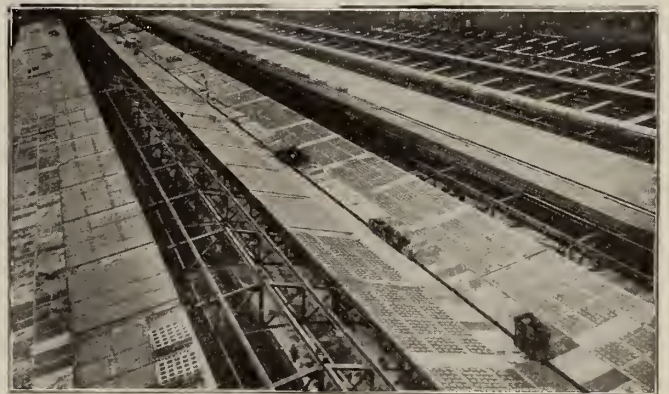
SIMPLEX SKYLIGHT, BORLAND BUILDING, CHICAGO

Length 165 ft., width 14 ft., gable of "dog house" construction. Span 9 ft. 6 in. ridge to gutter, without support. Has never leaked or needed attention.

Note that room is perfectly daylighted due to great glass areas and total absence of supporting beams. Observe attractive appearance of construction from below



SIMPLEX CONCRETE SKYLIGHTS OVER PLATFORM OF DELAWARE, LACKAWANNA & WESTERN R. R. TERMINAL, BUFFALO, N. Y.



SIMPLEX SKYLIGHTS OVER PLATFORMS, UNION STATION, KANSAS CITY, MO.

Installed for years, they have never needed any attention. Note great glass area

THE G. DROUVÉ COMPANY

Manufacturers of Puttyless Skylights and Sash Operators

TELEPHONE:
BARNUM 540

50 Drouvé Street
BRIDGEPORT, CONN.

Western Union Code

AGENCIES IN ALL PRINCIPAL CITIES

Products.

"ANTI-PLUVIUS" FIREPROOF, PUTTYLESS SKYLIGHTS—trade-marked and patented.

"STRAIGHT PUSH" and "LOVELL" SASH OPERATORS—patented; also WORM and GEAR SASH OPERATORS.
"Drouvé" Ship Skylight and Hatch Lifting Device.

Service.

A skilled estimating department will give every assistance in preparing specifications.

Detail drawings of different types and conditions will be forwarded on request, if engineers will indicate approximately their ideas.

Catalogues, prices, preliminary estimates or any co-operation will be gladly and promptly furnished.

"Anti-Pluvius" Puttyless Skylights.

Skylights are used in industrial buildings of all kinds; in sawtooth, flat or pitched roofs, and made in all types whether flat, single or double pitched, or hipped.

ADVANTAGES—A type that will satisfy the most exacting requirements of stiffness under wind and snow loads, of perfect watertightness, of freedom from condensation drip and of endurance against corrosion.

Strength of materials and of the structure are ideal; will support the weight of a man or men without danger to glass. Proper provision is made for easy cleaning of glass. Frames are flexible and full allow-

ances are made for contraction and expansion, vibration and wind pressures. Construction permits of easy removal of glass by any man about the place.

It is adaptable to all types of roofs: wood, metal, brick, tile or concrete, galvanized iron or asbestos.

Can be put up by anybody, anywhere.

Lights of glass are independent, and do not come in contact with each other, nor do they touch the channels. Skylight frames are shipped with or without glass. No sweating of steel members from chill caused by cold glass.

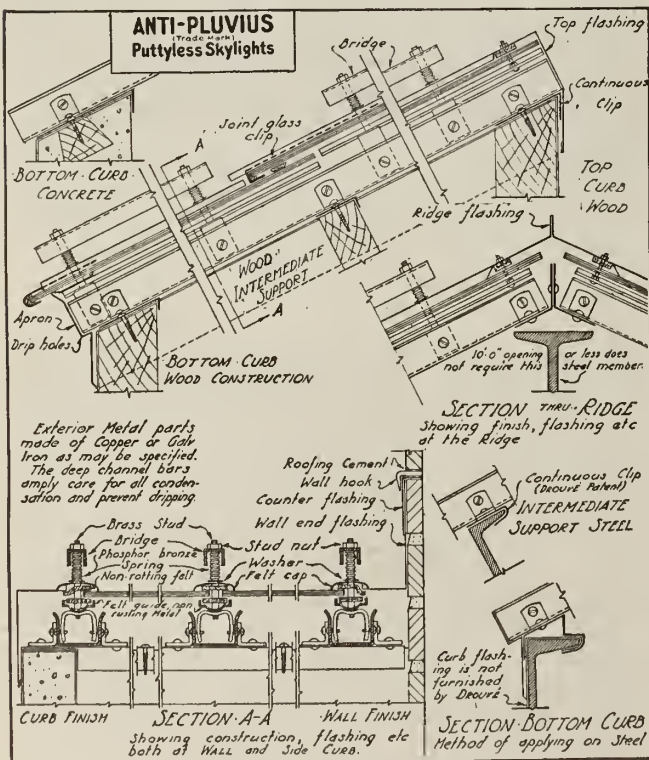
GLASS—Can be rough, hammered or ribbed, plain or wired, of any kind or thickness.

PAINTING—Steel channels or skylight frame have one shop coat of metal protective paint. Galvanized portions are unpainted unless requested.

SHIPMENTS—Shipped knocked down. Any person of ordinary intelligence can erect them (see assembling details).

The company will install these skylights anywhere, if desired.

INFORMATION REQUIRED FOR ESTIMATING—State type of skylight required, give size or sizes and number wanted. State trimmings desired. These cover outside exposed portions of skylight and include cap and flashings (not roofer's curb flashings) and may be of copper, or galvanized iron. Specify kind of glass (see "Glass").



DETAILS OF SINGLE OR DOUBLE PITCH TYPE GENERAL SKYLIGHT CONSTRUCTION

Scale 1/4 inch = 1 foot

"Straight-Push" Sash Operator.

Designed to operate all types and makes of sash in monitors, skylights and side walls of buildings. Designed to withstand all manhandling and unexpected conditions.

Guide rolls mounted on brass pins to prevent rusting. All working parts have brass-to-iron connections. The sweep of levers is level.

Leverage force applied is uniform throughout length of line, insuring equal opening and closing of all sash.

ERECTION—Erecting crews are maintained by the company to handle any job, anywhere, or any workman can install from erection instructions.

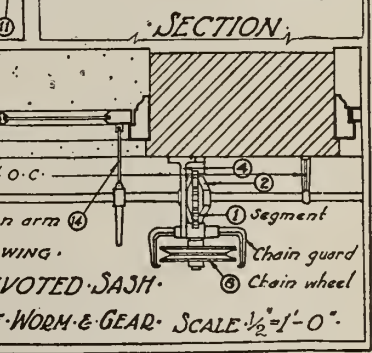
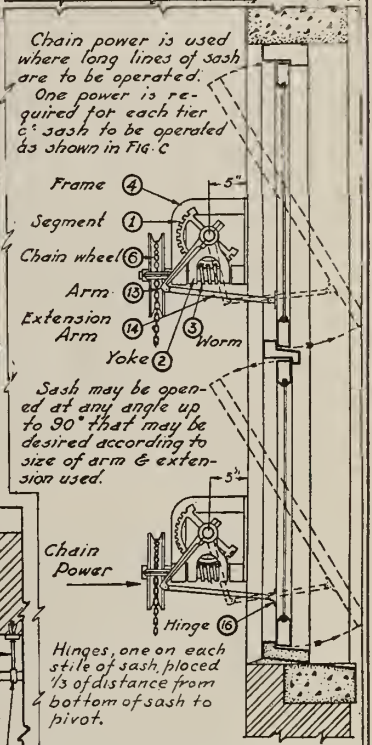
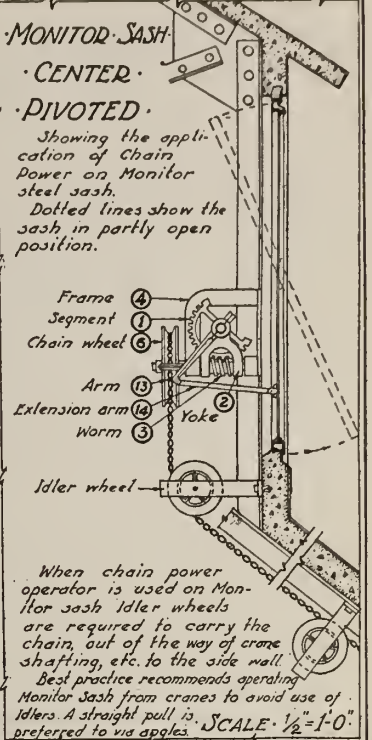
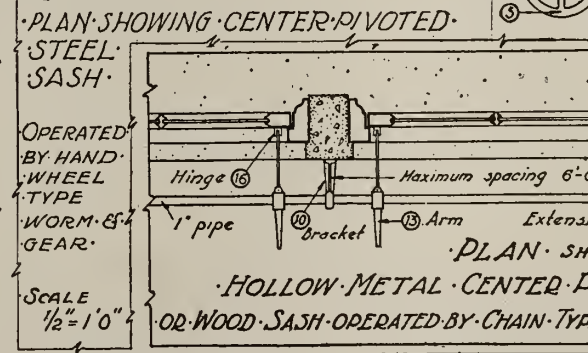
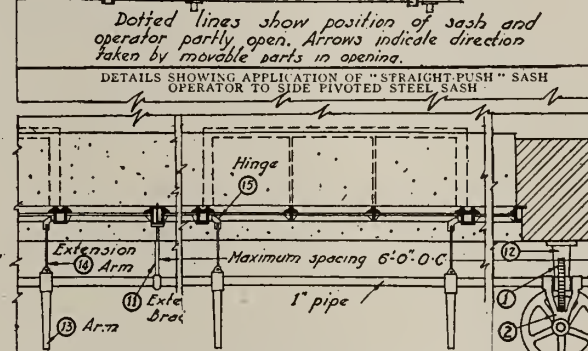
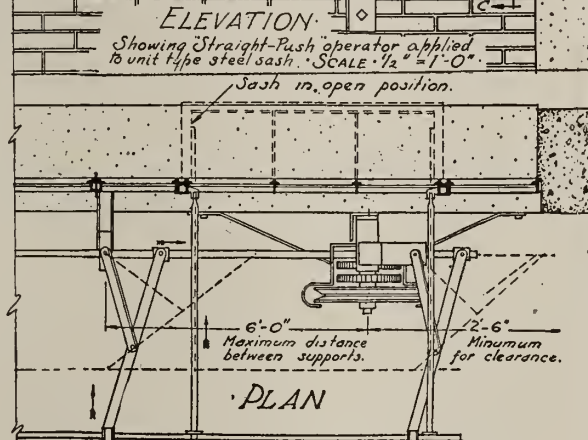
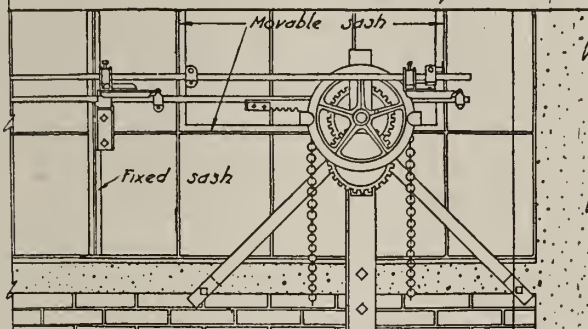
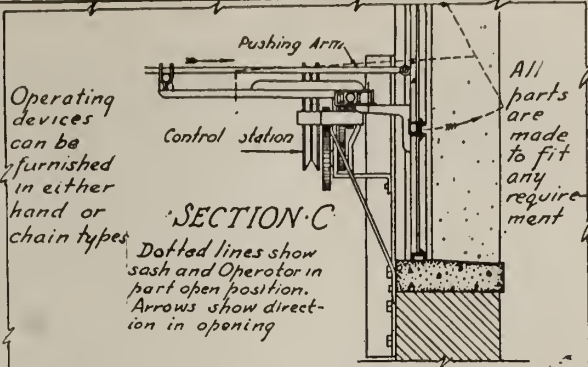
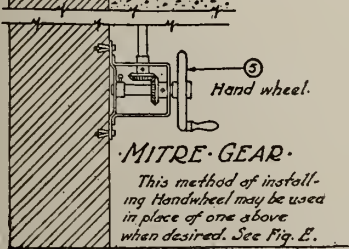
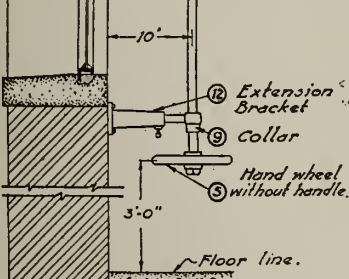
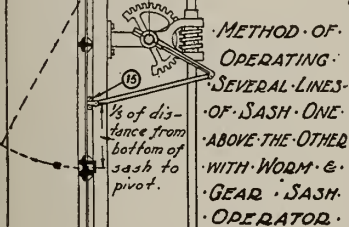
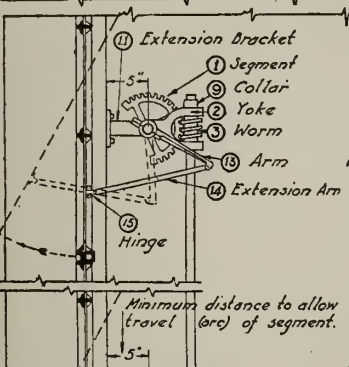
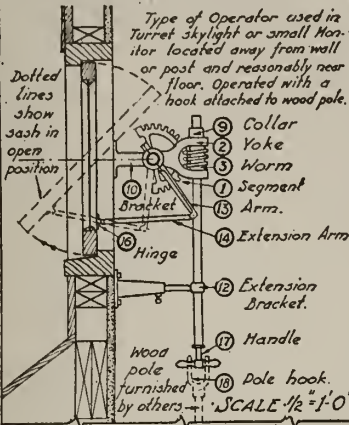
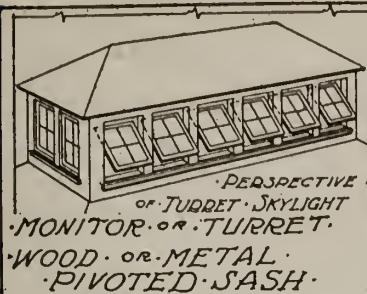
"Improved Lovell Dreadnought" Sash Operator.

This design, with its sweeping movement, gives large openings to heavy top hung sash. All parts made extra heavy, with phosphor bronze working joints.

Worm and Gear Operators.

Practically all types of standard worm and gear devices supplied as desired for operating lines of ventilating sash in side walls, pitched roofs, sawtooth roofs and monitors, and for pivoted or hinged sash.

Details of standard worm and gear operating devices forwarded on application and, when sufficient information is given, recommendations will be made as to efficient and economical procedure.



DETAILS SHOWING APPLICATION OF WORM AND GEAR TYPE SASH OPERATORS

ESTABLISHED 30 YEARS

HUGH R. BURNS, PRES. JOHN A. MERCIER, VICE-PRES. CHAS. R. WOOLENSACK, SECY-TREAS. CHRIS. YAUCH, SUPT.

THE HOWIE COMPANY, INC.

Manufacturers of Skylights

TELEPHONE:
GLENDALE 271370-374 Fourth Avenue
DETROIT, MICH.**Products.****PEERLESS SKYLIGHTS.**

Fireproof Windows, Tin Clad and Kalamein Doors, approved by Underwriter's Laboratories, Inc.; Copper and Bronze Doors, Architectural Sheet Metal Work, Ventilating Systems; Slate, Tin, Tile and Composition Roofing; General Sheet Metal Work, Barber's Genuine Trinidad Lake Built-up Asphalt Roofing, Barrett's 20-year Bond Specification Roofing; Jobbers in Slate, Tile and Roofing Supplies.

Peerless Skylight, Sawtooth and Marquise Constructions.

These are designed to provide a weatherproof and dustproof skylight construction and one that can be guaranteed against any and all possible glass breakage due to vibration; through expansion and contraction due to temperature changes, and from vibration of structure caused by machinery shafting fastened to roof trusses.

BARS, CUSHION, CAP STRIP and CONDENSATION GUTTER—Supporting bars are of special rolled steel bars, $\frac{3}{4}$ by $1\frac{3}{4}$ -in. T-section with upturned flanges. The glass is laid directly on these flanges in small panes, 24 by 24-in. size, overlapping each other 2 in. with a $\frac{1}{4}$ by $\frac{3}{4}$ -in. Genasco Asphalt strip laid between, thus forming a cross condensation gutter. A special Genasco Asphalt strip is laid along edge of glass and against side of bar. A sheet metal spring bearing cap is provided for a covering of T-bar and packing strips. This cap is but 23 in. long and is provided with a heavy brass cotter pin through center of cap. Cotter pin engages a slot provided in bar in such manner as to insure a tight springlike fitting to glass and packing strips; each light of glass being held in place independent of every other light by means of this cap and cotter pin, and thus left wholly free to move whenever affected by either expansion or vibration.

GLASS, OVERLAPPING, FLEXIBLE CROSS JOINT—The standard $\frac{1}{4}$ -in. wire glass is used in lights 24 by 24 in. in size, necessitating the offsetting of T-bars every 22 in., thus providing a horizontal flexible cross joint throughout the construction.

EXPANSION CASTINGS—Provisions for the expansion of the bar is provided by the upturned flanges of the bar engaging the special casting flanges, which castings are fastened to curb, ridge and intermediate purlins, as required, to suit the construction of the building. The curb castings are provided with weep holes.

CONTINUOUS CURB GUTTER—The sheet metal curb flashing is turned up $\frac{3}{4}$ in. on the inside directly back of curb casting; this necessitates the bar being offset at curb end, thus providing a continuous curb gutter $1\frac{1}{4}$ in. deep by 3 in. wide, guarding against the possibility of a leaky frozen-up curb. The metal ridge is bolted to bar with a $\frac{1}{4}$ by $1\frac{1}{4}$ -in. brass bolt.

SHEET METAL TRIMMINGS—The only sheet metal used in this construction is the cap curb and ridge, which can be of galvanized iron, lead coated metal or copper.

STANDARD CONSTRUCTION—The above is a standard construction and is carried in stock, thus facilitating quick shipment upon receipt of order.

COST AND MAINTENANCE—Peerless skylights cost no more than ordinary skylights and last from 4 to 5 times as long without additional cost of maintenance.

SUMMARY—The Peerless skylight is designed to meet all requirements and is the last word in skylight, marquise and sawtooth construction. It is absolutely proof against water, snow and dust; and will last as long as the building with no glass breakage possible, excepting by accident.

Details.

The following details illustrate the practical use of Peerless skylights, sawtooth and marquise construction.

Other details required to meet any other conditions evident in various building construction will be made and submitted for approval.

Specifications for Peerless Skylight and Marquise.

INTENT—This specification together with the accompanying drawings and details is intended to provide for all labor and material required for the completion and erection of all skylights as shown or mentioned.

WORK BY OTHERS—All steel framing, wood curbs, nailing strips, gutters and roof flashings, shall be provided for under another contract, unless otherwise specified.

WORK REQUIRED—Provide and install all skylights as shown or indicated on drawings. All skylights shall be "Peerless" skylight construction as manufactured by THE HOWIE COMPANY, INC., Detroit, Mich., complete as shown by their standard details, and adapted to the construction of the building.

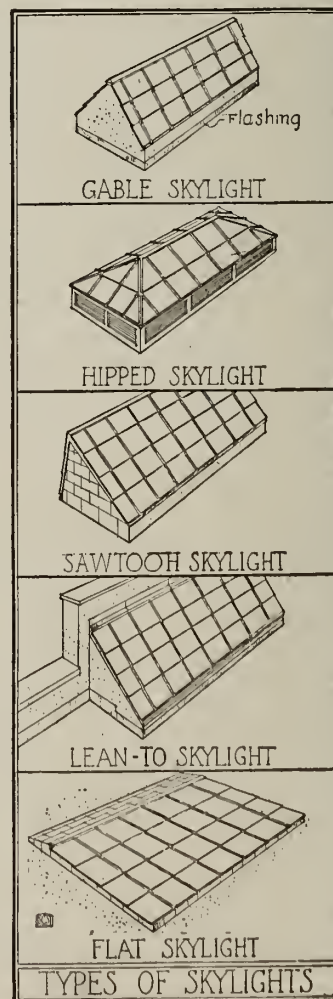
All sheet metal trimming shall be of No. 24-gauge galvanized iron or 16-oz. cold rolled copper.

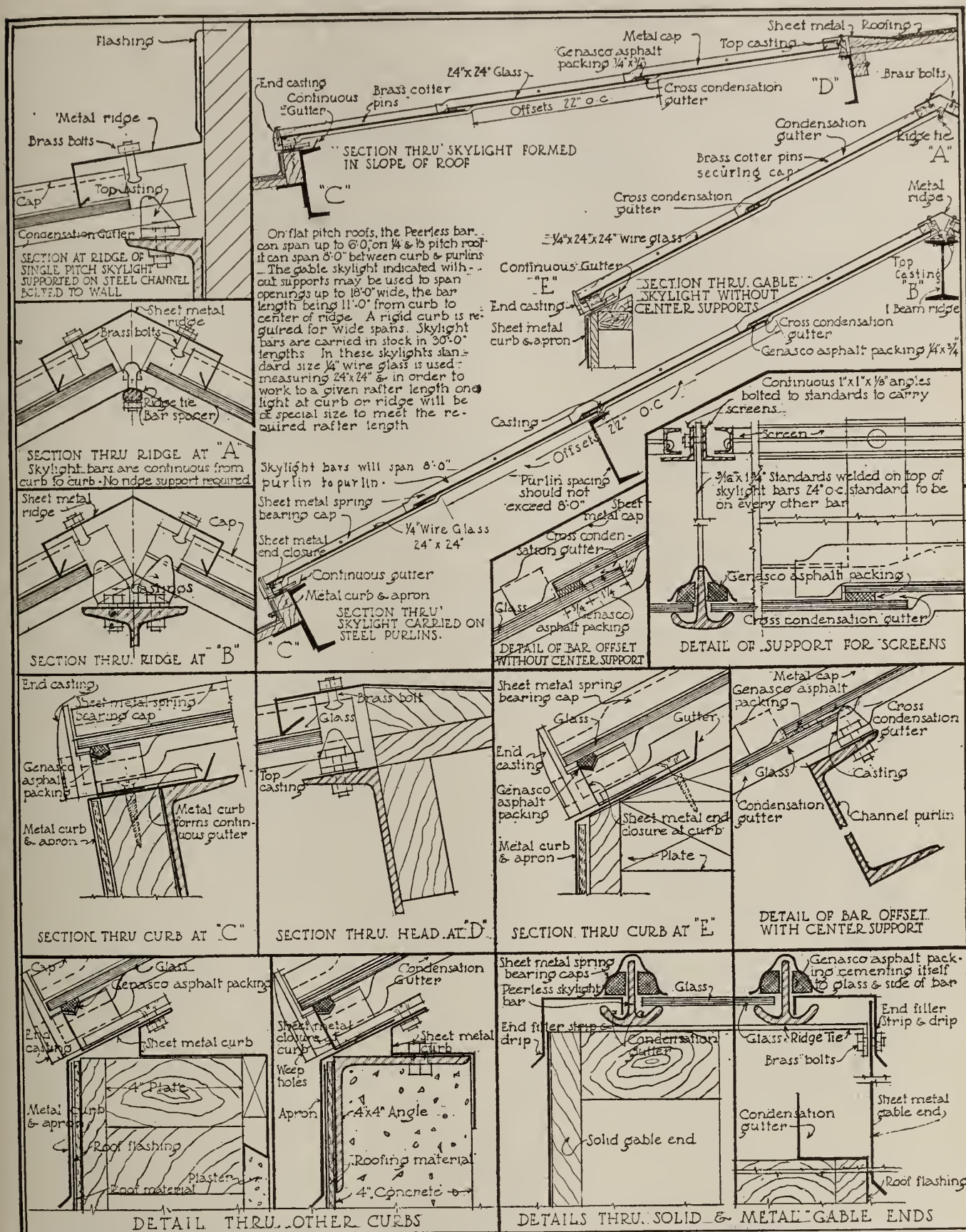
GLAZING—All skylights to be glazed with best quality $\frac{1}{4}$ -in. rough wire glass, not to exceed 24 in. in width. All glass to be left whole and clean at completion of the work.

PAINTING—All metal work in connection with skylight, except copper, shall be painted; also paint all skylight bars with 1 good coat of approved paint.

GUARANTEE—This contractor is to furnish a written guarantee for 5 years.

MARQUISE—The marquise shall be constructed of Peerless skylight bars with necessary end castings, brass nut flashing, etc., in accordance with THE HOWIE COMPANY, INC., construction.





DRAWN BY
SWEETS CATALOGUE
SERVICE INC.

DETAILS OF PEERLESS SKYLIGHT CONSTRUCTION

SHEET NO. 2
SCALE $\frac{3}{4}$ " = 3'
EQUALS 1'-0"

A. H. JETER & COMPANY, INC.

Manufacturers of Puttyless Steel Skylights

GENERAL OFFICE AND WORKS

91-95 Webster Avenue

LONG ISLAND CITY, N. Y.

BRANCH OFFICE: BRIDGEPORT, CONN., WM. V. DEE, Vice-president and General Sales Manager

Products.

PUTTYLESS STEEL SKYLIGHTS.

CAST IRON ROOF DRAINS.

Sheet Metal Skylights, Turrets and Louvers;
Architectural Sheet Metal Work of every description;
Metal, Tile and Slate Roofing.

Services and Estimates.

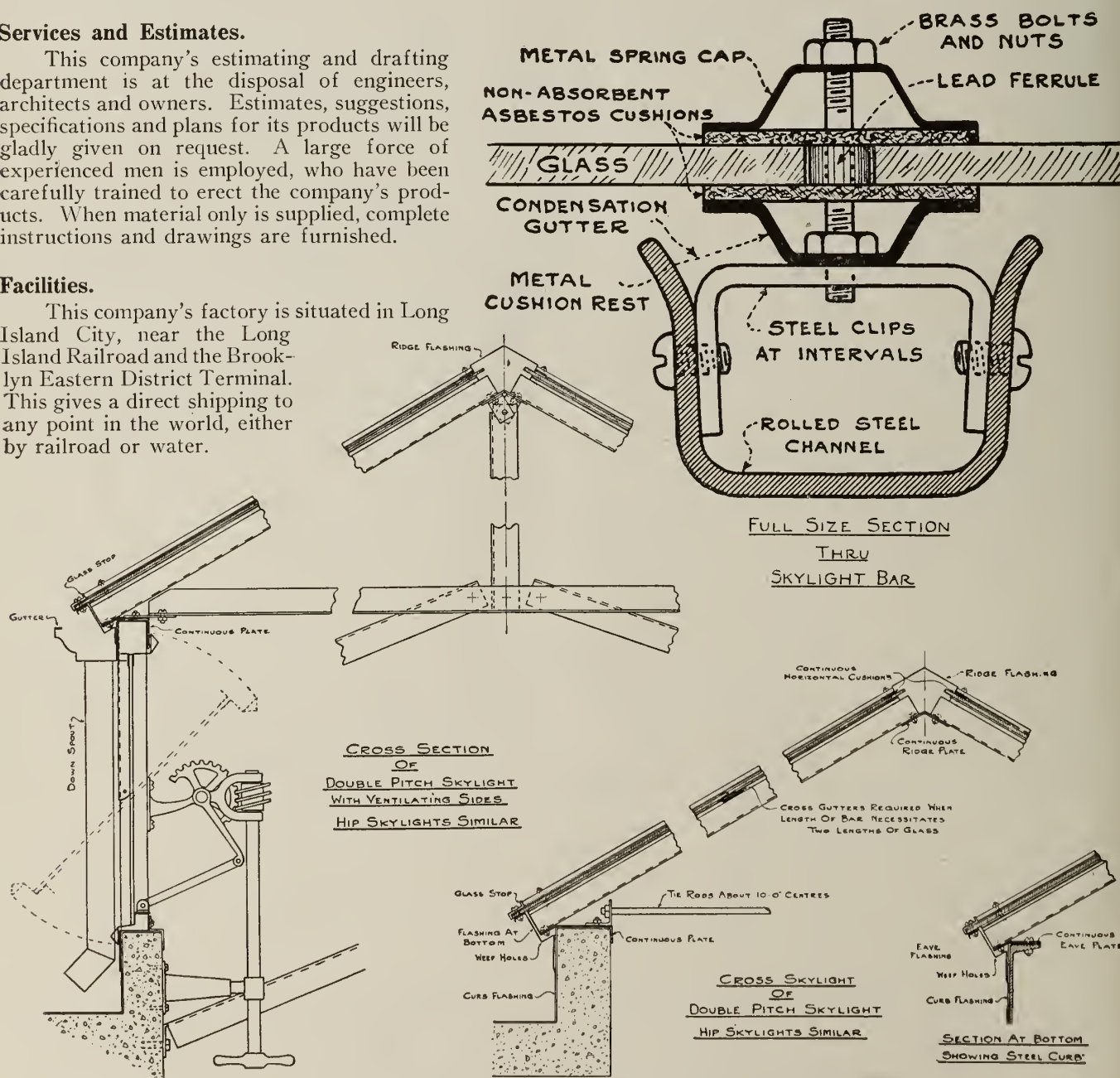
This company's estimating and drafting department is at the disposal of engineers, architects and owners. Estimates, suggestions, specifications and plans for its products will be gladly given on request. A large force of experienced men is employed, who have been carefully trained to erect the company's products. When material only is supplied, complete instructions and drawings are furnished.

Facilities.

This company's factory is situated in Long Island City, near the Long Island Railroad and the Brooklyn Eastern District Terminal. This gives a direct shipping to any point in the world, either by railroad or water.

Jeter's Puttyless Skylights.

SPECIAL FEATURES—The sash bar of Jeter's patented puttyless steel skylight is composed of a lower channel, over which is placed a special moulded glass rest, secured to the bottom channel by means of wrought iron stirrups and tap bolts.



TYPICAL DETAILS OF JETER PUTTYLESS STEEL SKYLIGHTS

Scale: 1 in. = 1 ft.

The glass rest is held in position by a brass bolt, which is of sufficient length to engage and secure the metal cap that covers the edges of the glass.

On the special moulded glass rest, a cushion of heavy saturated asbestos is provided, running entirely across the glass rest. After the glass is laid in place, a saturated asbestos sealing strip is provided, which is securely held in place by the metal cap. This feature insures against any dust or moisture getting under the glass and in to the sash bars or gutters.

A special moulded section is used as a continuous bottom support for the glass. This section also contains a pocket, on which is placed a strip of saturated asbestos upon which the glass rests. Connections at intervals of about 20½ in. are provided in the continuous bottom members, which receive and secure the bars. This method of asbestos cushioning device makes the skylight waterproof and dustproof and, being of a soft indestructible material, reduces the cracking of the glass to a minimum.

ADAPTABILITY—Jeter's patented system of putty-less steel glazing is adaptable for use in railroad terminals, museums, schools, hospitals, factories, machine-shops, etc.

The very simplicity of construction enables any mechanic to readily erect this system.

SPECIFICATIONS—All skylights shall be of rolled steel, of a type to allow for free expansion and contraction and made tight without use of paint, cement or putty.

Sash bar shall be composed of a special U-channel 2 in. wide and 1¾ in. deep, made of high carbon steel ¼ in. in thickness.

A special moulded glass rest made of No. 16 gage steel shall be provided. This glass rest shall be formed in the shape of a trough and shall be supported on wrought iron stirrups which will be tap-bolted through the walls of the special U-bar.

A heavy non-absorbent asbestos cushion shall be placed over the glass rest. Cushion and glass rest shall be securely fastened to the wrought iron stirrup by means of brass or copper machine screw.

A special continuous moulded member shall be provided at eaves of skylights. Between this member and the glass shall be placed a non-absorbent asbestos cushion and same drawn up tight under glass by means of bolts at bar centers.

After glass is set in place, provide a metal spring cap 1¾ in. out to out of flanges. This cap shall be underlined with a sealing strip of non-absorbent asbestos material, held in position by being punched and strung over the cap bolts. Edges of sealing strip shall not protrude beyond edges of cap. Securely fasten cap by means of a brass nut.

All skylights to be glazed with ¼-in. ribbed wire glass.

All caps, combing and trim shall be of (specify copper, zinc, or galvanized iron).

After fabrication and before assembling the sash bars, all parts shall be thoroughly coated with an application of bitumastic solution (or specify hot galvanizing).

Jeter's Improved Cast Iron Roof Drains.

These drains are decidedly superior to the troublesome old style drains and are offered at about the same cost as the latter.

They are adapted for use with interior leaders on slag, gravel or promenade tile roofs, with either concrete or wood construction.

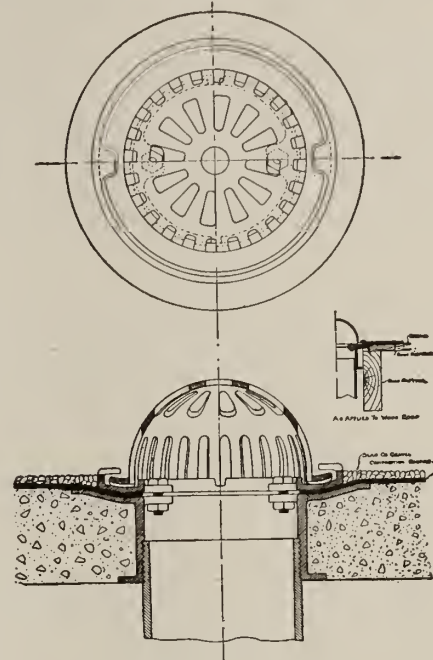
They are substantially constructed of cast iron, insuring service for the life of the building.

No extra metal flashing is required, as the roof material is flashed directly to the drain and clamped

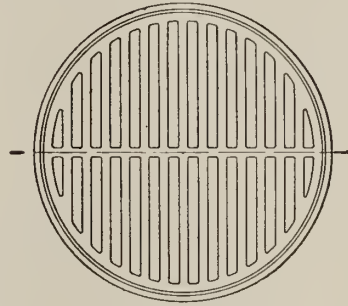
down in place by flashing rim, which also forms gravel or tile stop.

Being incorporated in concrete roof slab or fastened to wood construction eliminates any chance of shrinkage or separation between roofing material and drain, and proof against leakage is assured.

Their simplicity, few parts, ease of installation, durability and economy make them ideal drains.



For Slag or Gravel Roofs



For Promenade Tile Roofs

DETAILS OF JETER'S CAST IRON ROOF DRAINS
(One-eighth full size)

VAILE & YOUNG

Puttyless Skylights, Portable Steel Buildings, Sheet and Plate Metal Construction

Ridgely and Bush Streets
BALTIMORE, MD.

Products.

Manufacturers of SHEET and PLATE METAL CONSTRUCTION; STRUCTURAL STEEL WORK; PUTTYLESS METAL SKYLIGHTS; PORTABLE STEEL BUILDINGS.

Tanks, Hoppers, Blast Pipes and Breechings; Bronze and Copper Covered Doors and Windows.

Patent Metallic Puttyless Skylight.

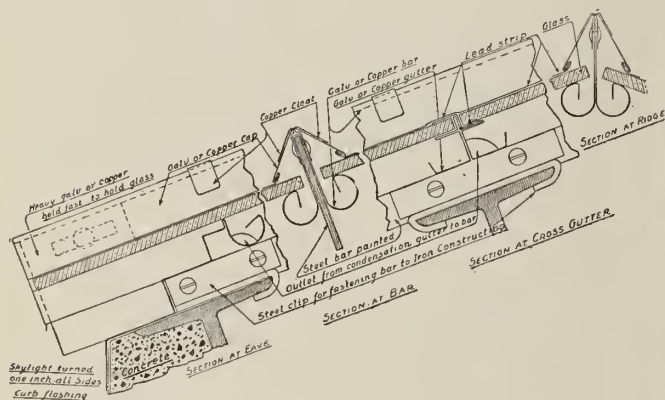
The VAILE & YOUNG patent metallic puttyless skylight is made of galvanized sheet metal or copper, the bars being constructed with two open tubular gutters and a tubular strengthening rib inserted between these, all well riveted together.

In spans less than 4 ft., the strengthening rib is omitted; and in spans over 8 ft., where additional strength is required, steel strengthening cores are inserted as shown.

Tubular condensation gutters are provided on inside of skylight at eaves. These conduct condensation to outlet holes at junction of eaves and bar gutters.

Bars are capped on outside with V-shaped caps, in each side of which is inserted a strip of heavy sheet lead; this is pressed closely to the glass, the cap being held firmly in place by heavy copper cleats, making the skylight absolutely watertight.

The readiness with which broken glass can be replaced is apparent, it being only necessary to loosen the copper cleats and remove the cap.



DETAILS OF PITCHED SKYLIGHT CONSTRUCTION

Sheet and Plate Metal Construction.

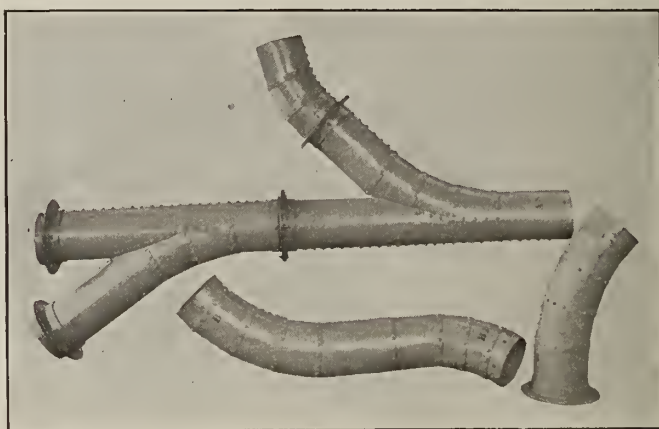
SCOPE OF OPERATIONS—The activities of this organization extend over every field embracing the design, construction and installation of sheet and plate metal work.

Contracts executed by VAILE & YOUNG include substantially every form in which sheet and plate metal can be constructed.

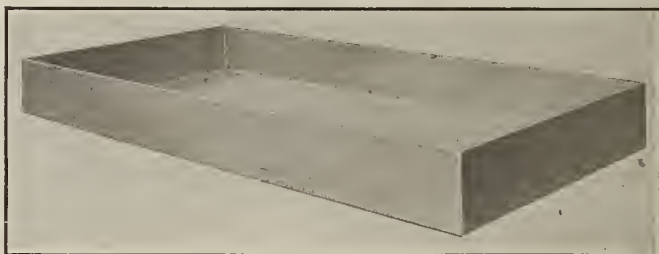
FACILITIES—This company, with new modern equipment and daylight factories, is prepared to handle special problems in sheet and plate metal construction

of every character, including structural steel, for mills, factory, and other equipment. Limit about $\frac{3}{8}$ in.; heavier in special lines.

Prompt execution of all contracts is assured as the method and factory equipment are strictly up-to-date. Nearly 100% increase in available floor space. All on one floor, assuring minimum cost for handling material.



SHEET METAL PIPING, BENDS, ANGLES, FLANGED JOINTS, ETC.



SHEET METAL PAN



SHEET METAL GEAR GUARD

"Kerber System" Portable Steel Buildings (Patents Pending).

VAILE & YOUNG are the sole manufacturers of the "Kerber System" of portable steel buildings, which are original, unique and simple in construction.

Buildings are rigid, substantial, sanitary, fireproof and portable. They are constructed entirely of standard sections formed of heavy galvanized steel sheets. The sections are interchangeable, thus enabling the purchaser to select any desired arrangement of doors, windows, etc. The portable feature is such that the buildings can be erected by any one.

Partitions, ceiling and lining of suitable material may be installed, without alteration, at any time after the buildings are erected, and when lined, an air space or cell is formed between the lining and outer wall which insures comfort and eliminates dampness.

Any desired heating arrangement may be used.

The purposes for which the "Kerber System" is adapted are numerous, as has been shown by practical tests. They can be dismantled at any time without damage to the various sections, thus insuring re-erection

without repairs or employment of skilled labor.

The sections are formed so that they can be nested, and are packed in substantial crates, thus reducing to a minimum the possibility of damage in transit.

PRICES—Prices will be quoted for deliveries to any point, f. o. b. Baltimore or destination, or including erection.

Co-operative Service.

The personnel of this company is composed of experts in sheet metal and steel plate construction, thoroughly conversant with the best practice in all branches of this line, and prompt and satisfactory service is guaranteed.

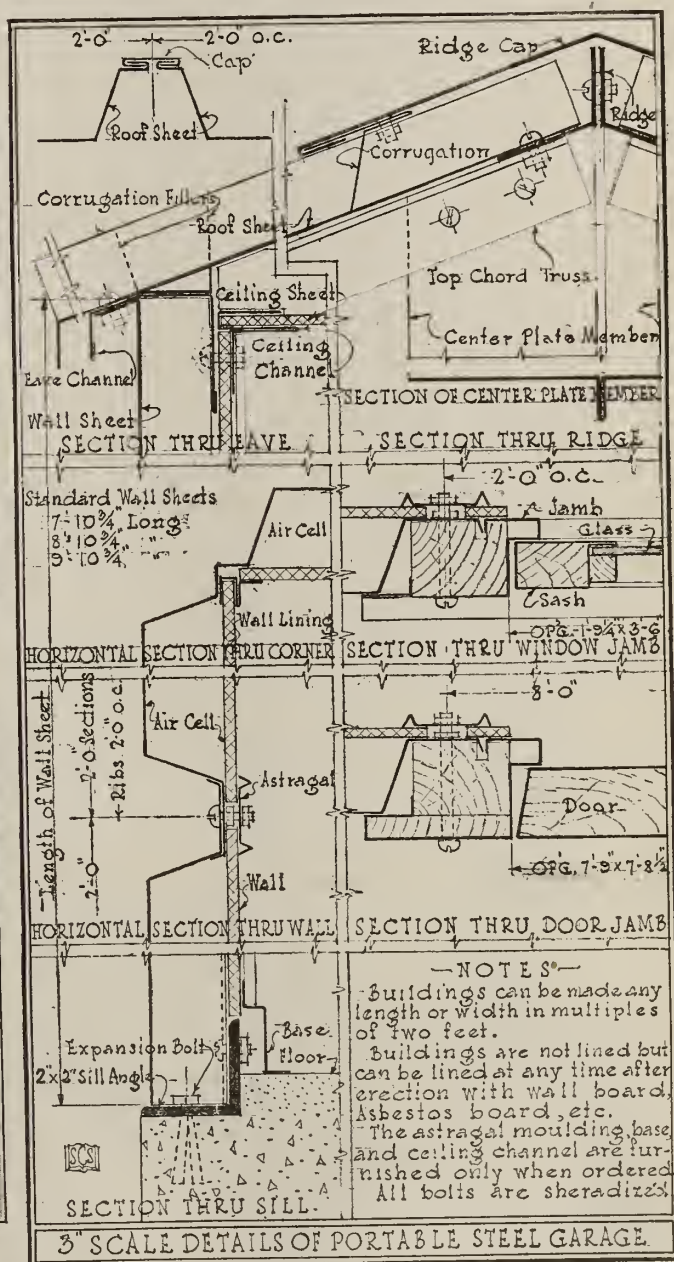
The drafting department will gladly co-operate in planning and offering suggestions for any special problem involving sheet and plate metal construction in any part of the country.



PORTABLE STEEL INDUSTRIAL BUILDING



PORTABLE STEEL GARAGE



ESTABLISHED 1873

E. VAN NOORDEN & COMPANY

Skylights and Ventilators

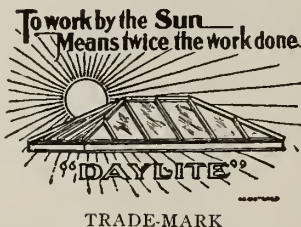
TELEPHONE:

100 Magazine Street, near Massachusetts Avenue
BOSTON, MASS.

Products.

Manufacturers of "ANCHOR-BAR" ROLLED STEEL, PUTTYLESS SKYLIGHTS; GALVANIZED STEEL OR COPPER VENTILATORS.

Also, Sheet Steel and Copper Skylights of every type, Sheet Steel or Copper Windows, Kalamein Doors.



TRADE-MARK

Rolled Steel, Puttyless Skylights, "Anchor-Bar" Type (Patent No. 931638).

The opportunity of suggesting framework for any type of glazed roof is solicited, and saving in steel framework is assured.

The Van Noorden rolled steel puttyless skylight is designed for large skylight areas. Fewer purlins or steel supports are required than for any other skylight.

The structural parts of rolled steel and trim of sheet metal (generally copper) form an unsurpassed combination for strength and weather protection.

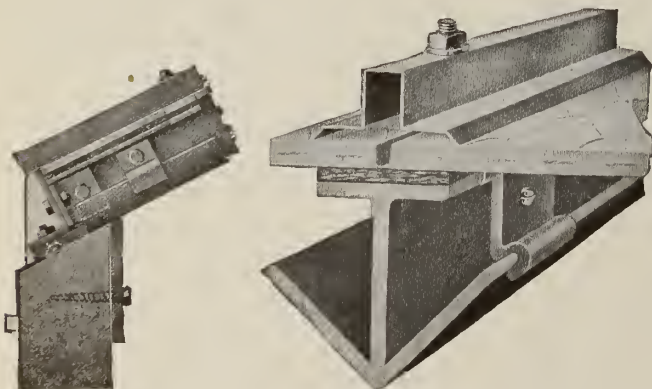
BAR—A tee and angle combination. Angle member serves as condensation gutter. Glass rests loosely on cushion of pure wool felt.

CURB—Continuous steel reinforcement at the base. The thrust of skylight bars is directly against this member, which must hold while the curb holds.

FEATURES—The combination of steel frame of bars, base and ridge form a self-supporting steel structure upon which the glass is loosely embedded after which the exposed sheet metal portions (generally copper) are applied. Caps secured with brass bolts.

EXPANSION AND CONTRACTION—Amplly provided for. Sheet metal parts are independent of rolled steel parts. Glass sets loosely on the cushion of wool felt.

ACCESSIBILITY FOR REPAINTING — Rolled steel members are readily accessible; sheet metal portions (preferably of copper), are impervious to weather conditions.



SECTION THROUGH CURB, "ANCHOR-BAR" SKYLIGHT

SECTION OF BAR IN "ANCHOR-BAR" SKYLIGHT

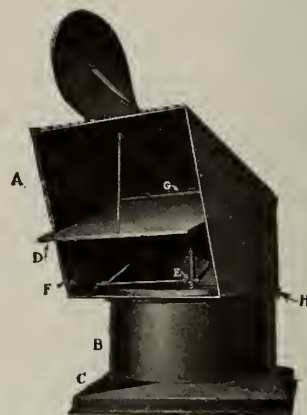
ADAPTABILITY—Wherever overhead light is desired. Inquiries should state over all length of outside of curb, bar length, pitch of skylight (5 ins. to the foot, or more) and distance between intermediate purlins.

"ANCHOR TRUSS BAR" (Patent No. 1140909)—Used where bar length is more than 11 ft. unless intermediate purlins are provided. Truss bars are self-supporting for a bar length up to 15 ft. The saving effected in the steel frame support is far greater than the excess cost of truss bar construction. Details on application.

"Storm King" Rotary Ventilator.

Consists of a stationary barrel surmounted by a sensitive ball bearing, flare shaped head that is always in correct position to the wind. Insures free exhaust; hinged damper, weatherstripped at top, permits full capacity when open and completely seals mouth of ventilator and prevents back action of snow, etc., when closed. Gutters provided at sides of damper.

Damper operated by chain, through tubular spindle, which can not foul braces or supports.

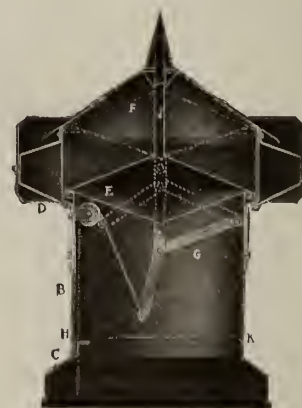


"STORM KING" ROTARY BALL BEARING VENTILATOR

A—revolving head; B—fixed barrel; C—base; D—gravity damper (open position); F—side gutter insuring tightness of damper; H—reinforcing channel

"Simplex" Ventilator with "Suretite" Damper.

Consists of stationary barrel and head with sliding damper. When closed, damper completely seals the top of shaft insuring absolute weather tightness. Damper is of double cone form. With damper open, lower cone accelerates up-draft in shaft and prevents back-draft. With damper closed, upper cone sheds filtration of fine snow. Damper can be locked in various positions.



"SIMPLEX" VENTILATOR WITH "SURETITE" SLIDING DAMPER

A—head; B—barrel; C—base; D—weather shield; E—"Suretite" gravity sliding damper (closed); F—damper (open); G—operating arm; H—chain lock (locking damper in open position); J—telescopic damper guide; K—gutter (for condensation)

J. C. KERNCHEN, PRESIDENT

AREX COMPANY

Industrial Ventilating Engineers

1598 Conway Building
CHICAGO, ILL.

BRANCH OFFICES IN ALL PRINCIPAL CITIES

Product.

AREX ORIGINAL SIPHONAGE ROOF VENTILATOR.
Arin Antidraft Window Ventilators.

Arex Siphonage Roof Ventilator.

The Arex ventilator assures, by natural means, constant, positive, uniform ventilation for any kind of building—mills, factories, foundries, warehouses, power plants, train sheds, etc. Foul air, warm air, fumes, gases, vapors, steam and smoke are quickly and completely removed.

DESCRIPTION—

Passing wind plays upon the siphons so as to accelerate the outflow of foul air from interior of building, but it permits none of the outside wind to enter the ventilator. Every opening an outlet.

Of galvanized iron, ingot or Toncan metal, cold rolled copper or any other special metal in any size or gauge. Brass bolts connecting the frustum to the siphons permit installation in two halves and facilitate painting inside and outside after installation.

ADVANTAGES—Down-drafts impossible; constant, positive ventilation assured; 300% greater air exhaust obtained; half the number of ventilators required. No cost for maintenance or operation; every joint securely riveted; no solder used; no movable parts; the whole

is one strong, solid piece. Approved by leading and most prominent architects and engineers in the country; also by government officials.

OFFICIAL TEST CAPACITY TABLE

Size of Arex, in.	Exhaust per hour, cu. ft.
4	4,189
5	6,545
6	9,425
7	12,828
8	16,755
9	21,206
10	26,180
12	37,699
14	51,313
16	67,021
18	84,823
20	104,720
22	126,711
24	140,796
26	176,976
28	205,251
30	235,619
36	339,293
42	461,813
48	603,187
54	763,407
60	942,477
66	1,140,397
72	1,357,167
84	1,847,256
96	2,412,743
108	3,053,626
120	3,769,900
132	4,561,621
144	5,428,667



SECTIONAL VIEW OF AREX
VENTILATOR
Showing siphonage system and
extraordinary outlet for escape of air



AREX ORIGINAL SIPHONAGE
VENTILATOR (PATENTED)

How to SPECIFY—Simply multiply cubical contents of room by number of air changes required per hour. The capacity table will tell exactly the size and number of Arex to use.

SHIPMENTS—Prompt shipments from large stock.

Co-operative Service.

Installations shown below are standard; special bases and pipe connections to order. Submit sketch.

The Arex Engineering Department gladly offers expert advice on any ventilating problem without obligation.



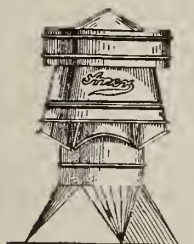
No. 1
Round Base for Flat
Roof



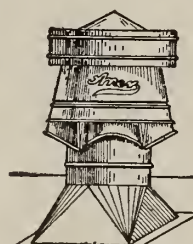
No. 3
Round Base for Slant
Roof



No. 5
Round Base for Gable
Roof



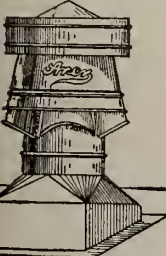
No. 7
Square to Round Base
for Flat Roof



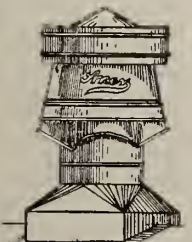
No. 8
Square to Round Base
for Slant Roof



No. 9
Square to Round Base
for Gable Roof



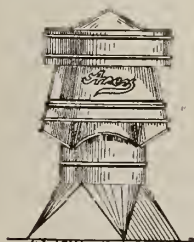
No. 11
Square to Round Base
with Shoulder for
Slant Roof



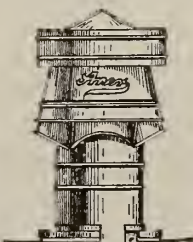
No. 12
Square to Round Base
with Shoulder for
Gable Roof



No. 13
Round Base for Flat
Concrete Roof with
Angle Iron Ring
at Bottom



No. 14
Square to Round Base
for Flat Concrete
Roof with Angle
Iron at Bottom



No. 15
Round Base for Flat
Concrete Roof with
Curb



No. 16
Square to Round Base
for Flat Concrete
Roof with Curb

TYPICAL STANDARD INSTALLATIONS OF AREX ORIGINAL SIPHONAGE VENTILATORS

ACME VENTILATOR CORPORATION

399 Atlantic Avenue
BOSTON, MASS.

Products.

ACME AUTOMATIC ROTARY VENTILATOR (United States Patent No. 1202842; Dominion of Canada Patent No. 189715).

AIRROUT AUTOMATIC BALL BEARING VENTILATOR. (Patent applied for.)

Acme Automatic Rotary Ventilator.

ADVANTAGES—No corrosion; no squeaks; no oil used; no down-drafts; absolutely weatherproof.

DESCRIPTION—Made of galvanized steel, Toncan iron, and copper. Painted standard or acidproof. Most simple, stable, and durable automatic rotary ventilator known to be in use.

CONSTRUCTION—Point—Ventilator revolves on case-hardened steel point against cast iron center, a method considered practical and satisfactory as the result of more than ten years' experience.

Air Congestors—Cause greater suction by actual scientific tests than any other known ventilator on the market.

gestors. Larger sizes are bound with $\frac{3}{16}$ -in. wire to increase the strength and stability.

Sail—Made of heavy gauge material and braced to add to its stability.

Bases—Can be furnished when required. In such cases, detailed specifications should accompany order. When questions as to position and construction are involved, the engineering department is ready to assist with an expert service based upon more than twenty years' experience in solving ventilator problems.

OPERATION—Cone is always kept pointed to the wind which passes through large outer openings of the air congestors (one on either side of cone), the constant pressure forcing the air through the smaller inside openings at higher velocity, thus the slightest movement of air outside automatically creates a strong and constant suction that draws air within the building upward through the ventilator pipe and out the exhaust opening. The outer rim of the storm guard—extending beyond and being separated from rim of the cone by space shown in Plate B—serves both as protection against weather and to increase suction power.

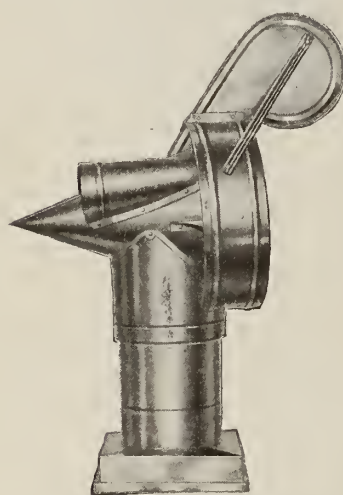
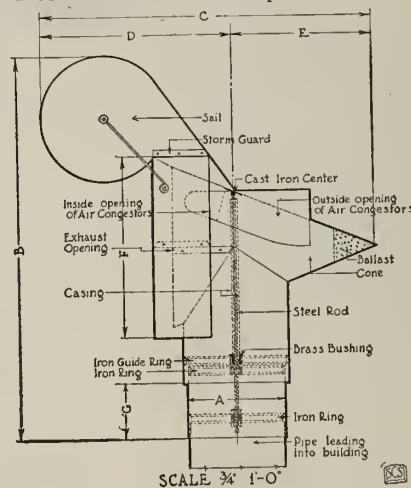


Plate A
VIEWS OF ACME VENTILATOR
Showing exhaust opening, storm guard, etc.



Plate B



DETAIL OF ACME AUTOMATIC ROTARY VENTILATOR

Size, in.	Dimensions, in.						
	A	B	C	D	E	F	G
4	4	16	13 $\frac{3}{4}$	7 $\frac{3}{4}$	6	7 $\frac{1}{2}$	3 $\frac{1}{4}$
6	6	24	20 $\frac{1}{2}$	11 $\frac{3}{4}$	8 $\frac{3}{4}$	11 $\frac{1}{4}$	5
8	8	32	27 $\frac{1}{2}$	15 $\frac{3}{4}$	11 $\frac{3}{4}$	15	6 $\frac{1}{2}$
10	10	40	34 $\frac{1}{4}$	19 $\frac{1}{2}$	14 $\frac{3}{4}$	18 $\frac{3}{4}$	8 $\frac{1}{2}$
12	12	48	41 $\frac{1}{4}$	23 $\frac{3}{4}$	17 $\frac{1}{2}$	22 $\frac{1}{2}$	10
14	14	56	48	27 $\frac{1}{2}$	20 $\frac{1}{2}$	26 $\frac{1}{4}$	11 $\frac{1}{2}$
16	16	64	55	31 $\frac{1}{2}$	23 $\frac{1}{2}$	30	13
18	18	72	61 $\frac{3}{4}$	35 $\frac{1}{4}$	26 $\frac{1}{2}$	33 $\frac{3}{4}$	15
20	20	80	68 $\frac{3}{4}$	39 $\frac{1}{4}$	29 $\frac{1}{2}$	37 $\frac{1}{2}$	17 $\frac{1}{2}$
22	22	88	75 $\frac{1}{2}$	43 $\frac{1}{4}$	32 $\frac{1}{4}$	41 $\frac{1}{4}$	18 $\frac{1}{4}$
24	24	96	82 $\frac{1}{2}$	47 $\frac{1}{4}$	35 $\frac{1}{4}$	45	20
30	30	120	103	59	44	56 $\frac{1}{4}$	25

Ballast—Causes equal pressure on sides of rod so that ventilator rotates to the slightest breeze.

Brass Bushing and Rod Protector—The friction part of the rod passing through the iron ring is protected by a brass bushing. Rod between point and bushing is protected by metal casing, making friction part proof again dust and dirt.

Storm Guard—Adds stability, makes ventilator weatherproof, and increases pulling force of air con-



GEO. H. LINCOLN CO. BUILDING, SOUTH BOSTON, MASS.



CARTER'S INK CO. BUILDING, CAMBRIDGE, MASS.



MERRIMAC MANUFACTURING CO., LOWELL, MASS.

SPECIFICATIONS—Should read as follows:

Acme automatic rotary ventilator, in. diameter, to exhaust cu. ft. per hour with a wind velocity of 6½ miles per hour.

NOTE—Insert number of cubic feet according to size and as given in table below:

DATA, ACME AUTOMATIC ROTARY VENTILATORS

Size, in.	Cap., cu.ft. per hour	Galvanized Iron Ventilators			Copper Ventilators		
		Gauge of metal	Weight, lbs.	Price	Weight of metal, oz.	Weight, lbs.	Price
4	5600	26	5	\$12.00	16	5½	\$18.25
6	12169	26	10	16.00	16	11	25.40
8	22418	26	16½	20.00	16	18	32.50
10	35028	26	29½	24.00	16	32	39.70
12	50441	26	40	29.00	16	44	47.75
14	68656	26	58	36.00	16 and 18	63	62.30
16	89673	26	73	45.00	16 and 18	80	75.00
18	113493	24	109	60.00	18	120	99.40
20	140115	22 and 24	140	72.00	18	154	115.75
22	175143	22	175	88.00	20	192	143.00
24	201765	22	217	112.00	20	238	172.00
30	314464	20	450	280.00	22	490	394.00

NOTE—The above exhaust capacities should be compared with other ventilators. These tests were made with actual outdoor working conditions, and are not the result of laboratory tests. Velocity of wind at time of tests, 6½ miles per hour. Temperature inside, 68°; outside, 50°. With higher temperature inside building and lower temperature outside, capacities would be greatly increased.

USES—Exhausts—Smoke, steam, gases, and fumes.

Drafts—For chimney to create suction and over-draft.

Industrial and Public Buildings, Theaters, etc.—For lifting foul air, heavy gases, fumes, and smoke. The use of Acme ventilators greatly increases efficiency of labor.

COMPETITIVE TESTS—All representations made by this corporation are based on actual facts. An Acme ventilator will be placed in competitive tests with any known ventilator and a sample will be sent for trial, also an engineer to demonstrate.

Actual tests show the Acme with a 35% higher efficiency than any other known ventilator.

Consult the Engineering Department for any information and suggestions.

PARTIAL LIST OF USERS OF THIS COMPANY'S VENTILATORS:

Amoskeag Mfg. Co., Manchester, N. H.; Broadway Iron Foundry Co., Cambridge, Mass.; W. H. McElwain & Co., Merrimac, N. H.; Winchester Laundry, Winchester and Lowell, Mass.; Boston Woven Hose and Rubber Co., Cambridge Mass.; Home Bleach and Dye Works, Pawtucket, R. I.; Assabet Mills, Maynard, Mass.; National Shawmut Bank, Boston, Mass.; Merrimac Paper Co., Lawrence, Mass.; M. H. Nichols Machine Shop, Waltham, Mass.; Merrimac Chemical Co., South Wilmington, Mass.; Parkhill Mfg. Co., Fitchburg, Mass.; Austin Co., Cleveland, Ohio; J. & P. Coates, Inc., Pawtucket, R. I.; Greater Northern Paper Co., Millinocket, Me.; Manhattan Print Works, New York, N. Y.; A. C. Lawrence Leather Co., Peabody, Mass.; Lever Bros. Soap Co., Cambridge, Mass.; Comique Theater, Lynn, Mass.; Nashua Mfg. Co., Nashua, N. H.; Perfection Cooler Co., Michigan City, Ind.; Queen Dyeing Co., Providence, R. I.; Sayles Finishing Plants, Saylesville, R. I.; Wanskuck Co., (Steer Mill), Providence, R. I.; U. S. Navy Yards, Charlestown, Mass. and Portsmouth, N. H.

Airout Automatic Ball Bearing Ventilator.

ADVANTAGES—Patented, ball bearing race; dust-proof and weatherproof attachments.

MATERIAL—Rust resisting galvanized iron and copper construction. Ventilator revolves on patented ball bearing attachment with metal casing to protect all parts from dirt and condensation, making it absolutely dust-proof.

BALL BEARING—Patented ball bearing attachment fastened to revolving head of ventilator and fitted over end of machined, cold rolled steel rod, insuring free and easy rotation.

STEEL ROD—Steel rod machined on top to receive ball bearing attachment, guided through ring on bottom of revolving part of ventilator, extended down and through ring fastened to stationary part of ventilator, secured and held permanent by locknuts.

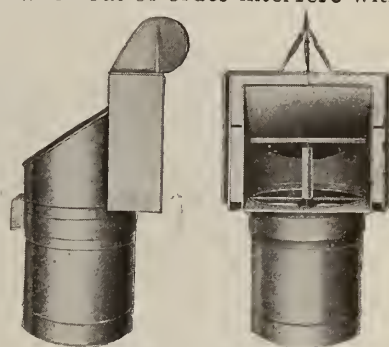
BRASS BUSHING AND ROD PROTECTION—Friction part of rod passing through iron ring is protected by brass bushing, and rod between bearing and bushing is protected by metal casing, making rod and bearing proof against dust, condensation, and corrosion.

BALLAST—Counterweights placed on back of ventilator to insure proper balance, so that head will rotate to slightest breeze.

DAMPER—Damper is of the butterfly type, weighted and placed in main pipe of ventilator, eliminating pulleys and chains, which when out of order interfere with the mechanical operation.

STORM GUARD—Adds stability and greatly increases pulling force.

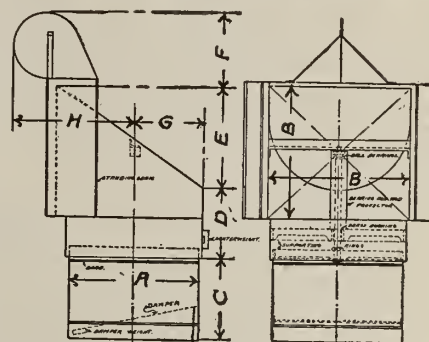
SAIL—Made of heavy gauge material and braced to add to its stability, keeping ventilator in proper position in relation to wind.



AIROUT VENTILATOR

SPECIFICATIONS should read as follows:

Airout automatic ventilator, in. diameter, to exhaust cu. ft. per minute with a wind velocity of 5 miles per hour; all ventilators to be equipped with storm guard, ball bearings, rod and bearing protector, and butterfly damper in barrel of ventilator.



DETAILS OF AIROUT VENTILATOR

DIMENSIONS OF AIROUT VENTILATORS

Size	Dimensions, in.								Gauge of metal	Oz. copper	Net wgt., lbs.	Cu. ft. per min.
	A	B	C	D	E	F	G	H				
8	8 8¾	5	4¾	6¾	8	4¾	4¼	7	24	18	12	160
10	10 10¾	6¼	5¾	8	5¾	5¼	8¾	8¾	24	18	15	250
12	12 12¾	7¾	6¾	9¾	7	6¾	10¾	10¾	24	18	25	350
14	14 14¾	8¾	7¾	11	8¾	7¾	12¼	12¼	24	18	38	460
16	16 16¾	10¾	8¾	12½	9¾	8¾	14	14	24	18	50	625
18	18 18¾	11¾	9¾	14¼	10¾	9¾	15¾	15¾	24	18	56	825
20	20 20¾	12¾	10¾	15¾	11¾	10¾	17½	17½	24	18	62	1000
24	24 25	15	13	19	14	12½	21	21	24	18	105	1375
30	30 31	18¾	16¼	23¾	17¾	15½	26	26	22	20	150	2100
36	36 37½	22½	19¾	28½	21	18¾	31½	31½	22	24	200	3200
42	42 43¾	26½	22¾	33¼	24½	22	37	37	20	26	280	4250
48	48 50	30	26	38	28	25	42	42	20	26	475	5550
54	54 56¼	34	29	42¾	31½	28	47	47	20	28	650	6850
60	60 62½	37½	32½	47½	35	31	52½	52½	20	28	750	8575

THE BURT MANUFACTURING CO.

Manufacturers of Ventilators and Exhaust Heads

601 High Street
AKRON, OHIO

Products.

"BURT" VENTILATORS: Double Damper, Fan, Sliding Cone Damper, and Ball Bearing Revolving; "BURT" EXHAUST HEADS.
For Oil Filters, see pages 593-95.

"Burt" Ventilators.

By means of "Burt" ventilators, impure air, hot air, smoke, steam and gas are taken out of buildings automatically and without any operating expense. The "Burt" glass-top ventilator constitutes both a skylight and a ventilator.

Whether ventilator is closed or open, the air shaft remains always unobstructed. Manufactured in any size required. Regular patterns are built throughout of galvanized iron, of suitable weight for each size. May be made with a metal top instead of a glass top, when required, either type of which may be mounted on top of a skylight or on the ridge of a roof.



FIG. 1A. "BURT" GLASS-TOP VENTILATOR
Sectional view

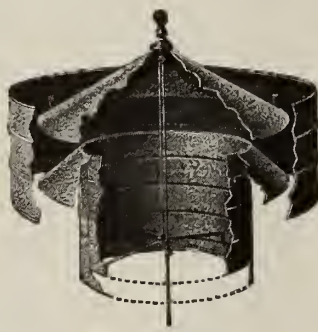


FIG. 2A. "BURT" METAL-TOP VENTILATOR
Sectional view

"BURT" DOUBLE DAMPER VENTILATOR (Patented)—Designed especially for weave sheds. It is being adopted by two-thirds of the new textile mills now being erected in the Eastern States.

When condensation is very severe, lower damper acts as a drip pan and collects moisture, and later this evaporates. Lower drip pan is placed below bottom damper as a safety device. In case lower damper should overflow, this collects all surplus water. The condensation trough in the air shaft collects a great deal of moisture and passes this to outside of ventilator.



FIG. 3F. "BURT" DOUBLE DAMPER VENTILATOR
Open

"BURT" FAN VENTILATOR—This ventilator will remove quickly and at a slight expense excessive fumes and odors in blacksmith shops, foundries, rubber factories, laundries, etc. Adapted for the most difficult conditions and will be found much more economical than the average blower system and just as effective.

Fan, operated either by pulley or by motor, at a speed of 350 to 400 revolutions per minute (requiring from $\frac{1}{4}$ to $\frac{1}{2}$ h.p.) will remove 10 times more air in a given length of time than the average stationary ventilator. Fully equipped with ball bearings.

In case of fire, the fusible links will break, causing damper to drop and shut off draft. Manufactured in 8 sizes; namely, 30, 36, 40, 48, 54, 60, 66, and 72 in.

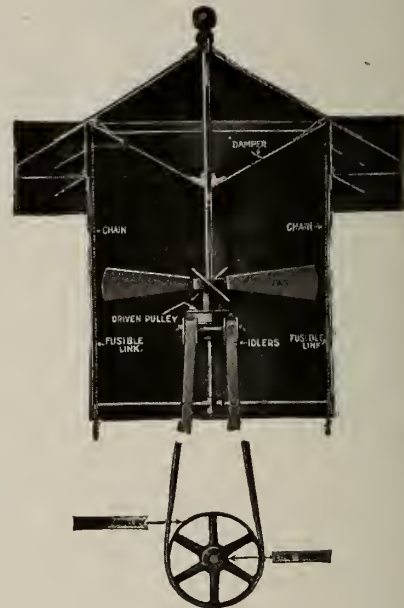


FIG. 4D. "BURT" FAN VENTILATOR
Sectional view

"BURT" SLIDING CONE DAMPER VENTILATOR—A strictly high grade cone damper, which automatically closes in case of fire. The raising and lowering device (patent applied for) is simple in construction, positive in action, and guaranteed not to stick or bind (Fig. 5B). Made with metal tops, and with or without fusible links.

"BURT" BALL BEARING REVOLVING VENTILATOR—Fully equipped with high grade ball bearings and guaranteed not to stick or bind. Owing to its peculiar construction, all the air currents are allowed to pass directly through the ventilator. (Fig. 6R.) Every ventilator is fully erected and tested before shipment.

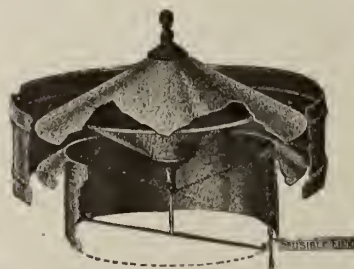


FIG. 5B. "BURT" SLIDING CONE DAMPER VENTILATOR
Showing cone damper open

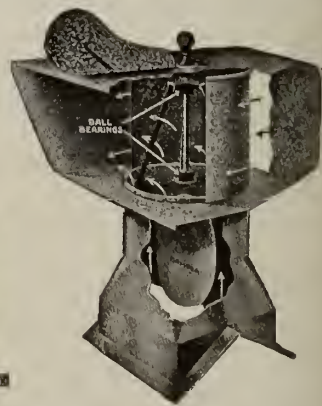


FIG. 6R. "BURT" BALL BEARING REVOLVING VENTILATOR
Sectional view

DIRECTIONS FOR ORDERING—In ordering bases always furnish sketch showing pitch of roof, and location of ventilators whether on ridge or slope, and round or square.

Ventilator bases are charged for extra, for which figures will be quoted on receipt of specifications. All bases equipped with dampers without extra charge.

Prices on ventilators made of copper, Toncan, American ingot iron, or any other material desired will be furnished on application.

DATA, "BURT" VENTILATORS

Diameters, in.		Gage of iron	Height without base, in.		Length air shaft from bottom of wind-shield, in.	Net weight without crating, lbs.		Area of diameter in sq. in.	Price
Neck	Outer rim or band		Glass top	Metal top		Metal top	Glass top		
12	22	22	14	17	4 1/4	17	20	113.10	\$8.00
14	24	22	15	17 1/2	4 1/4	20	24	153.94	12.00
16	26	22	15 1/2	19	5	24	30	201.06	15.00
18	29	20	16	21	5 1/2	28	34	254.47	19.00
20	32	20	18	23	5 1/2	33	42	314.16	23.00
24	38	20	22	26	6	45	56	452.39	27.00
30	46	18	24	30	6	90	105	706.85	38.00
36	54	18	27	36	8	130	155	1017.88	57.00
40	64	18	33	40	10	175	200	1256.00	75.00
42	68	18	34	42	10	190	225	1386.00	81.00
48	78	18	36	46	11	300	320	1809.00	90.00
54	86	18	40	51	14	350	400	2390.00	105.00
60	94	16	43	54	12 1/2	430	480	2827.00	120.00
66	102	16	46	55	15 1/2	500	550	3456.00	135.00
72	110	16	51	66	15 1/2	560	610	4071.00	150.00

Prices f. o. b. Akron, Ohio, and include sliding sleeve damper. Ventilator bases are charged for extra, for which prices will be quoted on receipt of specifications. Operating rope or chain not furnished.

GUARANTEE—This company expressly agrees to replace, free of charge, any of its ventilators which shall at any time be found to have been defective in workmanship or material.

Co-OPERATIVE SERVICE—The engineering department of this organization will gladly and expeditiously co-operate with engineers, architects, contractors and others, in the selection of proper types and sizes of ventilators, to suit particular conditions and requirements. Blue prints of all types will be furnished on application.

REFERENCES—A few prominent users are here given:

COMPANY	No. ORDERS
U. S. Steel Corporation	417
U. S. Government	111
Standard Oil Co.	161
American Beet Sugar Co.	23
Stone & Webster Engineering Corporation	49
American Steel & Wire Co.: Cleveland, Ohio, 116;	
Waukegan, Ill., 71; Joliet, Ill., 31; De Kalb, Ill.,	28
Goodyear Tire & Rubber Co., Akron, Ohio	17
Firestone Tire & Rubber Co., Akron, Ohio	26
Canadian Pacific Railroad Co., Montreal, Can.	389
Sheffield Farms-Slawson-Decker Co.	42

"Burt" Exhaust Head.

Attached to the exhaust pipe, this device prevents oil and wet steam from escaping, to drench and disfigure the building and rot the roof. Prevents condensed steam from falling on side-walks, which in winter forms ice under foot. After cylinder oil has been removed, the water employed in steam system may be repeatedly used.



FIG. 7A. "BURT" EXHAUST HEAD Sectional view

CONSTRUCTION—The "Burt" exhaust head is constructed with perpendicular sides, giving a large inside area, and providing abundant room for the expansion of the steam. With plenty of room for expansion, there is no back pressure; and as the area of the steam chamber is not lessened by useless stuffing, it is virtually increased. There are no baffle plates, no diaphragm nor scrap metal. This means the avoidance of friction, and increases the life of the apparatus.

The "Burt" exhaust head is equipped with malleable iron bases and drips (galvanized). Seams and attachments are watertight; the head can not overload or blow up if proper size is ordered.

DATA, "BURT" EXHAUST HEADS

Size of exhaust pipe, in.	Height, in.	Diam., in.	Size of drip, in.	Net weight, lbs.	Shipping weight, lbs.	Price
1 or 1 1/2	16	10	1	18	30	\$12.00
2 or 2 1/2	18	12	1	25	40	15.00
3 or 3 1/2	20	14	1	35	55	18.00
4 or 4 1/2	27	16	1	50	70	24.00
5	29	18	1 1/4	70	100	30.00
6	31	20	1 1/4	90	130	36.00
7	36	22	1 1/2	100	150	45.00
8	39	24	1 1/2	125	180	54.00
9	43	26	2	168	225	63.00
10	46	30	2	168	225	75.00
11	46	30	2	190	260	80.00
12	48	32	2	213	300	90.00
13	51	34	2	248	340	105.00
14	56	36	2	280	375	120.00
15	59	39	2	315	435	145.00
16	62	42	2	350	500	160.00
17	69	45	4	425	575	170.00
18	76	48	4	500	650	190.00
19	79	50	4	600	825	210.00
20	82	52	4	700	1000	225.00

Net f. o. b. Akron, Ohio

STANDARD EXHAUST HEADS—Designed for the utilization of centrifugal force for separating water and oil from exhaust steam. Due to the cone shape of the head, the incoming steam is given a whirling motion at the top of the head, and the water and oil strike the sides, flow down the drip outlet at the bottom, and thus do not come in contact with the incoming steam.



FIG. 8F. STANDARD EXHAUST HEAD Sectional view

LARGE EXHAUST HEADS—Where an exhaust head is used in connection with a rolling mill engine or hoisting engine, or where the exhaust is extremely severe, the individual conditions require special treatment. Large exhaust heads furnished any size desired and manufactured from any weight of iron specified. Quotations will be forwarded on receipt of information as to the horsepower of the engine and whether or not same is overloaded and the exhaust is severe.

REFERENCES—Among recent equipment of special exhaust heads have been the following:
Jones & Laughlin Steel Co., Pittsburgh, Pa., 30-in., No. 10 gage
Salem Iron Co., Leetonia, Ohio, 37 1/2-in., No. 10 gage
U. S. Steel Corporation, Pittsburgh, Pa., 42-in., No. 10 gage
Tennessee Coal & Iron Co., Birmingham, Ala., 24-in., No. 14 gage
Iroquois Iron Co., Chicago, Ill., 16-in., No. 10 gage
Anaconda Copper Mining Co., Butte, Mont., 24-in., No. 14 gage
Illinois Steel Co., 30-in., No. 10 gage

AUTO UTILITIES MANUFACTURING COMPANY

Manufacturers of Building and Car Ventilators

5 North La Salle Street
CHICAGO, ILL.

Products.

PEERLESS EXHAUST VENTILATORS for buildings, factories, steam and electric railway cars.

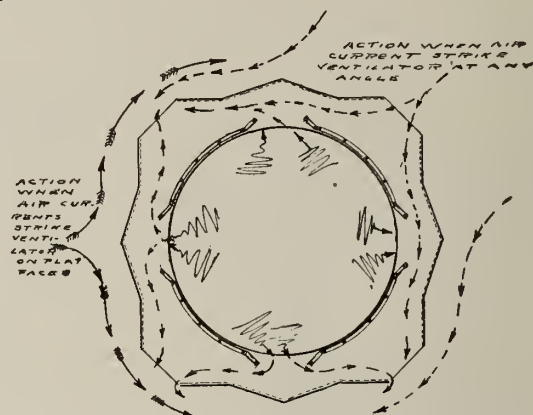
Description.

This ventilator differs entirely from any other type of exhaust ventilator. It is square in design with 4 V-shaped faces or sides. The outer openings are at the four corners, the inner outlet directly back of the V in the wind resisting face. The slightest air currents striking the V-shaped faces are forced over the corner opening at a greatly increased velocity, thus creating the vacuum.

The inner construction consists of 4 cylindrical parts with flat edges extending outward into the V of the face. These flat edges absolutely prevent down-draft and make positive a continuous exhaust, whether the wind passes over or through the corner openings. The collar extends up into the ventilator, creating a perfect drain and making the ventilator absolutely stormproof.



PEERLESS
VENTILATOR



PLAN SECTION THROUGH PEERLESS VENTILATOR

Indorsements.

No installation of Peerless ventilators has ever failed; they succeed where the round and rotary types can not.

The Bureau of Yards and Docks of the Navy Department for a considerable time took over our entire output for the proper ventilation of the great barracks buildings, where pure air is so vitally essential to the proper housing of thousands of men. As a result, the large camps at Great Lakes, Ill., Paris Island, S. C., Hampton Roads, Va., Philadelphia, Pa., Bay Ridge, Brooklyn, N. Y., Charleston, S. C., and dozens of smaller camps were all ventilated with Peerless ventilators.

The Peerless has the indorsement of the State Factory Inspection Department of Illinois, and of the Chicago Board of Health.

More than 60,000 are in use as smokejacks on stove heated street cars throughout the United States.

The Pullman Co. has used Peerless ventilators on every sleeping car built since November, 1914. Adopted as standard by them, because it gave greater pull than anything they could find and did not *back up or show an intake*.

A few other indorsers of Peerless ventilators are: Fulton Iron Works of St. Louis; Crane Co., Western Foundries Co., Western Packing Co., Jos. T. Ryerson & Son, all of Chicago; Studebaker Corporation at South Bend, Ind.; Advance Rumely Co., La Porte, Ind.

Construction.

The Peerless ventilator is built of the best grade galvanized steel, Ingot or Toncan metals and copper. No solder is used in the essential parts of its construction; all parts are double seamed or riveted; it has no movable parts, no top bands or any other parts to rust, give way, or blow off.

Advantages.

The Peerless is substantially built, and therefore long-lived.

It sells at a legitimate price and delivers full value for the money.

Its exhaust capacity can be relied upon; the user takes no chance of failure.

Its merit is the result of its design. A flat surface will give greater resistance to the wind than a round one.

The Peerless ventilator works in all kinds of weather.



TYPICAL INSTALLATION OF PEERLESS VENTILATORS ON FACTORY WITH MONITOR ROOF

GLOBE VENTILATOR COMPANY

205 River Street
TROY, N. Y.

Products.

Sole manufacturer of "GLOBE" DOME TOP SUCTION VENTILATORS; "GLOBE" CHIMNEY CAPS and "GLOBE" VENTILATED RIDGING.

Barn Birdproof Ventilators; Special "Globe" Car Ventilators and "Globe" Lamp Jacks.

Uses.

"GLOBE" VENTILATORS—Especially adapted for removing excessive heat and foul air from churches, schoolhouses and public buildings; for exhausting steam, smoke and gases from mills, foundries and factories; and for expelling impure air, moisture and odors from barns and stables—in fact, they meet every requirement of ventilators.

CHIMNEY CAPS—Prevent downward currents in chimneys and increase drafts in sluggish flues.

"GLOBE" VENTILATED RIDGING—For use on buildings where it is not desired to break the skyline by placing ventilators.



"GLOBE" VENTILATED RIDGING

Description of "Globe" Ventilators.

The "Globe" ventilator is made in all materials, of the proper gages to give lasting service; it is strongly braced with extra heavy steel bands, and is riveted, making an exceptionally strong ventilator, which is efficient under all conditions.

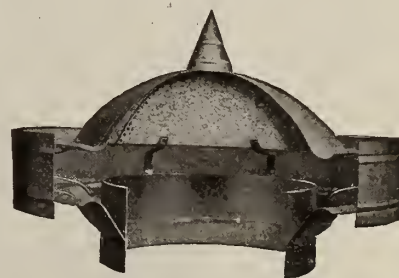
Glass top ventilators possess all the qualities of the metal top ventilators, and are designed to secure the greatest degree of ventilation and the largest area of light.



GLASS TOP "GLOBE" VENTILATOR



"GLOBE" VENTILATOR, WITH REGULATION SQUARE BASE



Sectional View



Regular View

DOMESTOP "GLOBE" VENTILATOR

Anemometer Readings.

Below is given a test made on the "Globe" 24-in. ventilator with 6-in. outlet, under the low wind velocity of less than 5 miles an hour.

RENSSELAER POLYTECHNIC INSTITUTE
Department of Mechanical Engineering
Troy, N. Y.

No. of reading	Velocity of wind in miles per hour	Velocity of air in the ventilator in feet per minute	Temperature difference
1	4.41	468	38°
2	4.65	457	38°
3	4.36	462	38°
4	3.74	447	37°

(Signed) ARTHUR M. GREENE, JR., M. E.

PRICES, DIMENSIONS, AREA SQUARE INCHES AND GAGES OF MATERIALS

Size, in.	Gage of iron	Weight of copper, oz.	Extreme outside diameter, in.	Total height, in.	Area, sq. in.	Price list*
6	24	18	11¼	9	28	\$3.40
8	24	18	14	11	51	4.65
10	24	18	17	12	79	5.75
12	24	18	18¾	13	113	6.75
14	22	18	25	18	154	13.00
16	22	18	27½	19	201	20.00
18	20	18	32	21	255	27.00
20	20	20	36½	23	314	33.00
22	20	20	38	25	380	36.00
24	20	20	43½	29	453	40.00
26	20	20	44	31	531	50.00
28	20	24	50	33	616	56.00
30	20	24	50½	35	707	65.00
32	20	24	54	38	804	80.00
36	18	24	68	50	1018	120.00
40	18	24	74	57	1257	180.00
48	18	28	84	64	1810	240.00
54	18	28	92	67	2290	300.00
60	18	28	99	70	2828	360.00

*Subject to liberal discounts.

PAUL R. JORDAN & CO.

Manufacturers of the "Aero" Line of Ventilators

TELEPHONES:

AUTO 25-301
BELL—MAIN 535

HOME OFFICE AND FACTORY
INDIANAPOLIS, IND.

PACIFIC COAST REPRESENTATIVE

LOS ANGELES, CAL., W. H. STEEL, 600 Metropolitan Building—Telephones, 60871; Broadway 502

PACIFIC COAST MANUFACTURER

LOS ANGELES, CAL., CALIFORNIA CORNICE WKS., 1610 Fernando Street—Telephones, East 809; A2601

CANADIAN REPRESENTATIVE

MONTREAL, QUE., J. E. MCCARTHY, 617 New Birks Building

Products.

AEROPLANE ROTARY VENTILATORS;
AEROBOOST COMMON FOCUS VENTILATORS;
AEROPULL STORM BAND VENTILATORS; AERO-AUTOMATIC
BASES; AERO-AUTOMATIC FRESH AIR INTAKES.

Wall Boxes; Ventilating Systems Complete; Auto-
matic Regulating Bases; Siphonage, Roof Barn, Toilet,
Schoolhouse, Car, Dampened, Glass Top, and Revolving
Ventilators.

The "Aero" Line.

There are three types of successful roof ventila-
tors—the rotary, ejector or siphonage, and storm band.
The "Aero" line presents the highest development in
each type. It does not exploit any fantastic ideas, but
harnesses each proven principle of air movement to
take fullest advantage of that principle.

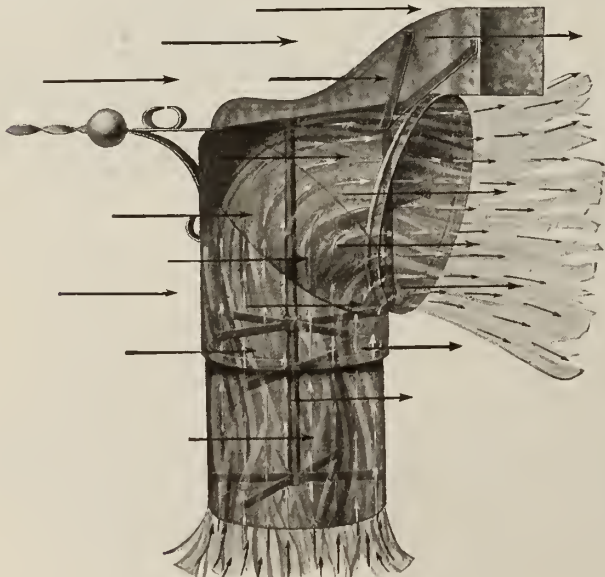
Aeroplane Rotary Ventilators.

A *top balanced* rotary ventilator, free swinging,
perfectly balanced with a weight, well braced with steel
flats set edgewise, reinforced with riveted steel seg-
ments, seamed and riveted throughout.

The *main bearing* at the top is of a special bronze on
steel one-ball type, which is non-corrosive, is practically
frictionless and has no setting tendency. Absolutely re-
liable under all conditions and requires no attention. It
never sticks.

In operation it swings around, responding to wind
direction, always keeping the mouth away from the
wind. The wind blowing past the mouth creates a
vacuum there, exerting a tremendous sucking action.

Four *special shaped planes* keep the mouth exactly
away from the wind and from this accurate adjustment
Aeroplane ventilators get their remarkable efficiency.
Sensitive to the lowest air movement.

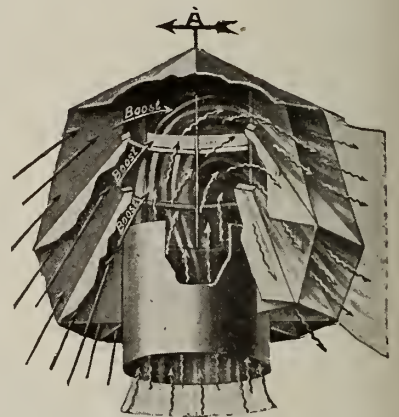


AEROPLANE ROTARY VENTILATOR

The "Aero" Line Aerobost Common Focus Ventilators.

A highly efficient stationary ventilator.
Triple siphonage, or triple ejector type

The three strata
of ejector tubes are
so focused as to give
a boosting action to
the exhausting foul
air at every point in
the same direction
that it is moving,
boosting it without
causing eddies or
whirls to impede its
rapid flow.

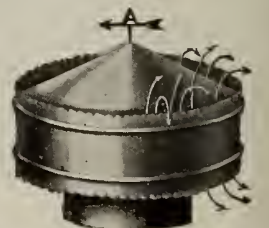


AEROBOOST COMMON FOCUS VENTILATOR

Aeropull Storm Band Ventilators.

A stationary
type, well designed
and well put up.

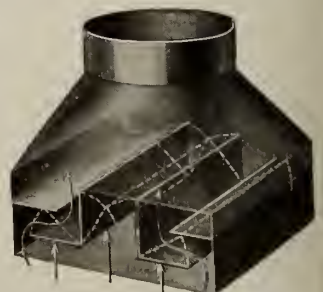
Its unequaled
free exhaust area and gen-
erous dimensions eliminate
the choking down tendency
of poorly designed storm
band ventilators.



AEROPULL STORM BAND VENTILATOR

Aero-automatic Bases.

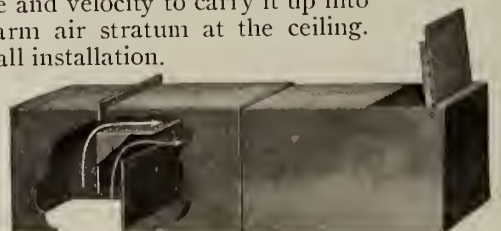
A base that can be used
with any ventilator, giving
automatic regulation to the
flow of air out the flue. Is
noiseless; needs no oiling or
attention of any kind. Is
well made and durable.
Keeps heat from being
sucked out of building when
ventilation conditions are too
favorable.



AERO-AUTOMATIC BASE

Aero-automatic Fresh Air Intakes.

Furnishes and controls a
steady and unvarying stream
of pure air, the diffusion
chamber giving the correct
volume and velocity to carry it up into
the warm air stratum at the ceiling.
For wall installation.



AERO-AUTOMATIC FRESH AIR INTAKE

KAIN & AUNGER COMPANY

Manufacturers of Rotary Ventilators

1364-1368 East 34th Street
CLEVELAND, OHIO

Product.

SI-FO VENTILATOR.

Description.

The Si-Fo ventilator is of the rotary type, with the siphonic feature perfected and embodied in the design and construction which gives it *power to eject more air than any other ventilator made.* (Note official test.)

It is constructed in a neat and durable manner, of sufficiently strong material and bracing to withstand long and continuous operation. It is made of rust resisting galvanized sheet metal or cold rolled copper. The revolving part of the ventilator is supported by a phosphor bronze bearing resting on a steel shaft. It is practically noiseless in operation and is guaranteed to operate at all times and under all conditions.

Operation.

As the wind strikes the cylindrical cone it is deflected outwardly to the larger or front end of the funnel. As the funnel tapers around the inner chamber, the outlet is contracted, which causes the air to leave at a greater velocity than that at which it entered. This produces siphonic action at the open end of the inner chamber and naturally exhausts air from the vertical chamber.

To further increase the velocity of the air for obtaining greater siphonic action, a plurality of openings is provided in the walls of the inner chamber. These openings are covered by inclined pockets having open front ends and closed rear ends.

As the air enters these pockets it is directed through the openings into the inner chamber near the open end, and this produces increased velocity of the air at the

discharge end of the inner chamber. The openings are made tapering and larger toward the discharge end to deliver a greater volume of air nearer the open end and thereby create siphonic action. The cylindrical form of this ventilator precludes the possibility of dead air pockets, which exist in the square or rectangular design of ventilators.

Results of Test.

This test was conducted by F. H. Vose, Professor of Mechanical Engineering, Case School of Applied Science, Cleveland, Ohio.

The Si-Fo ventilator used was 12-in. in diameter. Readings were taken of the wind velocity over the roof, and of the air velocity through the ventilator—readings being taken continuously for one hour. During this time the

- Average wind velocity was 4.28 miles per hour
- Maximum wind velocity was 5.6 miles per hour
- Minimum wind velocity was 2.24 miles per hour
- Air discharged by ventilator averaged 465 cu. ft. per min.
- Diameter of ventilator pipe at point of measurement was 12 in.
- Area of pipe at point of measurement being .7854 sq. ft.
- Average velocity of air through ventilator at point of measurement was 592.5 ft. per min.
- Distance from roof to lowest point of exhaust opening was 5 ft. 10 in.

At the same wind velocity, the Si-Fo ventilator has a greater velocity through the ventilator and moves more cubic feet of air per minute per square inch of area opening, than any other ventilator on the market.

PRICES, AND CUBIC FEET PER MINUTE BASED ON WIND VELOCITY OF 5 MILES PER HOUR

Diameter, in.	Weight, lbs.	Cu. ft. per minute capacity	Price, galvanized ingot iron	Price, copper
8	18	240	\$17.00	\$27.00
10	24	375	19.00	33.00
12	32	540	22.00	41.00
14	40	745	27.00	51.00
16	52	975	31.00	63.00
18	68	1230	39.00	77.00
20	96	1530	46.00	104.00
24	160	2200	58.00	154.00
30	205	3410	87.00	220.00
36	280	4950	118.00	298.00
42	395	6720	162.00	408.00
48	560	8750	219.00	580.00

Testimonial.

CLEVELAND, OHIO, November 13, 1918.

GENTLEMEN :

Last June you installed on our foundry five of your 16-in. Si-Fo ventilators, and on our furnace room two of your 18-in., and after almost five months continual use of same, we are pleased to advise you that the Si-Fo is without question the most efficient ventilator we have ever had installed, and we believe the most scientifically constructed ventilator on the market today.

The two 18-in. Si-Fo ventilators on our furnace room keep the room clear from all fumes and smoke at all times regardless of the kind of metal we are melting, while the five 16-in. on the foundry draw all the smoke and fumes out as fast as they rise from the metal we are pouring.

We take great pleasure in recommending the Si-Fo ventilator to any one contemplating installing ventilators.

Very truly yours,

THE AETNA BRASS MANUFACTURING CO.
Chas. Miles, President.

(Signed)



SI-FO VENTILATOR

KERNCHEN COMPANY

Ventilating Engineers

McCormick Building
CHICAGO, ILL.

TELEPHONE:
HARRISON 3072

NEW YORK OFFICE: 1265 Broadway—Telephones, Madison Square 2769 and 9478
AGENCIES IN ALL PRINCIPAL CITIES

Products.

“K-S-V’s” (KERNCHEN SIPHONAGE VENTILATORS), with or without dampers. Fuse Link Dampers for same when desired.

“K-S-V” (Kernchen Siphonage Ventilator).

For any type of building or enclosure, railway and street cars; chimneys, defective drafts, etc.

“K-S-V” (Kernchen Siphonage Ventilator) does the work of three others. Save this cost.

The correct siphon is the most powerful pulling force known to gravity science. It not only exhausts, it terrifically pulls.

The siphons harness the most delicate air currents, compressing and compelling them to co-act in mightily increasing the upward movement of air through the ventilator, and consequently increasing the pull.

CONSTRUCTION—Simplicity of construction and absence of any mechanism whatever are extra features of the K-S-V (Kernchen Siphonage Ventilator). It has over 200% free area or outlet. Nothing choking or hindering. Friction at minimum, exhaust at maximum.

The eduction pipe is of cylindrical form throughout. The upper end of the pipe is provided with several V-shaped slits or openings, each opening covered with a siphon, tapered inwardly toward the top and rising above the level of the pipe. A jacket of conical shape envelops these siphons, whereby other siphons are formed, greatly increasing the terrific pulling power of the ventilator. In addition, two hoods are put over the jacket near its mouth, augmenting considerably the pulling force and preventing rain, hail, sleet or snow from going through, thus being absolutely stormproof. There is no band of iron around the two top hoods interfering with the exhaust or outlet area. (See illustration of ventilator.)

The ventilator is in one piece and stationary—no mechanism, nothing revolving or rotating—always silently doing its work. Nothing to wear out. No cost for maintenance. A rotary ventilator requires a certain amount of wind energy to swing it around



before it gets ready to ventilate. The “K-S-V” uses this same wind energy to ventilate.

The damper is equally as simple as the ventilator and is made in one piece. It has no sliding sleeves or mechanism.

CAUTION—Beware of imitations and infringements. Protect yourself by specifying as follows: “K-S-V’s (Kernchen Siphonage Ventilators), manufactured by KERNCHEN COMPANY, McCormick Building, Chicago, Ill.,” and see that KERNCHEN COMPANY brass tags are on ventilators.

Official Tests.

Note in the following two indisputable official tests (which are signed by eminent authorities) the absolute proof of capacity and terrific pulling power. Compare the Case School of Applied Science Official Test (which was made on the roof of a building) with the Armour Institute Official Test (which was conducted in a laboratory), for scientific corroboration and verification of each other, and of our statements regarding the actual powerful pull of “K-S-V’s.”

We challenge all to furnish such signed, Institutes of Technology Official Tests.

Ventilation of Industrial Buildings.

Pivoted sash, sawtooth or monitor roofs, with hinged or pivoted windows, do not ventilate and are useful for light only. Wind pressure, direction, and angle govern

OFFICIAL TEST OF “K-S-V’s” (KERNCHEN SIPHONAGE VENTILATORS) CONDUCTED BY ARMOUR INSTITUTE OF TECHNOLOGY, CHICAGO

SHOWING EXHAUST UNDER DIFFERENT WIND VELOCITIES, AND WHICH SCIENTIFICALLY PROVES THE TERRIFIC PULLING POWER AND 100% TO 300% MORE EFFICIENCY THAN THAT OF OTHER VENTILATORS

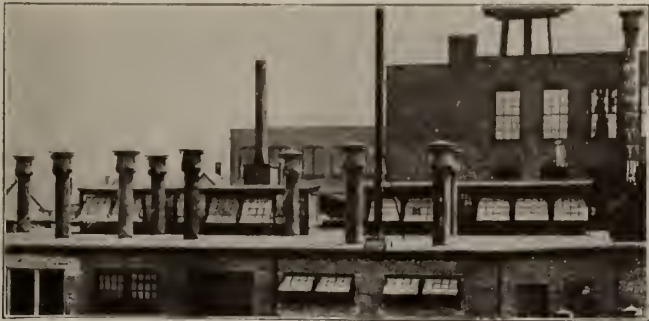
Wind velocity, miles per hour	Air pulled through ventilator, lineal ft. per min.	Size of ventilator, in.	Cubic feet air pulled through ventilator									
			12	14	16	18	20	24	30	36	40	48
5	460	Per min.	364.0	492.2	644.0	814.2	1,003	1,444	2,250	3,247	4,000	5,776
		Per hr.	21,840	29,532	38,640	48,852	60,180	86,640	135,000	194,820	240,000	346,560
10	670	Per min.	525.0	717.0	938.0	1,186	1,460	2,103	3,280	4,730	5,830	8,412
		Per hr.	31,500	43,020	56,280	71,160	87,600	126,180	196,800	283,800	349,800	504,720
15	960	Per min.	754.0	1,027	1,344	1,699	2,100	3,014	4,700	6,777	8,350	12,056
		Per hr.	45,240	61,620	80,640	101,940	126,000	180,840	282,000	406,620	501,000	723,360
20	1,220	Per min.	957.0	1,305	1,708	2,159	2,660	3,830	5,980	8,613	10,640	15,320
		Per hr.	57,420	78,300	102,480	129,540	159,600	229,800	358,800	516,780	638,400	919,200
25	1,480	Per min.	1,161	1,584	2,072	2,619	3,230	4,647	7,250	10,448	12,870	18,588
		Per hr.	69,660	95,040	124,320	157,140	193,800	278,820	435,000	626,880	772,200	1,115,280

(Signed) G. F. GEBHARDT, A. H. ANDERSON, Mechanical Engineers, Armour Institute of Technology

CASE SCHOOL OF APPLIED SCIENCE—TEST NOV. 6, 1913 ON ROOF OF LEADER BUILDING, CLEVELAND, OHIO		ARMOUR INSTITUTE OF TECHNOLOGY—TEST APRIL 17, 1911 IN LABORATORY	
15 inches		Diameter of ventilator	
15 inches			
5.32 miles per hour, or 6 $\frac{3}{4}$ % } stronger than Armour's }		Velocity of outside wind	
5 miles per hour			
497		{ Velocity of air pulled through ventilator } per min., lineal ft.	
460			
610		Exhaust of ventilator per min., cubic ft.	
564			
Outside temperature, 67° Fahr.		Inside temperature, 85.8° Fahr.	

(Signed) F. H. Vose,
Head of Mech. Eng. Dept.,
Case School of Applied Science.

(Signed) G. F. GEBHARDT,
A. H. ANDERSON,
Mech. Engrs., Armour Institute of Technology.



“K-S-V’S” INSTALLED ON THIS MONITOR OR LANTERN ROOF WITH PIVOTED SASH

window ventilation and produce contrary results. Instead of providing ventilation, they have generally an exactly opposite effect, for the outside air, entering a building through such openings, blows down or back the foul air, smoke, fumes, etc., which, instead, should be pulled out.

Louvers also have proved to be nothing but complete intakes, driving the foul air, fumes, steam, smoke, etc., down to the floor.

Greater Results with Less Cost.

“K-S-V’s” (Kernchen Siphonage Ventilators) are far cheaper than other makes since less than half the number or size are required to exhaust the same amount of air. Even then the inferior types, with their larger number or greater size, will not give results equal to the “K-S-V’s” (Kernchen Siphonage Ventilators) when the outside air currents are low.

This saving in the number or size of ventilators involves an added saving in installation.

And so, while the initial cost of the “K-S-V” (Kernchen Siphonage Ventilator) may be higher than some others from a diameter standpoint, this is much more than offset by its surpassing exhaust.

SIZES, GAGES, WEIGHTS AND PRICES OF VENTILATORS

Diam., in.	Area of vent., sq. in.	GALVANIZED				“ARMCO” (AMERICAN INGOT IRON) AND “TONGAN METAL”				COPPER			
		Gage	Weight, complete	Price without damper	Price of damper	Gage	Weight, complete	Price without damper	Price of damper	Oz. of copper	Weight, complete	Price without damper	Price of damper
6	28	26	5¼	\$9.70	\$1.44	26	5¼	\$12.13	\$1.80	16	8¼	\$14.80	\$1.68
8	50	26	10	11.80	1.68	26	10	14.75	2.10	16	14	20.40	1.92
10	78	24	17	15.60	1.92	24	17	19.50	2.40	18	30	34.00	2.36
12	113	24	24	16.40	2.12	24	24	20.50	2.65	18	32¾	37.00	3.08
14	154	24	35	19.60	2.36	24	35	24.50	2.95	18	48	49.50	3.84
16	201	24	48	22.80	2.60	24	48	28.50	3.25	18	62	60.80	4.74
18	255	24	60	26.00	2.84	24	60	32.50	3.55	18	74	72.00	5.70
20	314	22	71½	32.80	3.08	22	71½	41.00	3.85	20	109	100.00	7.38
22	380	22	93	38.80	3.32	22	93	48.50	4.15	20	137	124.00	8.10
24	453	22	113	43.60	3.56	22	113	54.50	4.45	20	153	138.00	9.28
26	521	22	126	55.20	3.84	22	126	69.00	4.80	20	210	184.00	10.26
28	615	22	157	62.40	4.07	22	157	78.00	5.10	20	235	208.00	11.20
30	707	20	184	67.60	4.32	20	184	84.50	5.40	24	247	224.00	13.12
36	1017	20	227	92.00	5.04	20	227	115.00	6.30	24	269	258.00	15.00

Above sizes are kept in stock and prices are f.o.b. our five factories: east, central, north and west. Prices on other and larger sizes, and other metals, supplied on application. When ordering, specify if damper is desired.

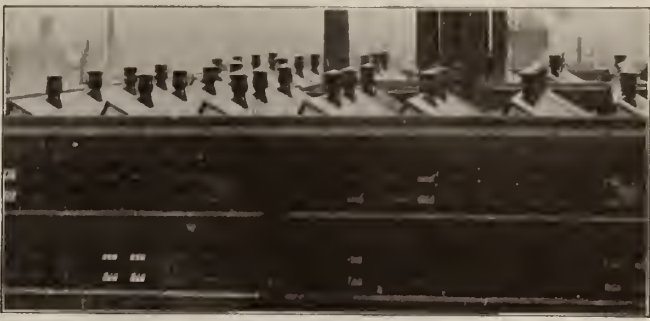
Special Ventilation Service.

The KERNCHEN COMPANY specializes in ventilation and its engineers are always available, gratis.

Particular attention given to difficult or unusual problems involving great heat as well as temperatures below the freezing point; steam conditions; elimination of condensation, moisture, fumes, gases or smudge, foul or vitiated air, in every type of building or room.

Booklet—“It Pulls.”

A postal will bring our latest illustrated booklet,



52 “K-S-V’S” INSTALLED ON THIS SAWTOOTH ROOF WITH PIVOTED SASH

entitled “It Pulls,” containing complete information concerning the “K-S-V’s” (Kernchen Siphonage Ventilators).

Testimonials.

The following letters, selected from many received from industrial houses of national and international reputation, convey a limited idea of the way that we and our “K-S-V’s” (Kernchen Siphonage Ventilators) are completely curing vexing and costly conditions of foul air, steam, smudge, condensation, moisture, gas, smoke, fumes, dust, etc., giving absolute satisfaction, in many cases after large fans and other types of ventilators have failed to give adequate relief:

AMERICAN CAR AND FOUNDRY CO., CHICAGO—“The Kernchen Siphonage Ventilator has proved very satisfactory. It is installed above our blacksmith shop and it pulls the bad air out.”

PACKARD MOTOR CAR CO., DETROIT—“Kernchen Siphonage Ventilators are handling the ventilating of the third floor of our Heat Treat Department and our Truck Blacksmith Shop very well indeed.”

NEW YORK, CHICAGO & ST. LOUIS RAILROAD CO. (“NICKEL PLATE”), CLEVELAND, OHIO—“The ventilators are working very satisfactorily.”

GENERAL RAILWAY SIGNAL COMPANY, ROCHESTER, N. Y.—“The operation of this ventilator is entirely satisfactory and we are considering the use of several more in the near future.”

HENRY DISSTON & SONS, PHILADELPHIA, PA.—“The Ventilators have been installed and are giving satisfaction.”

THE THOMPSON & NORRIS CO., BROOKVILLE, IND.—“During the months previous to the extreme cold weather, the Kernchen Ventilators absolutely prevented any dripping and condensation in our Machine and Store Room where we were formerly bothered very much, although we had four 36” fans and two ordinary ventilators.

“It was such a positive pleasure to go into this room after your ventilators were installed and find the floor and ceiling dry, whereas both used to be covered with moisture, that we wondered if such would be the case when the extreme cold weather set in.

“The extreme cold weather has been encountered and we have found your ventilators to be just as effective, and our Machine and Store Room has been kept absolutely free from steam, condensation and dripping.”

FRAZER PAINT CO., DETROIT—“The summer of 1916 will pass into weather history on account of the long, torrid spell in the Middle West. Factories and furnaces were forced to suspend operations on account of the heat or materially curtail productions.

“Detroit was no exception as a sufferer from the heat and our factory of metal sash construction became so hot that the men could not stand it and we were confronted with a shutdown at the time of the greatest rush of business in our experience.

“But instead, we installed K-S-V’s (Kernchen Siphonage Ventilators) according to the layout proposed by your man, and they saved the day for us.

“Not only did they cause a refreshing current of air by withdrawing the hot, bad air, but they reduced the temperature of the working rooms several degrees.

“We did not shut down, but, instead, had an output beyond the usual.

“When our factory was built in 1915, we had intended to install K-S-V’s, but the architect provided others and the contract had been let before we noticed it and we did not insist. Under stress, they proved entirely inadequate.

“We regard the K-S-V in a class by itself.”

MOYER MANUFACTURING COMPANY

Ventilators and Ventilating Systems

MONTEVIDEO, MINN.

Products.

Manufacturers of MOYER VAC VENTILATORS for every type of building.

Also Moyer Vac Ventilating Systems for industrial plants, slaughter houses, laundries, creameries and barns.

Efficiency of Moyer Vac Ventilators.

The Moyer Vac ventilator head shows on repeated tests a velocity of air in the flue equalling 85% of the velocity of the wind outside of the building, blowing from any direction.

The Moyer Vac is absolutely watertight in any storm. The series of openings around the top band let the rain flow off from the top cone. The rain follows the inside of the band and runs off in a solid sheet from the points of the inside of the deflector vanes.

Workmanship.

The Moyer Vac ventilator heads are made in a modern shop, using only the highest type of material, and with this company's patented knocked down construction, assembled on the job with stove bolts, a most rigid construction results.

Freight Saving.

The Moyer Vac patented knocked down construction makes possible the shipping of 10 Moyer Vac ventilator heads in less than one-half the cubic space taken by 1 ventilator head of equal size crated as is usual for shipment. Completely erected ventilator heads of standard construction allow but 10 ventilators to be shipped in a standard 40-ft box car. With the Moyer Vac patented knocked down construction regularly shipped in this same size car, 420 Moyer Vac ventilators give a loading weight well above the necessary minimum for a car of this capacity and taking low export rate.

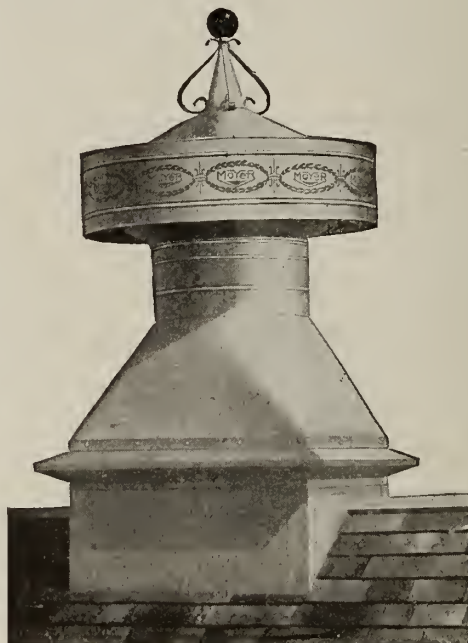
The freight classification on standard crated ventilators is two times first class rate, while Moyer Vac ventilators, knocked down and nested, are shipped at second



TRADE-MARK

class rate. This saving in freight is often the determining factor in the cost laid down on the job of Moyer Vac ventilator heads.

Where large sizes of ventilators are specified, the saving in the cost of erecting Moyer Vac ventilators in place on the roof is quite pronounced, as they can be hoisted into place and assembled in position without tackle.



MOYER VAC VENTILATOR

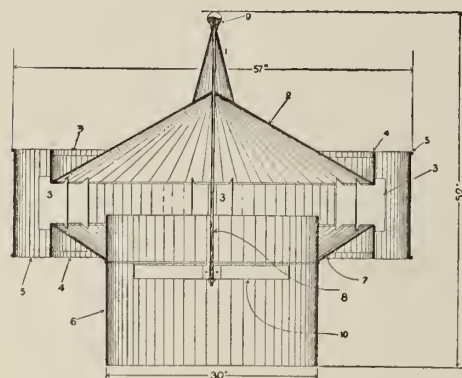
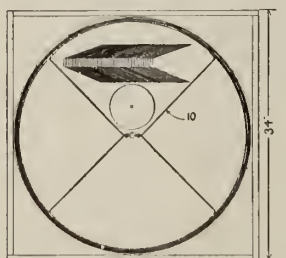
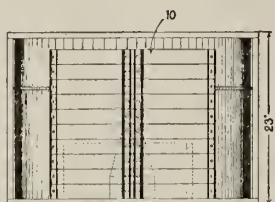


DIAGRAM OF VENTILATOR WITH INDEX OF PARTS

- | | |
|-------------------------------|----------------------|
| 1—Top cone | 6—Flue |
| 2—Upper dome | 7—Taper collar |
| 3—Storm band support brackets | 8—Tie rod |
| 4—Draft deflector | 9—Ornamental cap nut |
| 5—Storm band | 10—Spider |



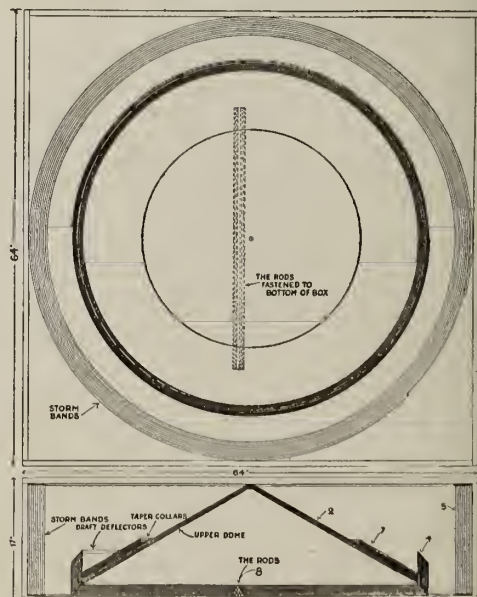
Box No. 1

TEN COMPLETE MOYER VENTILATOR HEADS BOXED FOR SHIPMENT

Box No. 1 contains following parts: Spiders—No. 10, Top Cones—No. 1, Cap Nuts—No. 9, Support Brackets—No. 3, the Flues—No. 6.

Box No. 2 contains: Storm Bands—No. 5, Draft Deflectors—No. 4, Taper Collars—No. 7, Upper Dome—No. 2, Tie Rods—No. 8.

All dimensions given in inches



Box No. 2

NEWARK CORNICE & SKYLIGHT WORKS

Rotary Ventilators and Sheet Metal Work

9-15 Seventeenth Avenue
NEWARK, N. J.

Products.

"FOUR-LEAF CLOVER" ROTARY VENTILATORS;
"FOUR-LEAF CLOVER" FANS; SHEET METAL and
KALAMEIN WORK.

"Four-Leaf Clover" Rotary Ventilator.

The operating feature of the "Four-Leaf Clover" rotary ventilator consists of a ball bearing rotary cap (wind propelled or power driven) with spiral propeller blades riveted on top and spiral exhaust blades on the bottom of the rotary cap. The principle employed in the design of the spiral propeller vanes and exhaust blades insures effective operation and a positive and continuous pull and discharge of air from below; it will exhaust under any and all conditions. In cases of ventilating low buildings or in courts where there is a downward movement of the wind it will exhaust air where other types reverse and take in air.

MATERIALS AND SIZES—Made of heavy galvanized iron or copper, according to specifications. The cap is firmly supported on strap iron framework, hot galvanized after fabrication, brass or copper framework being used for copper ventilators. Noiseless in action, revolving on ball bearings, no oil being required.

TEST OF CAPACITIES—A test sheet compiled by the mechanical laboratory, Pratt Institute, Brooklyn, N. Y., giving the discharging capacity, furnished on application.

"Four-Leaf Clover" Exhaust Fan.

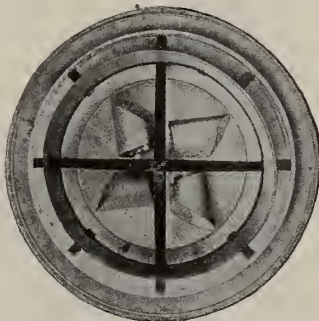
Especially adapted for theaters, halls, buildings and mines. Gives greater exhaust with less power consumption.

On account of its outward flat circular surface, it eliminates all outside resistance, giving a positive exhaust.

The "Four-Leaf Clover" exhaust fan can be used single or double, direct or indirect driven, installed horizontally or perpendicularly.



View of Fan Under Cap



Looking into Stem
"FOUR-LEAF CLOVER" ROTARY
VENTILATOR



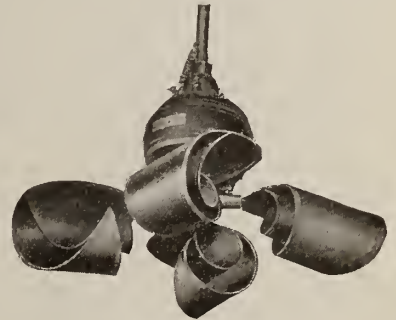
"FOUR-LEAF CLOVER"
EXHAUST FAN

"Four-Leaf Clover" Ceiling Fan.

Illustration shows ceiling fan blades for circulating air in theaters, hotels, restaurants, and offices.

The blades are made of thin sheet metal, suitably decorated and equipped with standard castings, so as to be interchangeable with the blades of any of the standard types of fan motors.

The action of this fan is the reverse of that of ordinary paddle designs. Instead of blowing down the hot air from the upper portion of the room on the heads of the occupants, causing disagreeable draughts, chilling of food, annoyance from smoke, etc., cool air from the lower part of the room is drawn up and distributed horizontally along the plane of the blades.



"FOUR-LEAF CLOVER" CEILING FAN

Sheet Metal and Kalamein Work.

This organization is equipped to manufacture high grade sheet metal and kalamein work of all descriptions. The highest standards of workmanship and the best known methods of construction are in use. The grade of work solicited demands the employment of highly skilled workers with a shop and the necessary machinery and tools to produce the best and most satisfactory results.

The illustration shows a typical specimen of the kalamein work supplied by the NEWARK CORNICE & SKYLIGHT WORKS.



KALAMEIN ENTRANCE DOORS, LAUTER BUILD-
ING, NEWARK, N. J.

J. H. & W. C. ELY, Architects

THE OHIO BODY AND BLOWER COMPANY

Rotary Ball Bearing Ventilators, Steam and Oil Separators, Steam Traps, Cast Iron Exhaust Heads, Feed Water Heaters

CLEVELAND, OHIO

BRANCH OFFICES

NEW YORK, N. Y., 39 Cortlandt Street
CHICAGO, ILL., 318 West Washington Street

PITTSBURGH, PA., Jones Law Building
ATLANTA, GA., Candler Building
AGENTS IN ALL PRINCIPAL CITIES

DETROIT, MICH., Builders Exchange
INDIANAPOLIS, IND., Board of Trade Building

Products.

SWARTWOUT ROTARY BALL BEARING VENTILATORS; SWARTWOUT HYDROMATIC STEAM TRAP; SWARTWOUT STEAM, OIL and AIR SEPARATORS; SWARTWOUT CAST IRON EXHAUST HEADS; SWARTWOUT HYDROMATIC WATER LEVEL CONTROL VALVE; SWARTWOUT AIR TRAPS; SWARTWOUT ALL SERVICE FEED WATER HEATERS. Swartwout Steel Core Ovens; Swartwout Gas-Oil Burners.

Swartwout Rotary Ball Bearing Ventilators.

Effective ventilation can be secured only by effective ventilators. "A hole in the roof is not ventilation." The Swartwout actively compels the flow of air. Because of large ball bearing and ample vane, the Swartwout always faces away from the wind. The free power of the breeze as it passes the mouth of the ventilator creates an active and continual suction which pulls out a steady flow of used air from below.

Responding to every change in wind direction, the entire area of the mouth is always efficient. The flow of air, regulated by chain operated dampers, takes only one right angle turn.

The Swartwout ventilator is built of special rust resisting, galvanized metal (or copper on specification) of ample gauge over a framework of sturdy angle iron, galvanized after forming on template and punching. It is suspended on a skeleton of steel channels and angle iron and revolves on large size non-corrosive, frictionless bronze bearings and hard composition balls, placed centrally in a dust-proof housing.

When specified, a full size wired glass top may be substituted for the sloping metal top, affording a combination



TRADE-MARK Registered in U. S. Pat. Off.

ventilator and self-cleaning skylight. Accurate directions for mounting are supplied on each ventilator.

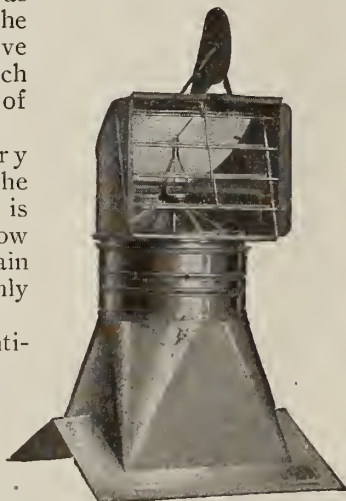
SKYLIGHT TYPE—The illustrations show the Swartwout "Air-Light" ventilator with sloping (self-cleaning) glass top.

Note that no position of ventilator or damper can obstruct the passage of light into the room below.

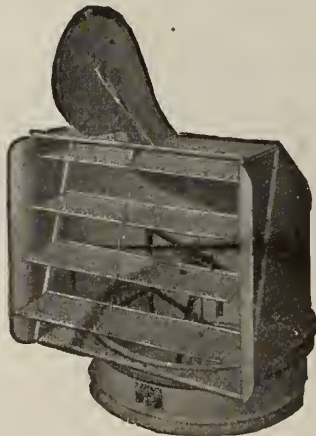
One view also illustrates the type of base recommended and shows both ventilator and base as built in copper, which is furnished when specified.

AIR REQUIREMENTS—In large buildings the number of cubic feet of air required for each person in an hour is as follows:

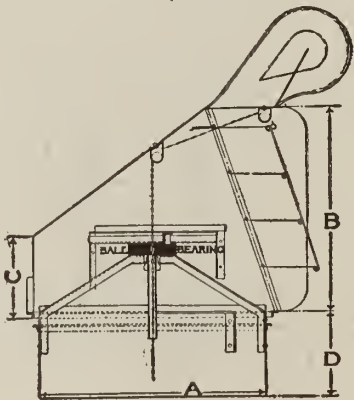
In workshops and barracks, 3000; office rooms, 1800; schools, 2400; hospitals, 3600; churches, theaters, 2000; dining rooms, 1800; toilet and bathrooms, 2400.



SWARTWOUT ROTARY BALL BEARING SKYLIGHT TYPE VENTILATOR WITH BASE



Front View Showing Louvers Open Back View Glass Top Skylight Type
SWARTWOUT ROTARY BALL BEARING VENTILATOR



Section
SWARTWOUT ROTARY BALL BEARING VENTILATORS

A in.	B in.	C in.	D in.	Gauge iron	Weight copper, oz.	Net weight, lbs.	Crated weight, lbs.	*Capacity cu. ft. air per min.	Price	Code word
10	9 1/2	4	5	24	18	15	25	190	\$25.00	Sulceicolle
12	11	4 3/4	5	24	18	20	30	275	25.00	Sulciforme
14	12 1/2	5 1/4	5 1/2	24	18	30	40	370	40.00	Sulcipenne
16	14 3/4	6	5 1/2	24	18	40	50	490	50.00	Sulciman
18	16 1/2	6 3/4	6 1/2	24	18	45	65	650	65.00	Sulfacide
20	18 1/2	7 1/4	6 1/2	24	18	50	70	800	75.00	Sulfatable
24	22	9	6 3/4	24	18	85	115	1100	85.00	Sulfatado
30	27 1/2	11 1/2	9 1/2	22	20	120	165	1700	100.00	Sulfatage
36	33	13 1/2	11	22	24	160	215	2550	150.00	Sulfatamos
42	38 1/2	15 1/2	11 1/4	20	26	225	325	3400	210.00	Sulfataria
48	44	18 1/2	11 1/4	20	26	320	430	4450	240.00	Sulfataron
54	49 1/2	20 1/2	13 3/4	20	28	525	650	5500	350.00	Sulfateur
60	55	22 1/2	15 1/2	20	28	610	735	6850	400.00	Sulfatique
66	60 1/2	24 1/2	16 3/4	20	28	700	825	8250	450.00	Sulfato
72	66	27	16 3/4	20	28	810	960	9850	500.00	Sulfazote

Ship by fast freight.....Inceptor
Ship by express.....Incepting
Quote lowest price f.o.b. factory.....Goorkha
Quote lowest price cost and freight.....Goorder
Quote price f.a.s. New York City.....Gooseberry
How soon can you ship.....Incarnat

Collars two gauges heavier than top. All ventilators are supplied with chain through ventilator with swivel at end. Additional chain furnished at nominal cost. In ordering, only dimension A is required.

*CAPACITY—Figures shown here taken from actual anemometer readings of a ventilator in service under actual conditions (not a laboratory test). The wind velocity was 5 miles per hour, or about one-half average wind velocity of United States, as shown by official government reports. Conditions of test were: Temperature, outside, 30°; inside, 60°. Average wind velocity, 440 ft. per minute, or 5 miles per hour.

SPECIFICATIONS—All ventilators to be of the rotary ball bearing type, glass top [metal top] of galvanized [copper] rust resisting metal, all interior members of angle iron, galvanized after forming and punching. The ventilators to turn sensitively on accurately machined bronze bearings, employing bell metal balls, and counterweighted on outside. The ventilators to be equipped with outside louver dampers to throw accumulated dirt outside of building, louvers to be operated from within by rustproof chains over brass pulleys. Gauge of metal* to be THE OHIO BODY AND BLOWER COMPANY, Cleveland, Ohio, standard, as furnished in Swartwout rotary ball bearing ventilators at regular prices. Top of collar and bottom of hood to be stiffened with galvanized angle iron rings.

* (If desired, give standard gauge for each size, as shown on preceding page.)

ANY OR ALL OF FOLLOWING FEATURES MAILED FREE—Ventilation Data Card—A quick reference for the drafting room and specification man, printed on heavy card 8½ by 11 in. Contains requirement tables, complete base and ventilator specifications, anemometer test figures, capacity tables, etc. Fits letter size file.

"The Gospel of Fresh Air"—A 24-page handbook giving facts on the fresh air needs of every industry, together with capacity tables and specifications.

Specification Index Cards—Containing specifications, dimensions and list prices. 3 by 5 in. and 4 by 6 in.

Swartwout Steam Separators.

Centrifugal force is a certain and powerful separator, and, as applied in Swartwout separators, does not interfere with the pressure or straight through flow of the steam. The steam is given a whirling motion by the helix, and centrifugal force throws the heavy particles of water and oil to the walls of the separator, whence they flow into the large chamber below.

Built in any size for any pressures, Swartwout steam separators give 99% effective separation, and produce commercially dry steam without causing appreciable back pressure.

The illustrations show the types most frequently required.

PRICES, STEAM SEPARATORS

Size pipe, in.	Vertical type	Horizontal type	Size pipe, in.	Vertical type	Horizontal type
1½	\$25.00	\$25.00	5	\$95.00	\$95.00
2	35.00	35.00	6	120.00	120.00
2½	45.00	45.00	7	140.00	140.00
3	50.00	50.00	8	175.00	175.00
3½	60.00	60.00	10	250.00	250.00
4	70.00	70.00	12	300.00	300.00
4½	80.00	80.00			

Discounts on application. For further information see Catalogue No. 117.



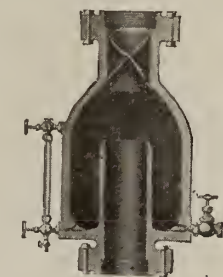
SWARTWOUT VERTICAL ANGLE STEAM SEPARATOR (Patented)



SWARTWOUT RECEIVER TYPE STEAM SEPARATORS (Patented)



SWARTWOUT VERTICAL STEAM SEPARATOR (Patented)

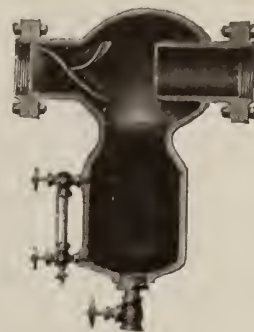


SWARTWOUT HORIZONTAL STEAM SEPARATOR (Patented)



Swartwout Oil Separators.

Applying the same principle of helico-centrifugal force (*it's the whirl that does the trick*) as in the steam separators, Swartwout oil separators are guaranteed to remove the oil from the exhaust steam so thoroughly that as steam or water of condensation it may be used for heating water by direct contact, feeding boilers and the like.



SWARTWOUT HORIZONTAL OIL SEPARATOR (Patented)



12-in. and Smaller



14-in. and Larger

SWARTWOUT VERTICAL UP-CURRENT OIL SEPARATORS (Patented)

PRICES, OIL SEPARATORS

Size pipe, in.	Standard vertical down-current	Special vertical up-current	Standard horizontal
1½	\$35.00	\$38.50	\$35.00
2	45.00	49.50	45.00
2½	50.00	55.00	50.00
3	60.00	66.00	60.00
3½	65.00	71.50	65.00
4	75.00	82.50	75.00
4½	80.00	88.00	80.00
5	90.00	99.00	90.00
6	115.00	126.50	115.00
7	135.00	148.50	135.00
8	165.00	181.50	165.00
9	210.00	231.00	210.00
10	240.00	264.00	240.00
12	280.00	308.00	280.00
14	350.00	385.00	350.00
16	425.00	467.00	425.00
18	500.00	550.00	500.00
20	600.00	660.00	600.00



SWARTWOUT VERTICAL DOWN-CURRENT OIL SEPARATOR (Patented)

Discounts on application. Catalogues on request. Prices do not include water gauge, drip valve, nipple and companion flanges and bolts. These can be furnished at additional cost when requested. Unless ordered otherwise bolt holes of flanges will straddle vertical center line.

Swartwout Air Separators.

Air tools, such as hammers, chippers, drills and hoists, must be supplied with air that is as nearly dry as possible. Water in the air lines will cause trouble by knocking, etc.; while in cold weather the lines may be damaged by water freezing.

The Swartwout helico-centrifugal horizontal air separators will remove all condensation from the air. The air has a straight, unobstructed passage through the separator. There are no baffle plates or angles to reduce the pressure.

The "corkscrew" helix imparts a whirling motion to the air, and the centrifugal force thus set up throws all particles of water to the outside walls of the chamber, where they run down and are collected and drawn off by a Swartwout hydromatic trap. Nothing but dry air leaves the chamber. This application of the centrifugal principle, a natural law, is patented in Swartwout air separators.

Swartwout Hydromatic Trap.

The illustration shows the trap just before discharge.

The rising water fills the bucket, causing left side of bucket to drop to post below. The lever action of the hinged bucket on the pull rod opens the discharge valve wide. Steam pressure empties the bucket and buoyancy then lifts the bucket, closing the valve.

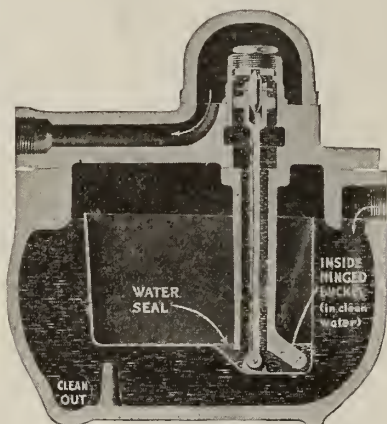
The perfect water seal within the bucket prevents steam from passing over, a patented feature exclusive with this trap. The bucket is hinged on the inside. Scale or sediment in the trap body can not clog the hinge, as the swirl of water thoroughly cleans it at each discharge.

The presence of only two moving parts reduces wear to a minimum. Valve and seat (reversible) are of monel metal. In the higher pressures the valve is double ended. The action of the valve being intermittent, removes all chance of wire-drawing.

The design, construction and materials are such that the Hydromatic can be used at all pressures up to 250 lbs., merely by substituting interchangeable valves and seats.

The Hydromatic is guaranteed to perform up to rated capacity and against defective material or workmanship.

For complete information to be filed, write for Trap Bulletin No. 207 and Steam Specialty Catalogue No. 117 containing full specifications, drawings, installation diagrams of separators, exhaust heads, etc.



SWARTWOUT HYDRAMATIC TRAP
(Patented)

CAPACITIES, WEIGHTS AND PRICES, HYDRAMATIC TRAPS

Size in.	Lin. ft. of 1-in. pipe	Sq. ft. of radiation	Lbs. of water per hour	Weight, lbs.	Price
1/2	9000	3000	1000	35	\$18.00
3/4	15300	5100	1700	60	22.00
1	18000	6000	2000	90	28.00
1 1/4	40500	13500	4500	120	35.00
1 1/2	50400	16800	5600	170	50.00
2	70650	23550	7850	250	70.00
3	124200	41400	13800	435	150.00

All sizes can be fitted with valves and seats suitable for pressures from 0 to 250 lbs. When ordering state the highest operating pressure. If no pressure is specified, traps will be fitted with 150-lb. valves.

Swartwout Air Traps.

Swartwout air traps (patented) are indispensable on air lines supplying pneumatic hoists.

A Swartwout air trap placed at the lowest part of the air line and primed with water will positively collect all condensate and discharge it without loss of pressure. There can be no loss of air, as the bucket float is always buoyant, and after each discharge automatically closes the valve and water seals it.

No sediment can hinder the action of the hinge, as it is washed clean of all sediment by the swirl of the water at each discharge. The valve and seat are of

monel metal and will wear indefinitely. By a simple change of these the trap will work under any pressure up to 250 lbs.

Each trap is fully guaranteed as to material, workmanship and operation.

See steam traps for specifications and prices.

Swartwout Hydromatic Water Level Control Valve.

Maintains a constant water level in open heaters, tanks, vats, reservoirs, etc.

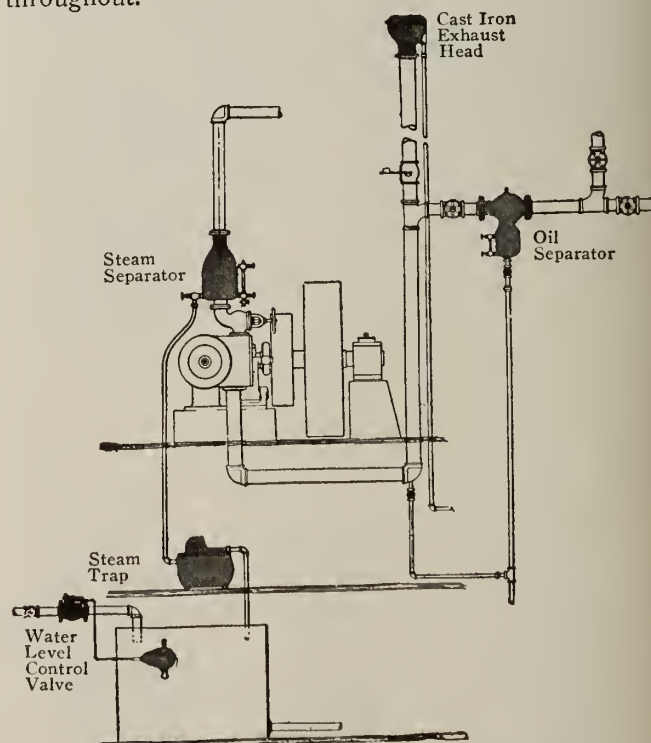
The controlling valve is opened or closed by its pilot valve controlled by its float. There is no mechanical connection between the pilot valve and the main inlet. This allows the pilot valve to be placed in any convenient position. The float, rising or falling with the water, opens or shuts the pilot valve, which in turn causes the water to flow through or back up in the auxiliary pipe running from the main valve to the pilot valve. This opens or shuts the hydromatic valve that controls the main inlet.



SWARTWOUT
HYDRAMATIC
WATER LEVEL
CONTROL VALVE
(Patented)

The water level can not vary more than 1 1/2 in., as that is the full movement of the float between the wide open and closed positions. In actual practice it is usually less than 1 in.

The pilot valve is of extra heavy, solid brass construction, guaranteed against defects in material or workmanship. There are no leather washers or packed joints. The seat is ground in and may be easily reseated when worn. The float is of the indestructible seamless copper type, making a strictly high grade proposition throughout.



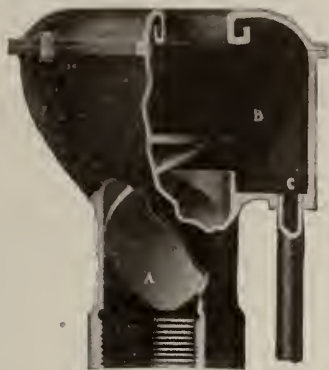
PROPER INSTALLATION OF THE SWARTWOUT VERTICAL STEAM SEPARATOR, HORIZONTAL OIL SEPARATOR, STEAM TRAP, WATER LEVEL CONTROL VALVE AND CAST IRON EXHAUST HEAD

Drip from separator should be carried full size to trap, and drip from exhaust head full size to catchbasin or sewer

Swartwout Cast Iron Exhaust Heads.

The helico-centrifugal principle is also employed in the Swartwout cast iron exhaust head. The whirling motion given the steam throws the heavy water particles to the walls of chamber "B," where they flow out through drip pipe "C." The result is positive separation without back pressure.

Swartwout cast iron exhaust heads will last a lifetime, and are light in weight and ornamental from the architectural viewpoint.



SWARTWOUT CAST IRON EXHAUST HEAD (Patented)

PRICES, CAST IRON EXHAUST HEADS

Size exhaust pipe, in.	List price	Size exhaust pipe, in.	List price	Size exhaust pipe, in.	List price
1	\$20.00	5	\$50.00	20	\$360.00
1 1/2	20.00	6	60.00	22	450.00
2	20.00	7	75.00	24	600.00
2 1/2	25.00	8	90.00	26	700.00
3	25.00	10	125.00	28	800.00
3 1/2	30.00	12	150.00	30	900.00
4	30.00	14	200.00	32	1000.00
4 1/2	40.00	16	250.00	34	1100.00
	40.00	18	300.00	36	1200.00

Discounts on application. Catalogue on request.

NOTE—Sizes 5 in. and smaller are tapped; larger sizes are flanged. Bolt holes of flanges are drilled to straddle center line of drip outlet on sizes 6 in. and larger. Companion flanges and bolts furnished at extra cost when requested.

Drip pipe should be carried full size to catchbasin or sewer.

Swartwout All Service Feed Water Heaters.

Designed by a man who has devoted his life to the study and designing of open feed water heaters, the Swartwout feed water heater is the result of a lifetime of specialized endeavor.

It has a higher standard of efficiency and economy than ever before attained in a feed water heater. It has many features never before thought possible.

The steam enters the heater through a Swartwout Helix oil separator (patented) which imparts a whirling motion to the steam, throwing all oil and condensate against the walls of the separator, where they collect and run down to the trap and thence to the waste pipe. After purification of the steam it enters the body of the heater, where it is deflected downward, passing through and under the trays, completely filling the chamber.

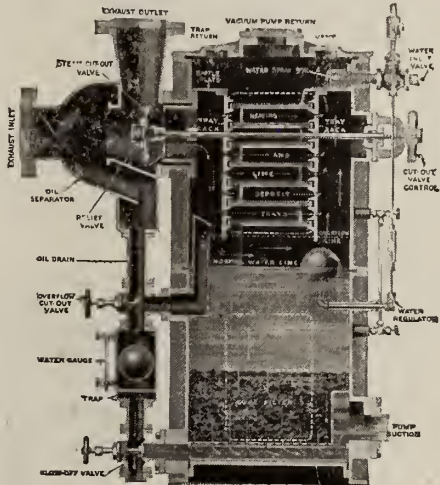
The steam opening into the heating chamber is provided with a cut-out valve of the floating ball type. This valve is opened and closed from the opposite side of the heater. The overflow is also provided with a cut-out valve which, together with the main steam cut-out valve, enables the operator to cut the heater out of service at any time for cleaning or inspection without stopping the engine or in any way interfering with the plant.

The fresh water is controlled by a balanced valve, actuated by means of a self-draining float, which keeps the water at the proper level at all times.

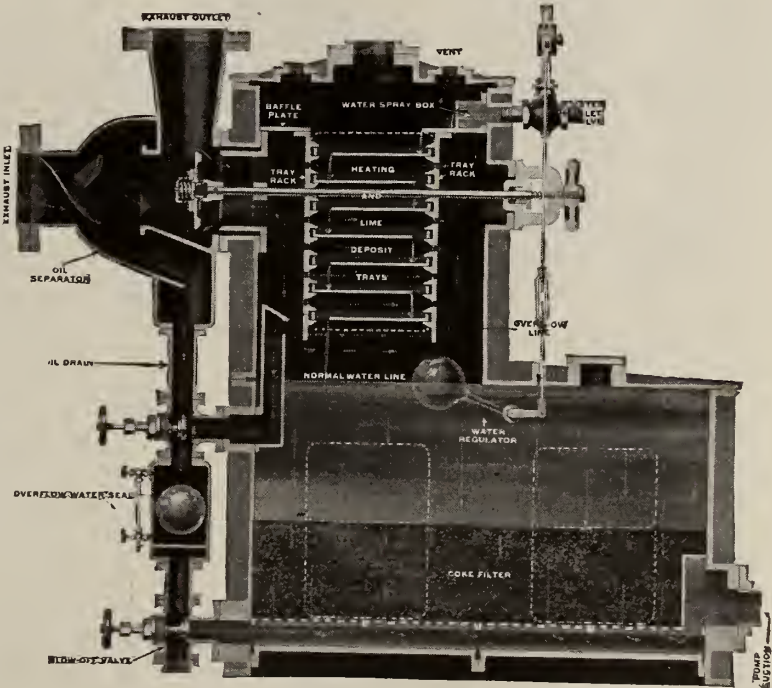
Any excess of water entering the heater, from drips, condensate or leaky valves, will cause the water level to rise to the overflow box, overflow to the trap and thence to the waste pipe.

The Swartwout feed water heater is peculiarly adapted to the present conditions of continuous plant expansion. It is built like a sectional bookcase and sections can be added from time to time as the power plant grows. It is not necessary to buy a heater that is too big now, to take care of any possible growth. Neither is it necessary to scrap the heater every time a new boiler is bought.

Write today for a detailed description of the heater which "grows with your plant." It is mighty interesting reading.



Style A Two Units



Style A Three Units

SWARTWOUT ALL SERVICE FEED WATER HEATER
Built like a sectional bookcase, it grows with the plant

ROHRMAN-COOPER CO., INC.

Manufacturers of Roof Ventilators

TELEPHONE:
RANDOLPH 2378

Marquette Building
CHICAGO, ILL.

Product.

PYRAMID ROOF VENTILATOR.

Adaptability.

The Pyramid is a siphon ventilator especially adapted to all structures where humans are housed or gather, such as factories and commercial buildings, state or county institutions, churches, halls, or schools. Barns also should be ventilated with Pyramid ventilators.

Description and Advantages.

The Pyramid ventilator will exhaust the maximum quantity of foul or warm air, smoke fumes, gases or vapor from within and makes down-drafts from without impossible. Condensation from steam is exhausted the same as air. The ventilator is so constructed as to make it proof against snow, ice or rain collecting or adhering to any part. Screens prevent the nesting of birds.

It is free from rough edges and flat, exposed surfaces. No solder is used except where necessary to close up airholes.

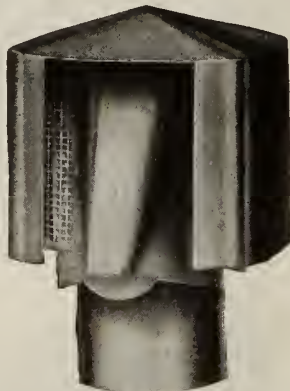
It is extremely artistic in appearance and entirely fireproof.

The Pyramid ventilator contains no movable parts to rattle and groan; it is absolutely silent. No upkeep is necessary. First cost is last cost.

Construction.

The Pyramid ventilator is made by skilled workmen in a union shop, and pure ingot or Toncan metal is the only material used, except when made of copper. No Pyramid ventilators are made of the cheaper metal known as galvanized steel. They are not intended as temporary makeshifts, but are built to last a lifetime.

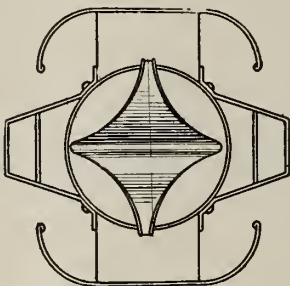
Two distinctive and scientific features of Pyramid ventilator are the inner deflector and four openings, two



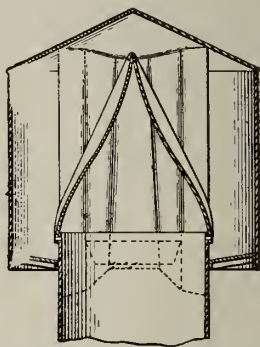
PYRAMID VENTILATOR
Patented Feb. 11, 1919

on each side of the siphon. These relieve pressure in case of a storm, and whichever way the wind may blow—down, up, either side, or corner—it forms an intense suction inside of the ventilator.

The deflector answers two purposes: first, prevents down-drafts; second, will discharge condensation from steam in a similar manner to which the foul air is discharged. No condensation of steam can leak back through the stem of the ventilator.



PLAN VIEW SHOWING
FORMATION OF PARTS
INCLUDING INNER
DEFLECTOR



INNER DEFLECTOR IN-
STALLED IN VEN-
TILATOR

A Notable Test.

The following test was made of two ventilators installed on the same building at Great Lakes, Ill. It was conducted by Prof. A. H. Anderson, under the direction of Mr. G. F. Gebhardt, Mechanical Engineer of Armour Institute, a recognized authority.

In the test, Specimen "A" was a well-known ventilator, not a Pyramid. Specimen "B" was the regular Pyramid ventilator.

Diameter at base of ventilator, 18 in.; area, 1.8 sq. ft. Temperature inside and outside, 70°.

Wind, ft. per min.	Wind, miles per hr.	Air vel. in ventilator, ft. per min. (due to aspiration)	Ratio ventilator vel. to wind vel.	Air vel. added to allow for 50° temp. diff.	Total air vel., ft. per min.	Cu. ft. per hr.
A 700	7.91	232	33%	247	479	51,730
B 740	8.36	267	36%	247	514	55,512
A 420	4.74	184	44%	247	431	46,548
B 590	6.66	253	43%	247	500	54,000

SIMULTANEOUS TEST—Air velocity in ventilator, feet per minute, due to aspiration:

A	122.0
B	142.5

Wind velocity not determined in the simultaneous test. Temperature, 70°.

This column computed from an assumed temperature difference of 50°.

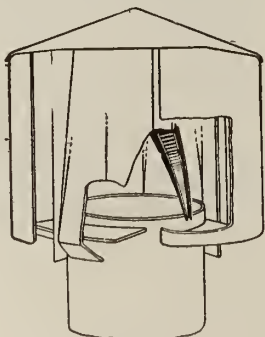
G. F. Gebhardt & Co.
Engineers.

A. H. Anderson,
Testing Engineer.

NOTE—The original report of this test is on file in our office and will be submitted upon application to any architect or engineer interested.



THE INNER
DEFLECTOR



ELEVATION OF VENTI-
LATOR
Note through broken lines
the inner deflector

ROYAL VENTILATOR COMPANY

412 Locust Street
PHILADELPHIA, PA.

Products.

Manufacturers of "ROYAL" VENTILATORS of Galvanized Steel, Pure Iron, Copper, etc.

Glass Top Ventilators; Rectangular and Square Ventilators with fire retarding dampers; Smoke Jack and Combination Ventilators; Insectproof and Bird-proof Ventilators.

Double Cone Ventilators.

The double cone is designed to withdraw smoke, fumes, and impure air without any resistance being offered to the outward flow. The lower cone is placed directly in the center of ascending air, which, upon striking it, is deflected directly upward and outward. There are no obstructions. Only an upward draft is obtained. The "Royal" ventilates continuously, regardless of wind or temperature conditions. The tapered frustums force outside air currents over top and down sides, providing a constant strong upward draft.

Construction.

If the construction of the "Royal" ventilator is examined critically, the "Royal" will be specified.

The double cone has two thicknesses of metal, doubling the life of the ventilator. Every known mechanical improvement is embodied in the "Royal"; all sections are built with lapped seams, giving three thicknesses of metal at joints; all edges are wired for rigidity and weather resistance; all bracing is accomplished with malleable iron stays, so arranged as not to impede passage of air. Absolutely weatherproof.

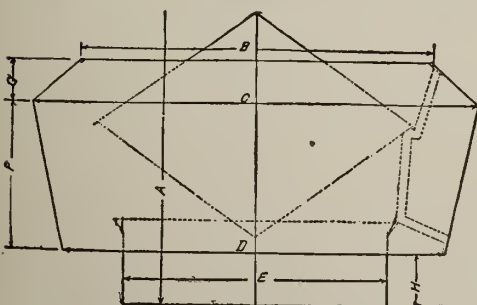
The "Royal" is especially adapted for foundries and chemical plants.

Specification.

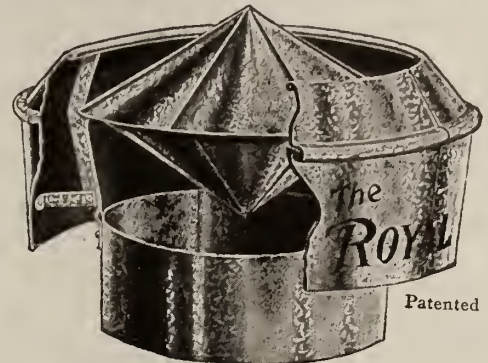
"Furnish and erect Royal Double Cone (Glass Top) Ventilators, manufactured by ROYAL VENTILATOR COMPANY, Philadelphia, Pa."



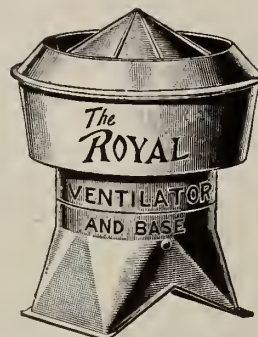
RECTANGULAR "ROYAL" VENTILATOR
Metal or glass top. Made to any size



SECTIONAL DRAWING "ROYAL" DOUBLE
CONE VENTILATOR
Send for catalogue and model



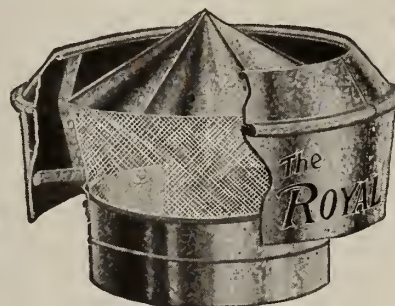
"ROYAL" DOUBLE CONE VENTILATOR



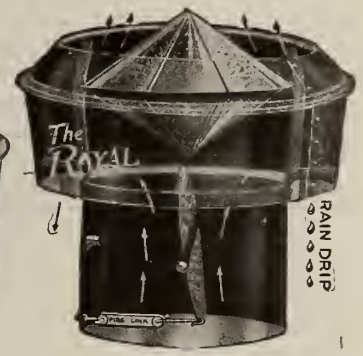
BASES MADE TO FIT ANY
TYPE OF ROOF



"ROYAL" GLASS TOP
VENTILATOR
Gives more light and ventilation



INSECTPROOF VENTILATOR
For hospitals, barns, powder mills, etc.



"ROYAL" VENTILATOR
With fire damper

DATA WITH REFERENCE TO SECTIONAL DRAWING

Size, in.	A	B	C	D	E	F	G	H	Area, sq. in.	Gage of iron	Ounces of copper	List price	Cu. ft. exhaust per minute, wind 7 miles
10	12	13	16	14	10	5	2	3	78	24	16	\$5.75	141
12	13	15	19	16	12	6	2	3	113	24	16	6.75	159
16	17	20	26	23	16	8	3	3	201	24	16	20.00	388
18	18	23	29	26	18	8	3	3	255	24	16	27.00	490
20	21	25	31	28	20	10	4	5	314	24	16	33.00	606
22	24	26	34	32	22	11	4	5	380	24	16	36.00	729
24	24	30	39	34	24	11	5	5	453	22	16	40.00	874
26	24	33	42	36	26	13	4	3	527	22	16	50.00	1005
28	26	35	45	40	28	13	5	3	615	20	16	56.00	1186
30	26	35	45	41	30	14	5	4	707	20	18	65.00	1364
32	25	37	47	44	32	14	5	4	804	20	18	80.00	1551
34	28	40	50	48	34	15	5	4	908	20	18	100.00	1765
36	28	44	56	51	36	15	6	4	1017	20	18	120.00	1961
40	34	47	61	55	40	16	7	5	1257	18 and 20	18	180.00	2424
42	32	52	68	63	42	17	7	3	1386	18 and 20	18	190.00	2673
44	35	54	70	64	44	18	7	5	1620	18 and 20	18	200.00	3124
48	39	59	75	70	48	19	8	4	1809	18 and 20	20	240.00	3489
54	42	68	84	77	54	22	9	4	2390	18 and 20	20	300.00	5414
60	47	76	94	82	60	23	8	8	2807	18	24	360.00	6665
66	52	81	103	94	66	26	9	6	3504	18	24	420.00	7851
72	50	86	108	98	72	26	10	6	4071	18	24	480.00	10682

F. O. SCHOEDINGER

Manufacturer of Rotary Suction Ventilators

COLUMBUS, OHIO

Products.

SCHOEDINGER'S ROTARY SUCTION BALL BEARING VENTILATORS.

"Columbus" Stationary Ventilators, Puttyless Skylights, Underwriter's Tin Clad Fire Doors.

Also sole manufacturer of Schoedinger's Universal Lock Joint Metal Ceilings and Kinnear and Gager's Quad Lock Metal Ceilings.

Description.

Schoedinger's rotary suction ventilator is rigidly constructed from galvanized steel, ingot iron, Toncan metal or copper, supported by an adequate framework of rust resisting steel and malleable iron. It is equipped with high grade, high speed hardened steel ball bearings, which are immersed in heavy acid resisting lubricant, fully weatherproofed and easily accessible.

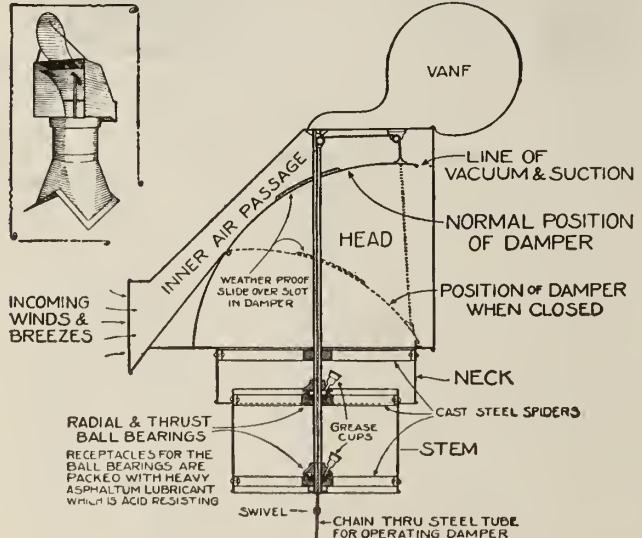
Operation.

Schoedinger's rotary suction ventilator contains the inner air passage through which the passing winds and breezes blow with accelerated force, unhampered by conflicting cross currents, causing a pronounced vacuum in the head of the ventilator. The head of the ventilator is much larger than the stem, allowing the rising foul air to spread out along the horizontal line of the diaphragm, where it is caught by the suction of the swiftly moving air currents discharging from the passage above and carried out.

The diaphragm consists of one smooth, curved galvanized sheet, which greatly assists in the free passage of the air, especially at low wind velocities.

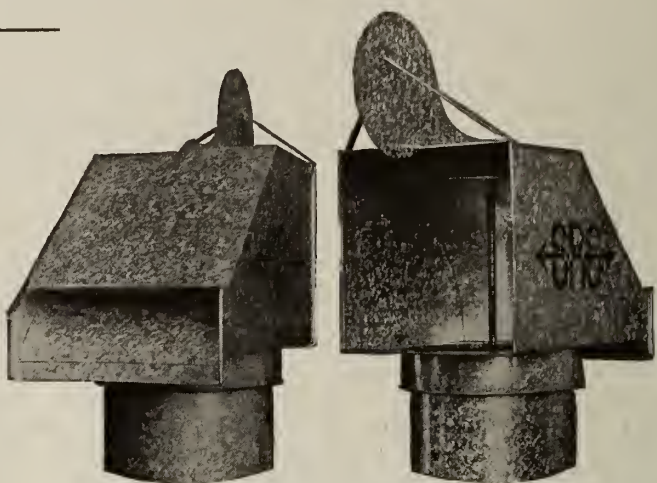
The ample vane always holds the mouth of the ventilator away from the wind, making same proof against weather, rain, storm and down-drafts.

As no mechanical power is used, no operating expense results.



(PATENT PENDING)

SECTION SHOWING NEW DAMPER IN THE HEAD OF SCHOEDINGER'S ROTARY SUCTION VENTILATOR



SCHOEDINGER'S ROTARY SUCTION VENTILATOR (Patent pending)

Official Test.

Official test of Schoedinger's rotary suction ventilators made at the mechanical Engineering Laboratories of The Ohio State University:

Wind velocity miles per hour.....		5	10	15		
Velocity of air through ventilator, ft. per min...		538	632	726		
Cubic feet of air discharged					Gauge metal	Crated weight, lbs.
Size of Ventilator	10"	per min. 294	345	397	26	50
		per hour 17,640	20,700	23,820		
	12"	per min. 423	497	571	26	60
		per hour 25,380	29,820	34,260		
	14"	per min. 575	674	774	26	70
		per hour 34,200	40,440	46,440		
	16"	per min. 752	880	1,013	26	85
		per hour 45,120	52,800	60,780		
	18"	per min. 950	1,117	1,283	24	100
		per hour 57,000	67,020	76,980		
	20"	per min. 1,173	1,380	1,585	24	130
		per hour 70,380	85,800	95,100		
	24"	per min. 1,690	1,985	2,280	24	170
		per hour 101,400	119,100	136,800		
	30"	per min. 2,640	3,100	3,570	22	250
		per hour 158,400	186,000	214,200		
	36"	per min. 3,810	4,470	5,130	22	320
		per hour 228,600	268,200	309,800		
	42"	per min. 5,170	6,080	6,990	20	380
		per hour 310,200	364,800	419,400		
	48"	per min. 6,750	7,920	9,120	20	550
		per hour 405,000	475,200	547,200		
	54"	per min. 8,550	10,030	11,550	20	640
		per hour 513,000	601,800	693,000		
	60"	per min. 10,570	12,400	14,270	20	810
		per hour 634,200	744,000	856,200		
	66"	per min. 12,800	15,000	17,280	20	1000
		per hour 768,000	900,000	1,036,800		
	72"	per min. 15,230	17,880	20,550	20	1180
		per hour 913,800	1,072,800	1,233,000		

[Signed] F. W. MARQUIS,

Professor of Steam Engineering, The Ohio State University. June 9, 1917.

B. F. STURTEVANT COMPANY
AUTOFORCE VENTILATOR DEPARTMENT
HYDE PARK, BOSTON, MASS.

FOR LIST OF BRANCH OFFICES SEE PAGE 985
REPRESENTATIVES EVERYWHERE

Product.

AUTOFORCE VENTILATOR.
For Heating and Ventilating Apparatus, see pages 985-1003.

Patents.

This company holds the following patents in connection with ventilators: 634215 Oct. 3, 1899; 697125 Apr. 8, 1902; 702581 June 17, 1902.

Uses.

Autoforce ventilators are of special value in factories, foundries, theaters, hotels, churches, schools, residences, stables, garages, mills, tanneries, kitchens, etc.

Description and Advantages.

The Autoforce ventilator is superior to any other natural ventilator as it effectively utilizes the force of the wind to create a suction, which suction always pulls inside air through ventilator to the outside. Ventilators are built of galvanized iron, but can also be furnished of Toncan metal or of copper. Butterfly dampers with a fusible link designed to meet fire insurance requirements can be furnished as an extra. All ventilators have eyes riveted to sides, so that guy wires furnished by others may be readily attached.

If Autoforce air pumps are used, fewer of them will be required to perform the work than with other types of ventilators.



AUTOFORCE VENTILATOR

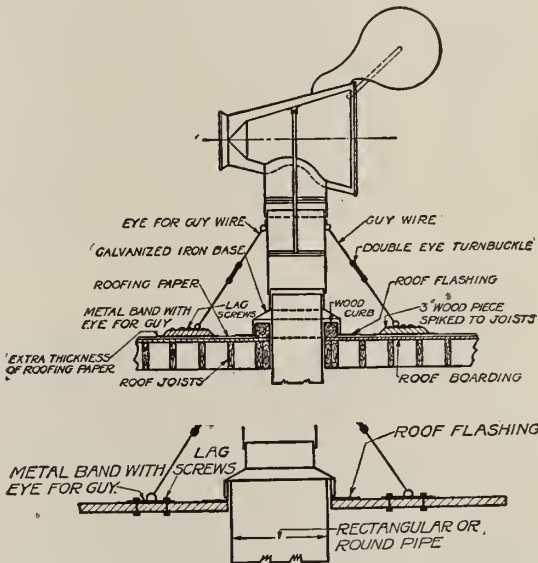
Specifications.

Specifications should read as follows:

The natural draft ventilation shall be... No...Autoforce, made by the B. F. STURTEVANT COMPANY, each ventilator to remove....cu. ft. air per hour.

Installation.

Erect plumb and firm, and guy in four directions with double galvanized iron wires, taking up the slack in each with a double eye turnbuckle.



SECTIONS OF AUTOFORCE VENTILATOR GIVING METHOD OF ANCHORING TO BOTH WOOD AND CONCRETE ROOFS

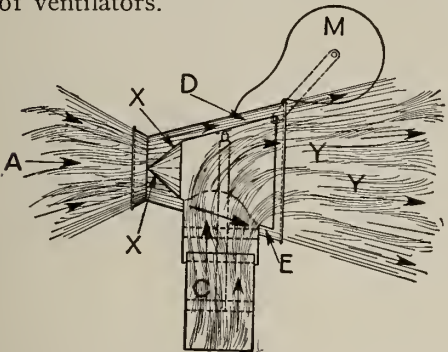
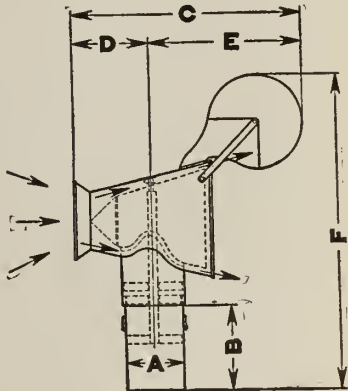


DIAGRAM SHOWING ACTION OF VENTILATOR

DIMENSIONS, AUTOFORCE VENTILATORS

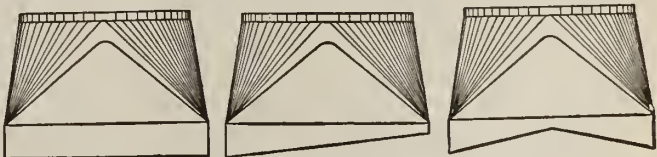
No.	Weight lbs., not packed	All dimensions are in inches						Cu. ft. of air displaced per hour with wind vel. 8 miles per hour
		A	B	C	D	E	F	
4	6	4	5	15	5 1/2	9 1/2	22	5,000
6	16	6	7	22 1/2	8	14 1/2	30	11,300
8	30	8	8 1/2	30	10 3/4	19 3/4	39	20,100
10	40	10	10	37 1/2	13 1/2	24	46	31,400
12	52	12	12	45	16 1/2	28 1/2	54	45,200
14	85	14	14	52 1/2	19	33 1/2	63	61,500
16	114	16	16	60	21 1/2	38 1/2	71	75,900
18	173	18	18	67 1/2	24	43 1/2	80	90,700
20	240	20	20	75	26 1/2	48 1/2	90	101,700
24	315	24	24	90	32 1/2	57 1/2	106	156,000
30	512	30	30	112 1/2	40	72 1/2	132	300,000



DIMENSION DIAGRAM

Air entering at A is spread out by nose of inner cone X; since the ring of air emerges at increased speed, it tends to decrease pressure in front of exit YY; suction thus created draws air up connecting flue C; tailpiece M keeps pump at all times headed to wind, so that continuous satisfactory operation is secured.

Note that operation is on same successful principle as the steam injector or Hancock inspirator.



STANDARD BASES FOR AUTOFORCE VENTILATORS
Order specially, if desired

ALIGNUM FIREPROOF PRODUCTS COMPANY, INC.

Manufacturers of Fireproof Doors and Other Fireproof Products

356 Lexington Avenue

NEW YORK, N. Y.

BRANCH OFFICES

PHILADELPHIA, PA., Real Estate Trust Building
DETROIT, MICH., Builders & Traders Exchange.

BOSTON, MASS., 181 Congress Street
CHICAGO, ILL., Building Material Exhibit

FACTORY: SOUTH RIVER, N. J.

Products.

STEEL CLAD ALIGNUM FIRE DOORS.
All-Alignum Fireproof Doors.

Description of Alignum and Its Advantages.

Alignum is manufactured from fireproof mineral components, principally of asbestos, amalgamated under hydraulic pressure.

It is strong, yet resilient. It is an insulator of heat and sound; is not subject to decay; does not swell, shrink, warp, nor check, and is not friable.

There is no deteriorating action between aliumin and steel, nor is there any corrosion of steel surfaces bonded to aliumin in process of manufacture, not even when exposed to high humidity for long periods.

Alignment has been approved by the Department of Buildings of New York and the Underwriters' Laboratories, Inc.

Alignum Fire Doors.

Alignum fire doors are lighter than 3-ply tin clad doors. Alignum has a tensile strength of about 1300 lbs. per sq. in. For greater strength, it is reinforced with wire mesh.

ANGLE TYPE FIRE WALL DOOR—Shown in illustration to left and is labelled by the Underwriters' Laboratories, Inc. for all types of openings up to 120 sq. ft. of area. It is particularly well adapted for use in fire walls, elevator shafts and other openings where heavy traffic is likely to occur, on account of its great strength and durability.

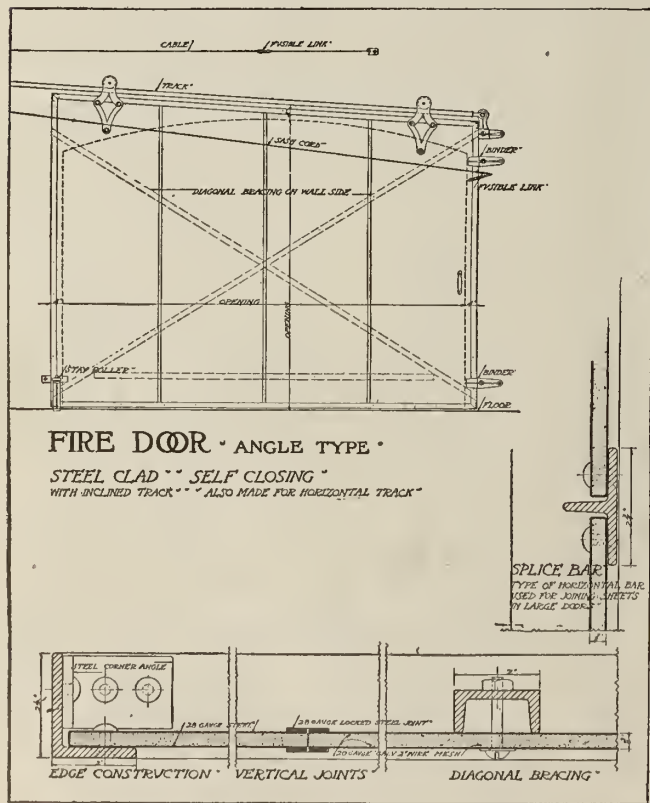
PANEL TYPE FIRE WALL DOOR—Shown in illustration below and is labelled by the Underwriters' Laboratories, Inc. for all types of openings up to 80 sq. ft. of area. This door is strongly recommended for use in all stairways, penthouses, and other openings of this type in industrial buildings.

FINISH—Unless otherwise specified, doors will be furnished with one shop coat of paint.

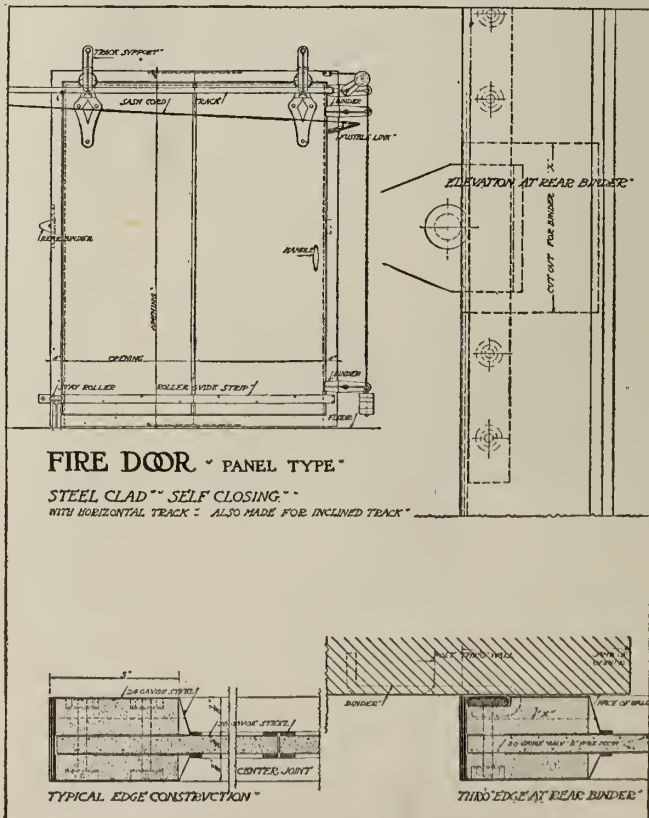
HARDWARE—Any standard hardware for 3-ply tin clad fire doors can be applied to Alignum fire doors.

Exhibition of Samples.

Samples of Alignum fire doors are on exhibition with the Architects' Sample Corporation, 101 Park Avenue, New York, N. Y., and at the Laboratories of Investigating Committee of Architects and Engineers, Plainfield, N. J.



CONSTRUCTION DETAILS OF ANGLE TYPE FIRE DOOR



CONSTRUCTION DETAILS OF PANEL TYPE FIRE DOOR

CORNELL IRON WORKS

Manufacturers of Rolling Steel Shutters and Doors

TELEPHONES:

CHELSEA { 1423, 1424
550

26th Street and 11th Avenue
NEW YORK, N. Y.

Products.

ROLLING STEEL SHUTTERS and DOORS, Hand Chain and Motor Operated, for residences, office buildings, garages, wharves and piers, warehouses, elevator shafts, store fronts and buildings of all kinds.

Description.

Material consists of deep, corrugated, strong and stiff continuous sheets of flexible open hearth steel. Edges reinforced with malleable shields to take up wear in the side guides. Construction of steel throughout. Send for catalogue.

Operation.

There are three typical methods of operation:

SELF-COILING TYPE—Standard for openings up to 8 ft. wide. Push up and pull down by hand. The quickest acting construction possible.

HAND CHAIN AND GEARING TYPE—Standard for openings of over 100 sq. ft. Shaft revolved by endless hand chain acting through single or compound gears.

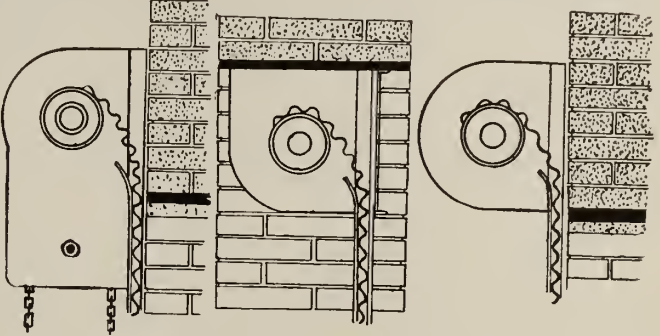
AUTOMATIC CLOSING TYPE—Controlled by fusible link melting at 150° Fahr.

SPECIAL CASES—Motor, worm and bevel gear drive are also used in special cases.

Advantages.

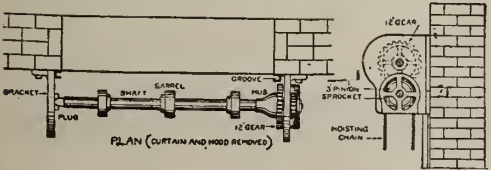
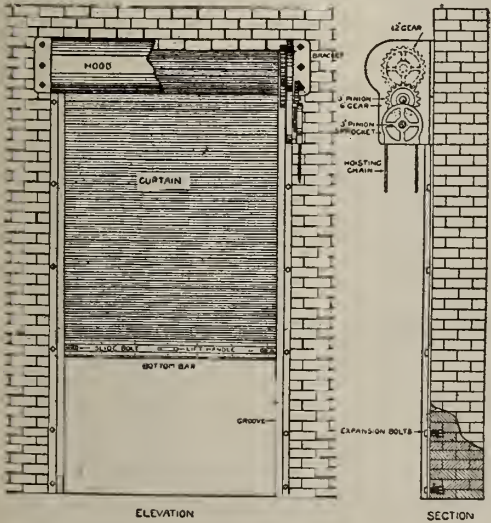
Cornell doors present to smoke and flame a continuous-sheet of deep corrugated steel. By use of a special die the rigidity of the sheets is increased

about 26 times; all parts are reached by the painter's brush, no points or slats to invite corrosion. Repairs, due to accidents, can be made with great convenience. Installations of 40 years and more speak for the wearing qualities of shutters made by this company.



TYPES OF ROLLING STEEL SHUTTERS AND DOORS

Height of opening, ft.	8	10	12	14	16	18	20	22	24
Diameter of coil, in.	12	13	14	15	16	17	18	19	20



DETAILS OF CONSTRUCTION OF CORNELL ROLLING STEEL DOORS



MOTOR DRIVEN DOORS, 60 x 40 FT., WITH AUTOMATIC STOPS
Designed and erected by CORNELL IRON WORKS

GEO. W. JOHNSON MFG. CO.

Manufacturers of Standard Underwriters' Labeled Automatic Fire Doors

1210-1212 South Eighth Street
ST. LOUIS, MO.

209-211 West 17th Street
KANSAS CITY, MO.

Products.

STEEL ROLLING DOORS and SHUTTERS; COUNTER-BALANCED TRUCKOVER ELEVATOR DOORS.

Also, Automatic Tin Clad Sliding Fire Doors, Tin Clad Hinged Fire Doors and Shutters, Dufold Doors, Boiler Plate Doors and Shutters, Wood Rolling Partitions, Iron Stairs and Fire Escapes.

Steel Coil Doors.

Steel coil doors provide protection for openings of any size; occupy the minimum amount of space and have a smooth finished appearance from either side of the wall.

The Johnson doors are made of flexible corrugated steel, galvanized. The corrugations are short and deep, giving the maximum resistive power against wind pressure.

No. 100, PUSH UP—Spring counterbalanced, operated by hand. For nominal openings.

No. 100A—Spring counterbalanced, automatic closing. For nominal openings.

No. 110, CHAIN HOIST—Spring counterbalanced, operated by means of endless chain. For large openings. This type is fitted with roller bearings when desired.



NO. 110 STEEL COIL DOOR INSTALLED ON TRACK OPENING

SPECIAL FEATURES—The Johnson automatic attachments with two fuse links, one placed at the ceiling line, are superior to the old style attachments with link only at the opening.

Experience has demonstrated that ceiling link released doors where fire occurred, and in many cases the link at the opening was still intact when fire was extinguished.

Elevator Truckover Doors.

The most practical freight elevator door on the market. Serves the purpose of a fire door and elevator safety gate combined, cutting off draft at each floor.

The patented trucking bar is pivoted and conforms to location of elevator platform. If same is below sill level, this bar automatically adjusts itself to the proper angle, giving a smooth surface for trucks, even with small wheels, to pass over without jar or damage to contents.

Another important feature is the interlocking guides, which prevent danger of heavily loaded trucks striking door from room side when closed and forcing same out of guides. Such accidents have occurred when doors were equipped with only plain guides, resulting in contents of truck falling into shaft.

Doors are substantially made and are durable. No weights or springs are required, as one door counterbalances the other with simple and perfect mechanical operation.

Doors work easily, and can be equipped with safety attachments.

Write for more particulars and details.



ELEVATOR TRUCKOVER DOOR

PENN METAL COMPANY

Manufacturers of Fireproofing Specialties

65 Franklin Street
BOSTON, MASS.

JERSEY CITY, N. J., Corner of First
and Washington Streets

PORTLAND, ME., 95 Exchange Street

PHILADELPHIA, PA., 25th and Whar-
ton Streets

EXPORT OFFICE, 26 Cortlandt Street, NEW YORK, N. Y.

Products.

PENCO HOLLOW METAL DOORS, HOLLOW METAL WINDOWS, METAL SHELVING, KALAMEIN DOORS, TIN CLAD FIRE DOORS.

Penco Expanded Metal Lath; Sheet Lath; Metal Studs; Metal Corner Bead; Metal Ceilings; Metal Siding; Metal Shingles and Roofing; Metal Culverts and Flumes; Metal Buildings; Kornerite, a plaster base for internal angles; Metal Ship Partitions and Bulkheads; Metal Deck Plates and Treads; Stair Risers; Metal Boxes.



TRADE-MARK

It is perfectly rigid. It will hold "limit to capacity" loads without buckling or warping. All fancy trimmings or extra unnecessary parts are eliminated.

Simplicity of construction allows it to be easily adjusted or expanded indefinitely at a most reasonable cost.

Penco shelving will fit any space, and can be used for open shelving, or equipped with back panels. Can be made with partitions and fronts for enclosed shelving purposes, or bins.

Prompt shipment from Boston.

Penco Hollow Metal Doors.

Formed of steel or genuine Hampton metal.

Designed to serve under the most exacting conditions. Simplicity of construction is the foremost consideration, next to quality. Installation of a Penco door is simplified by the elimination of all unnecessary units.

Penco Hollow Metal Windows.

Formed of galvanized steel or genuine Hampton metal.

Officially approved by the National Board of Fire Underwriters.

Guaranteed architecturally correct. In design, mechanical perfection, workmanship and quality, they represent the best that over 50 years of service can make them, with these exclusive features:

No screws, bolts or fasteners are exposed to the weather.

Installation or repair of any one part does not necessitate removal of the entire window, or any part of it, for each member is independent.

These utilitarian features of Penco hollow metal windows recommend them where eventual economy is desired.

Made double hung, pivoted, or any standard or special types to fit any size opening.

Penco Metal Shelving.

Formed in all standard and special sizes from Nos. 14 to 20 gage special annealed sheets.

Co-operative Service and Catalogue.

A special department, under the supervision of a construction expert, is maintained for the purpose of figuring requirements or drafting suggestions, in consultation with engineers.

Catalogue containing full description of Penco products sent on request.

Partial List of Installations.

Buckley Storage Warehouse, 690 Dudley Street, Boston, Mass., 152 openings of door frames

Bay State Storage Warehouse, Springfield, Mass., 311 openings of doors and frames

Bay State Storage Warehouse, Lowell, Mass., 165 openings of doors and frames; C. H. Blackall, Architect

Metropolitan Storage Warehouse, Cambridge, Mass., 467 openings of doors; Peabody & Stearns, Architects

United Candy Co., Boston, Mass., 167 openings of doors; Haven & Hoyt, Architects

Lang Building, Haverhill, Mass., 108 openings of doors and frames

Gates Lane Car Barn, Worcester, Mass., door openings 16 by 44 ft.; Fuller & Delano, Architects

Whiting-Adams Brush Factory, Boston, Mass., doors and frames; Guy Lowell, Architect

Cambridge Theater, Cambridge, Mass., doors and frames; Charles R. Greco, Architect



PENCO KALAMEIN DOOR



PENCO TIN CLAD FIRE DOOR

THE KINNEAR MANUFACTURING CO.

Steel and Wood Rolling Doors, Shutters and Partitions

COLUMBUS, OHIO

BRANCH OFFICES

BOSTON, MASS., 85 Water Street
PHILADELPHIA, PA., Wesley Building, 17th and Arch Streets
INDIANAPOLIS, IND., 917 State Life Building

CHICAGO, ILL., 1860 C. & C. Bank Building
CLEVELAND, OHIO, 409 Union Building
DETROIT, MICH., 709 Ford Building

AGENCIES

NEW YORK, N. Y.
CINCINNATI, OHIO
DENVER, COLO.
ROCHESTER, N. Y.

ST. LOUIS, MO.
LOS ANGELES, CAL.
NEW ORLEANS, LA.
PITTSBURGH, PA.

ATLANTA, GA.
SPOKANE, WASH.
MEMPHIS, TENN.
SEATTLE, WASH.

SAN FRANCISCO, CAL.
VANCOUVER, B. C.
WINNIPEG, CANADA
MONTREAL, CANADA

Products.

STEEL ROLLING DOORS and SHUTTERS; WOOD ROLLING DOORS and PARTITIONS; BIFOLDING DOORS; VERTICAL SLIDING SECTIONAL DOORS; SLIDING FIRE DOORS.

Kinnear Construction.

In Kinnear steel rolling doors and shutters, the curtains are made of open hearth interlocking steel slats, with malleable iron endlocks. Curtain is coiled upon barrel journalled in cast iron brackets, and travels in steel guides at the sides; it is counterbalanced by helical springs, enclosed in barrel. A steel galvanized hood encloses the coil and protects it from the weather.

Wood rolling doors and partitions are made of hard pine, cypress, oak or birch, with ribbons of phosphor bronze.

Folding and vertical sliding doors are constructed either in wood or steel, or wood frame covered with steel.

Fire Protection.

Steel rolling doors and shutters are valuable fire retardants for the protection of openings in fire walls, vertical shafts and exterior window and door exposures.

Special fire door types bearing the names of "Akbar," "Acme," "Atlas" and "Superior" are constructed under the supervision of the Underwriters' Laboratories, Inc., and are inspected and labeled by their representative at the factory.

Installation of Rolling Doors.

Two forms of installation are generally used in mounting steel rolling doors and shutters:

FIRST—On face of wall; the coil brackets are placed above the bottom of lintel and the guides at the sides of the opening.

SECOND—Mounted in the opening; the coil and brackets are placed under the lintel and the guides on the jambs.

ERECTING—Any good mechanic can erect our material.

Blue prints and instructions accompany every shipment showing application and method of erection.

Installation of Folding and Sliding Doors.

These are mounted upon face of wall, either interior or exterior.

Operation.

Three methods of operation are employed:

MANUAL—By means of handle in bottom of curtain.

MECHANICAL—By means of endless chain, sprocket and gear; or crank, shafting and gear.

POWER—By means of electric motors.

Co-operative Service.

The following pages illustrate but a few of the many constructions we are prepared to furnish.

Catalogues Nos. 51, 52 and 53, showing complete line, furnished on application.

We are constantly making improvements, having a department devoted exclusively to developments and designing. Special designs submitted to cover unusual conditions.



Pennsylvania R.R. Steel Foundry, Altoona, Pa.



Pennsylvania Grain Elevator, Girard Point

INSTALLATIONS OF KINNEAR STEEL ROLLING DOORS



Elevation



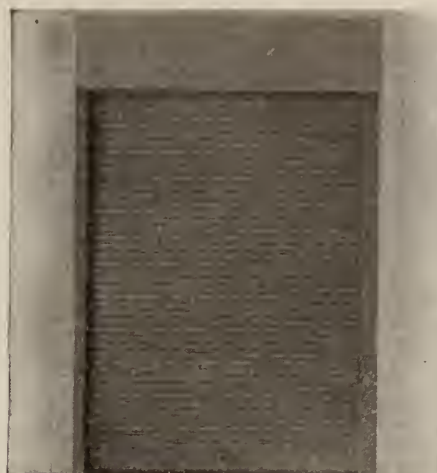
Vertical Section



Cross Section

CONSTRUCTION NO. F. M. 10

Mounted on face of wall; counterbalanced by springs. Operated manually by handle in bottom bar of curtain. When door is placed on exterior face of wall, hood is inclined to shed water



Elevation



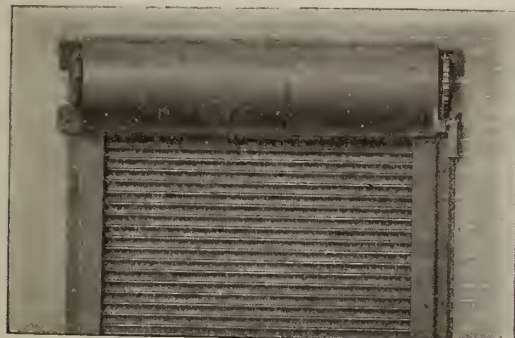
Vertical Section



Cross Section

CONSTRUCTION NO. B. M. 10

Mounted in opening; counterbalanced by springs. Manually operated by handle in bottom bar of curtain. Hoods can be paneled to meet special requirements



Elevation



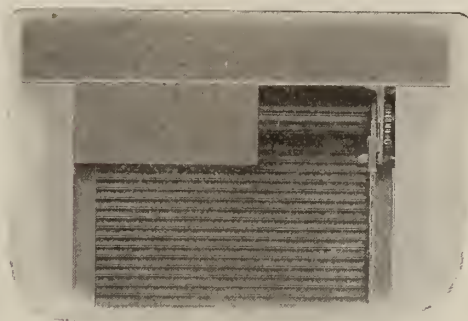
End View



Cross Section

CONSTRUCTION NO. F. H. 20

Mounted on face of wall; counterbalanced by springs. Operated by means of endless chain, sprocket and gear



Elevation



Vertical Section



Cross Section

CONSTRUCTION NO. B. H. 20

Mounted in opening; counterbalanced by springs. Operated by means of endless chain, sprocket and gear



BUTLER BROS., CHICAGO, ILL.

Kinnear steel rolling doors on shipping platforms. Compactness of doors admits of placing openings in close arrangement, making practically the entire side of building available to teams, which greatly facilitates handling of merchandise



CURTIS PUBLISHING CO., PHILADELPHIA, PA.



Interlocking Steel Slat No. 2

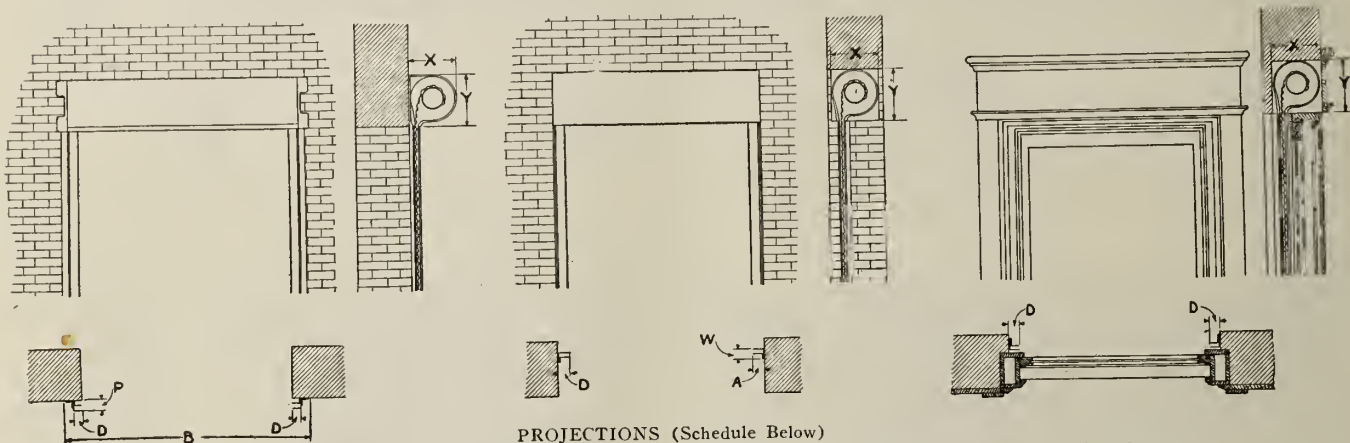
Fitted with alternate endlocks. It is $1\frac{13}{16}$ ins. wide on centers, depth of crown, $\frac{9}{16}$ in. Made in gages Nos. 24, 22, 20, 18 and 16. Especially adaptable to shutters equipped with mechanical operating device

Interlocking Steel Slat No. 5

Fitted with alternate endlocks; $1\frac{1}{2}$ ins. wide on centers, depth of crown, $\frac{1}{2}$ in. Made in gages Nos. 22, 20 and 18. Especially designed for doors and shutters manually operated by handle in bottom bar. When in perpendicular arrangement, shoulders are brought into rigid alignment

CONCAVE AND CONVEX SIDES OF INTERLOCKING STEEL SLATS

Kinnear steel rolling doors and shutters are composed of slats illustrated above. Concave and convex sides, and method of interlocking are shown. Note that either side of the interlocking joints sheds water. Malleable endlocks reinforce edges and prevent longitudinal separation. They also provide an excellent wearing surface in the guides

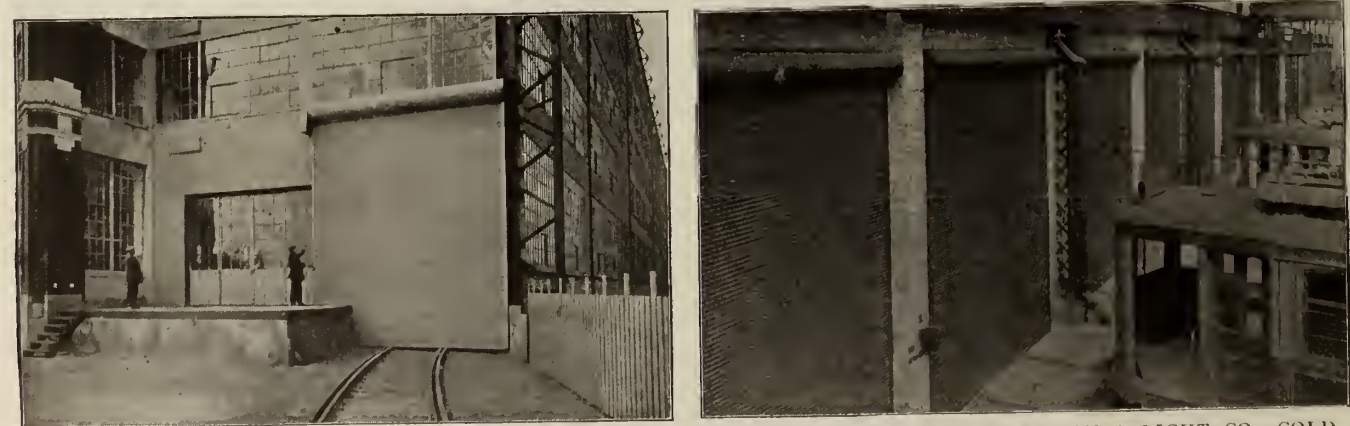


PROJECTIONS (Schedule Below)

Above are indicated the salient dimensions of the more ordinary construction of usual sizes of Kinnear steel rolling shutters. View to the left shows shutter placed on face of wall; central view shows shutter placed between jambs, and that to the right shows curtain with concealed coil. The following dimensions are for shutters of height and width indicated

Width 3' 0" to 6' 0"						Width 6' 0" to 10' 0"					Width 10' 0" to 15' 0"					Width 15' 0" to 20' 0"				
Groove depth "D" 2"						Groove depth "D" 2½"					Groove depth "D" 3"					Groove depth "D" 3½"				
Height	X	Y	P	A	W	X	Y	P	A	W	X	Y	P	A	W	X	Y	P	A	W
ft. ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
6 0	12¾	14	2½		3	13½	15	2½		3½	12¾	14	2½	5	4	12¾	14	2½	7	4½
8 0	13½	15	2½		3	13½	15	2½		3½	12¾	14	2½	5	4	12¾	14	2½	7	4½
10 0	14½	16	2½		3	14½	16	2½		3½	12¾	14	2½	5	4	15¼	17	3½	7	4½
12 0	14½	16	2½		3						12¾	14	2½	5	4	15¼	17	3½	7	4½
6 0	9½	11	2½	3½	3	10½	12	2½	4	3½	12¾	14	2½	5	4	12¾	14	2½	7	4½
8 0	10½	12	2½	3½	3	11¼	13	2½	4	3½	12¾	14	2½	5	4	12¾	14	2½	7	4½
10 0	11¾	13½	2½	3½	3	11¾	13½	2½	4	3½	12¾	14	2½	5	4	15¼	17	3½	7	4½
12 0	12¾	14	2½	4	3	13½	15	2½	4½	3½	13½	15	2½	6½	4	15¼	17	3½	7	4½
14 0	14½	16	2½	4	3	14½	16	2½	4½	3½	15¼	17	3½	6½	4	16¼	18	4	7	4½
16 0	15¼	17	3½	4	3	15¼	17	3½	4½	3½	16¼	18	4	6½	4	16¼	18	4	7	4½
18 0	15¼	17	3½	4	3	15¼	17	3½	4½	3½	16¼	18	4	6½	4	16¼	18	4	7	4½

Schedule is for No. 2 slats. Sizes above division line apply to shutters operated by handle in bottom of curtain. Those below division line apply to shutters operated by endless chain or crank and bevel gear. Dimension "P" applies only to face of wall constructions. Dimensions "W" and "D" only to "between jamb" constructions. Dimension "A" applies only to chain hoist side of hoist operated shutters placed between jambs. Dimension "B" should always be at least 8 ins. wider than width of door opening for moderate sized shutters, and for very large shutters 10 or 12 ins. and more if possible. We do not recommend manually operated construction for curtains of larger area than approximately 100 sq. ft.; chain hoist should be used on larger sizes. Wherever desirable, automatic device may be combined with manually operated construction. Regarding any further details and unusual sizes or special constructions, direct correspondence is suggested.



FORD ASSEMBLY PLANT, CAMBRIDGE, MASS.

MILWAUKEE ELECTRIC RAILWAY & LIGHT CO., COLD SPRINGS, WIS.

Fire Doors and Shutters.

Constructed under the supervision of the Underwriter's Laboratories, Inc., and labeled.

IMPORTANT FEATURES—Kinnear fire doors and shutters are specially designed for fire protection. Details of construction have been carefully developed.

The following are some of the more important features:

(1) An auxiliary or inner hood is automatically dropped and closes the space between the barrel and outer hood, thereby preventing the passage of flame over the barrel.

(2) Special endlocks closing the concaved ends of slats and preventing the passage of flame around the edge of the curtain.

(3) Fusible washers employed in the construction of grooves which melt and allow the members composing the grooves to expand without cramping.

(4) Non-corrodible metal used for bearings and contact points of the automatic release.

(5) Single line contact bearings in releasing levers.

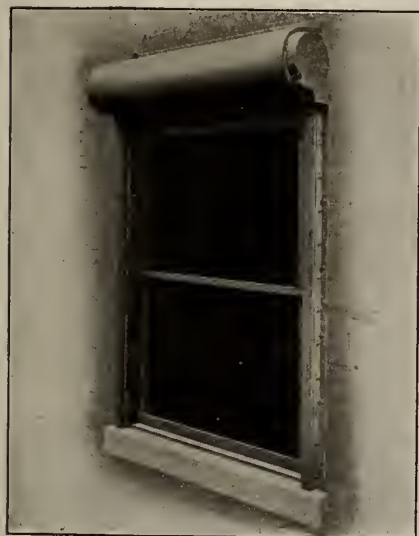
(6) Provision made for expansion of parts for all temperatures up to 2000° Fahr.

(7) Disposition of fusible links, insuring prompt closing.

(8) The enclosure of automatic release, protecting it from the weather.

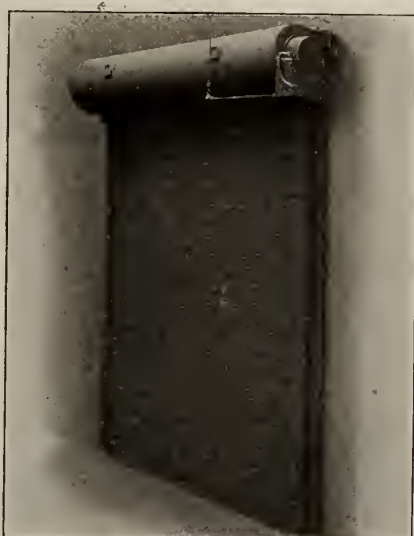
SPECIAL EQUIPMENT—THE KINNEAR MANUFACTURING Co. is prepared to furnish governors controlling the speed of curtain in automatic closure.

CATALOGUES—General Catalogue No. 51 and the special Fire Door Catalogue No. 53 illustrate many additional types and their applications. These doors are designed to obtain easy operation in normal service, and are easily opened and reset by a single person after automatic closure.



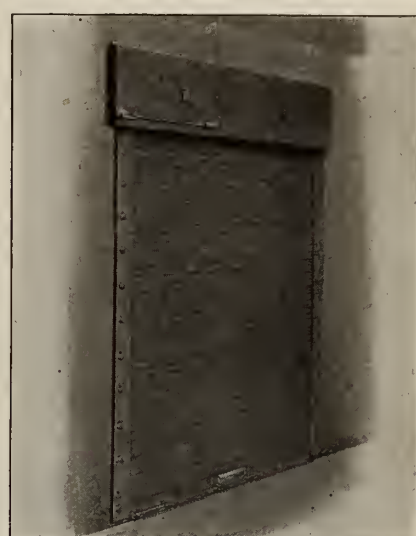
SUPERIOR NO. 1

Single shutter for exterior windows; opening not to exceed 10 ft. wide by 10 ft. high. Mounted on face of wall. Normally open; automatically closed. Equipped with governor, controlling speed of the descending curtain



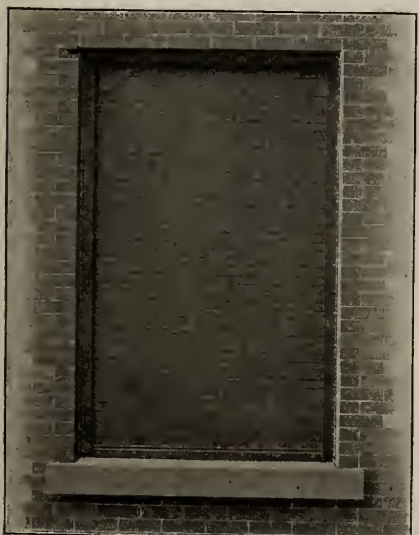
AKBAR NO. 3

For elevator shafts; opening not to exceed 80 sq. ft. in area. Installed on face of wall. Manually operated by means of handle; automatically closed



ACME NO. 4

Double doors for fire walls; opening not to exceed 80 sq. ft. in area. Doors mounted in opening. Manually operated by means of handle; automatically closed



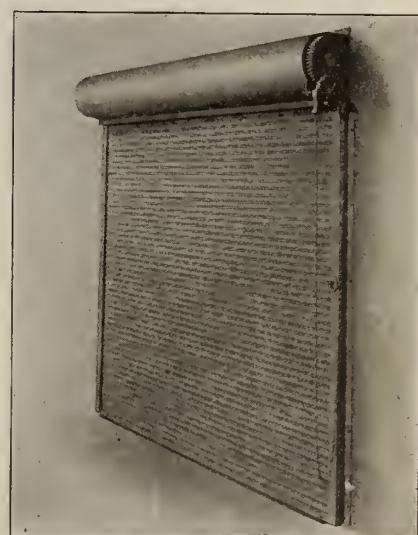
ACME NO. 8

Single shutter for exterior window openings, not exceeding 10 ft. wide by 10 ft. high. Grooves mounted between jambs; coil concealed above head of window. Normally open; automatically closed. Equipped with governor, controlling speed of the descending curtain



AKBAR NO. 7

Double doors for fire walls; opening not to exceed 80 sq. ft. in area. Mounted on face of wall. Mechanically operated by means of crank; automatically closed



ATLAS NO. 3

Single door mounted on interior face of exterior wall; opening not exceeding 10 ft. wide by 10 ft. high. Operated mechanically by means of endless chain, sprocket and gear; not equipped with automatic closing device

"Ajax" Door for Openings in Fire Walls.

Approved for openings not exceeding 80 sq. ft. in area, double doors required.

DESCRIPTION—This door is composed of interlocking cellular sections $2\frac{1}{2}$ ins. thick, assembled on steel frame.

Filled with non-combustible material which does not produce smoke or gas when highly heated.

Mounted on track. Overlaps the opening sides and top.

All of the hardware on the door is attached, except hangers, and holes are provided for these.

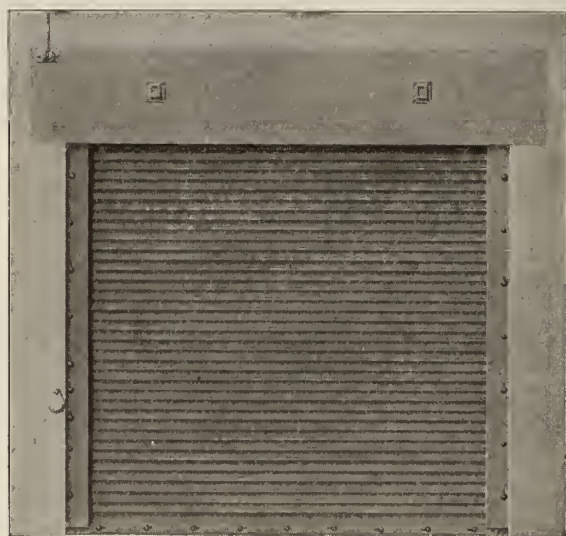
Manually operated by means of handle, and automatically closed by weight released by fusible links.



"AJAX" SLIDING DOOR EQUIPPED WITH AUTOMATIC CLOSING DEVICE

Akbar No. 8 Doors.

Double doors mounted in an opening not exceeding 80 sq. ft. in area. Normally open; automatically closed by releasing device actuated by a fusible link. Escape-governor forms part of the standard equipment and controls the speed of the descending curtain. Mechanical means of opening are provided, consisting of crank, shaft and gear, which are not disengaged during automatic closure.



AKBAR NO. 8

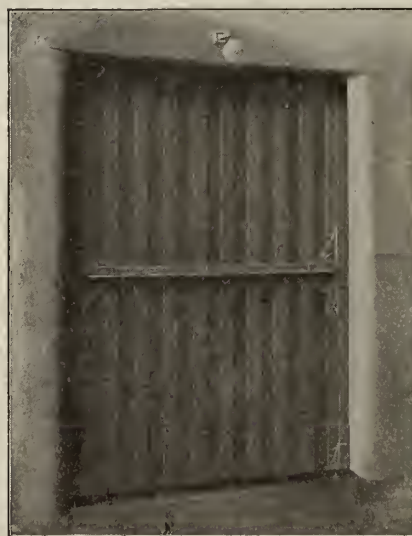
Counterbalanced Doors.

Single door for elevator shafts; not exceeding 80 sq. ft. in area. Installed on face of wall inside of shaft.

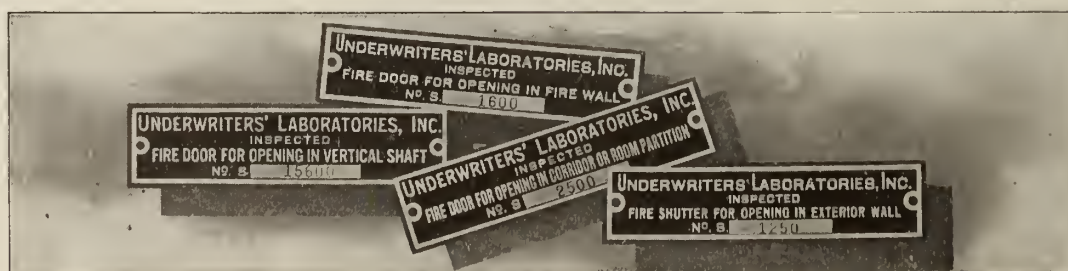
Manually operated and automatically closed.

The sections are constructed of heavy angle and plate frames, connected at the corner by malleable iron gussets.

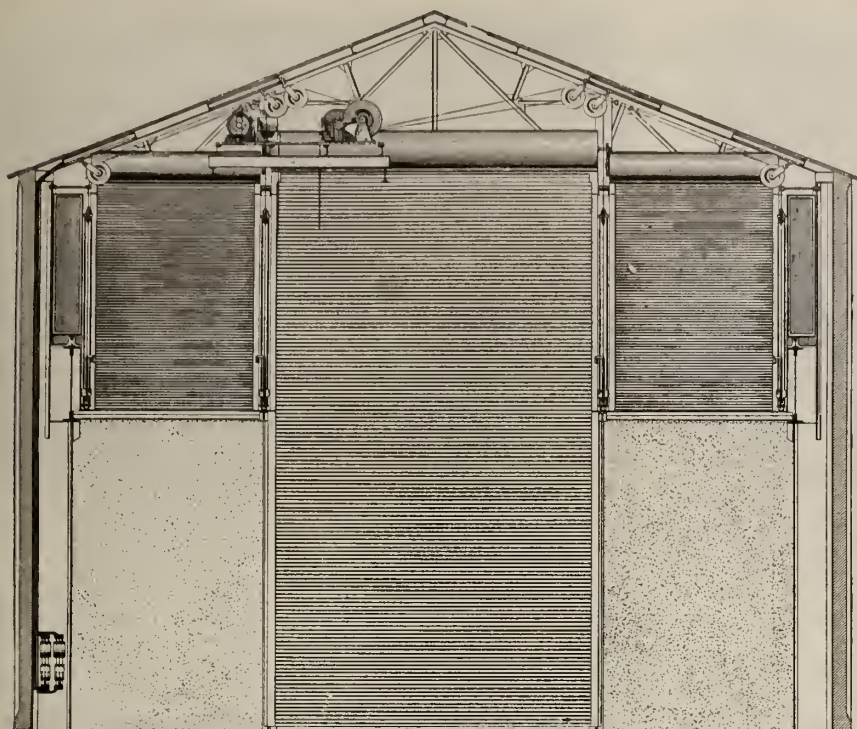
The covering is sheet steel, ribbed surface.



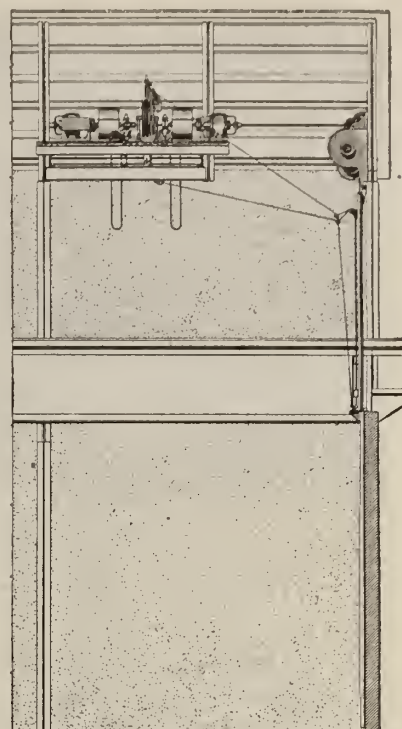
COUNTERBALANCED DOOR



UNDERWRITERS' LABELS



CROSS SECTION SHOWING END ELEVATION OF BUILDING WITH DOOR EQUIPMENT



VERTICAL LONGITUDINAL SECTION

Crane Opening Doors.

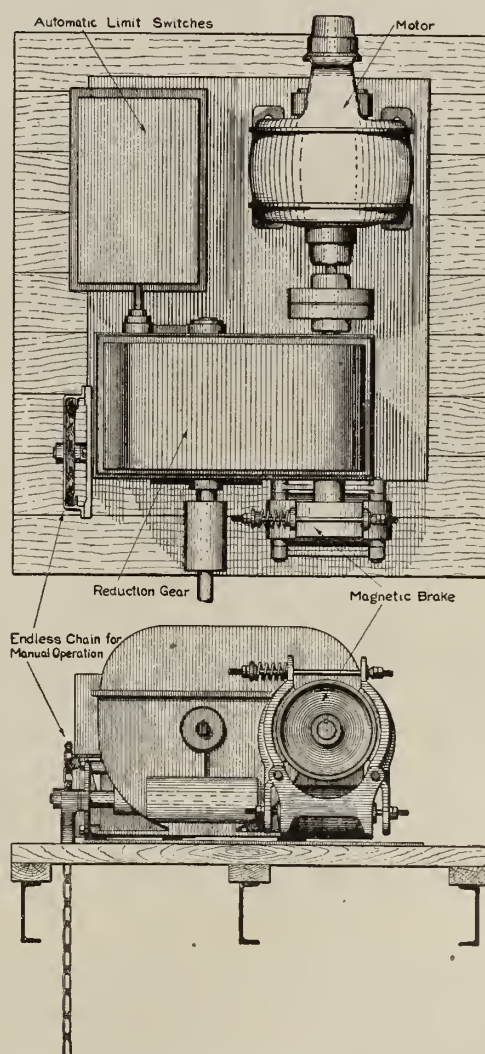
The above illustration shows a typical crane opening and the best arrangement of door equipment. It consists of three steel rolling doors, separated by hinged post with grooved edges for the curtains to travel in. At the crane girders a different post design is used, the groove section extending to the sill with a panel closing the space above the girder. The posts are arranged to lock and unlock automatically.

The operating mechanism is situated on a platform supported by the lower cords of the roof trusses. The doors and posts are operated by separate power units, which are similar except for the posts, where a drum is provided for winding the lifting cable.

Each unit comprises a motor; limit switches, controlling the travel of the doors or posts; an automatic magnetic brake and automatic cut-out, both controlled by the limit switches; and reduction gear enclosed in cast iron box, gear running in oil bath. Gears are steel, with cut teeth. All bearings are fitted with grease cups.

The reduction gear box is arranged to combine power and manual operation. Its peculiar design and construction permit employment of either method without shifting clutches; it is only necessary to throw the electric switch, or pull the endless chain; the manual operation is intended for emergency.

Electric operation controlled from any convenient point, preferably accessible from the ground floor.



MECHANISM, PLAN AND ELEVATION CRANE OPENING DOOR



VERTICAL SLIDING SECTIONAL DOOR

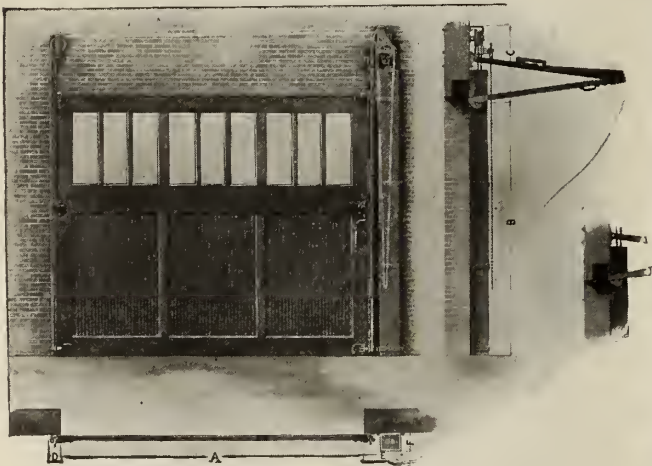
Composed of two or more sections consisting of trussed frame covered with corrugated iron, hung independently with chains, connected with counterbalance weights. Operated by endless chain



SANTA FE FREIGHT SHED, LOS ANGELES, CAL.
Equipped with Kinnear vertical sliding doors. Interior view showing three positions of the door

Kinnear Bifolding Door, Type No. 1.

Door comprises two sections hinged together and supported at center by radial arms pivotally connected to wall brackets. Chains are attached at the bottom which communicate with the counterbalance weight. The bottom of door is fitted with rollers, which travel in guides attached to wall, and transmit the thrust.



BIFOLDING DOOR, TYPE NO. 1



NORFOLK & WESTERN FREIGHT HOUSE, NORFOLK, VA.
Installation of Kinnear bifolding door, type No. 1

TABLE FOR DETERMINING CLEARANCE "C," USING 8" x 9" COUNTERWEIGHT

B—Height of opening in feet	A—Width of opening in feet					
	6	8	10	12	14	16
6	2' 4"	2' 5"	2' 7"	2' 9"	2' 10"	3' 1"
7	2' 4"	2' 5"	2' 8"	2' 10"	2' 11"	3' 1"
8	2' 5"	2' 6"	2' 9"	2' 10"	3' 0"	3' 2"
9	2' 6"	2' 6"	2' 9"	2' 11"	3' 0"	3' 2"
10	2' 6"	2' 7"	2' 10"	3' 0"	3' 1"	3' 3"
11	2' 7"	2' 9"	2' 10"	3' 0"	3' 1"	3' 3"
12	2' 7"	2' 9"	2' 11"	3' 1"	3' 2"	3' 4"
13	2' 8"	2' 10"	3' 0"	3' 1"	3' 3"	3' 5"
14	2' 8"	2' 11"	3' 0"	3' 2"	3' 4"	3' 5"
15	2' 9"	2' 11"	3' 1"	3' 2"	3' 4"	3' 6"
16	2' 10"	3' 0"	3' 1"	3' 3"	3' 5"	3' 7"

Clearance "D," 6". Clearance "E," 18". Clearance "F," 10".
Example—Required "C" for door 12 ft. wide by 10 ft. high. See intersection of column 12 and line 10, the dimension is 3'0". This may be reduced by cutting out the floor under counterweight, permitting it to extend below floor level.
Where clearances at top and sides are not available for regular equipment, it is advisable to request information, accompanying the same with details of openings. We will be pleased to furnish drawings showing special attachments applicable to the conditions.
Clearances for types Nos. 2 and 3 sent on application.



PENNSYLVANIA FREIGHT HOUSE, CAMBRIDGE, OHIO
Installation of Kinnear bifolding door, type No. 1

Kinnear Bifolding Doors, Type No. 2.

Especially designed for large openings. Operates with ease and rapidity.

It is unnecessary to "break" door by hand, as is generally done in other types of folding doors; operations of unlocking, "breaking" and raising are accomplished by means of endless chain.

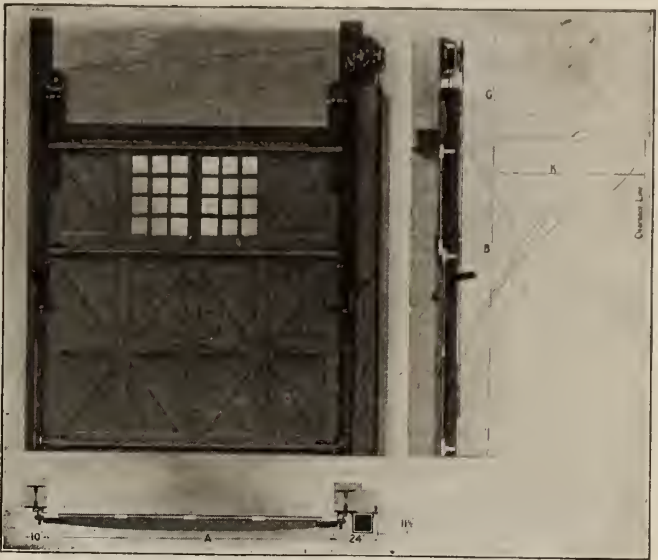
A reversal of these functions occurs when door is closed. In opening, lower section moves upward a distance approximately 18 ins., when hooks on lower section engage reciprocal members on upper section; door then folds radially to a point above opening.

DIMENSIONS—The schedule gives the clearances "C" and "K" for different size openings, using standard construction. The dimension "C" can be reduced either by using different size counterweights or by permitting the counterweights to extend below the floor level.

ADAPTABILITY—Suitable for depots, freight houses, docks, warehouses and shops.

Especially well adapted to situations which necessitate providing for lighting the interior.

MATERIAL AND CONSTRUCTION—Doors are constructed of wood, flat or corrugated steel. When specified, they are pierced by lights of plain or wire glass fixed in wood or metal frames. The hardware and



KINNEAR BIFOLDING DOOR, TYPE NO. 2

B	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"	16'-0"	17'-0"	18'-0"	19'-0"	20'-0"
C	3'-9 $\frac{1}{2}$ "	3'-10 $\frac{1}{2}$ "	4'-0 $\frac{1}{2}$ "	4'-2 $\frac{3}{8}$ "	4'-4 $\frac{1}{16}$ "	4'-5 $\frac{1}{8}$ "	4'-7 $\frac{1}{2}$ "	4'-9 $\frac{1}{4}$ "	4'-11"	5'-0 $\frac{3}{4}$ "	5'-2 $\frac{7}{16}$ "
K	7'-1 $\frac{1}{2}$ "	7'-8"	8'-3"	8'-10"	9'-5"	9'-11 $\frac{1}{2}$ "	10'-6 $\frac{1}{2}$ "	11'-1 $\frac{1}{2}$ "	11'-8"	12'-3"	12'-10"



INTERIOR VIEWS SHOWING KINNEAR BIFOLDING DOORS, TYPE NO. 2, IN CLOSED AND OPEN POSITIONS

framing members are properly proportioned to the size of doors and have ample strength to prevent excessive deflection of the sections when doors are raised.

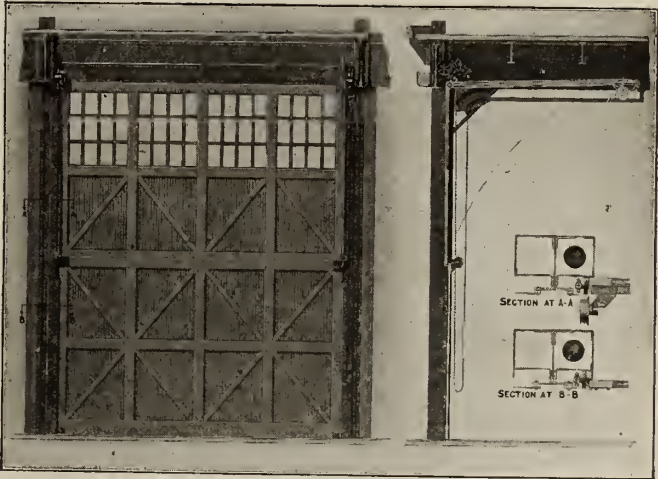
The structural design and liberal use of material give both strength and durability.

OPERATION—Doors are counterbalanced by weights. Operated by mechanism consisting of endless chain and reduction gear. They operate with ease and rapidity.

Types Nos. 2 and 3 are self-breaking and self-locking.

Bifolding Door, Type No. 3.

Designed for large openings. Made in two sections. In operating, the lower section raises to half the height of the opening. The door then breaks and both sections move simultaneously, the lower edges vertically and the upper edges horizontally on suspended tracks, to a position above the opening as shown by phantom lines.



BIFOLDING DOOR, TYPE NO. 3

THE J. G. WILSON CORPORATION

SUCCESSORS TO THE JAS. G. WILSON MFG. CO.

Manufacturers of Rolling Doors and Shutters in Steel, Wood, Bronze

TELEPHONE:

VANDERBILT 1875-76

8 West Fortieth Street
NEW YORK, N. Y.

CABLE:

"LYDIAN, NEW YORK"

FACTORY ADDRESS, MAIL AND TELEGRAPH: NORFOLK, VA.

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CHICAGO, ILL., H. B. DODGE & Co., McCormick Building	PITTSBURGH, PA., H. H. CHARLES, Bessemer Building
PHILADELPHIA, PA., L. H. MYRICK, Otis Building	ATLANTA, GA., J. M. VAN HARLINGEN, Candler Building
BOSTON, MASS., E. A. BAKER, 17 Pearl Street	BUFFALO, N. Y., M. S. TREMAINE, Fidelity Building
LOS ANGELES, CAL., R. B. EMMONS, 600 Metropolitan Building	

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TOLEDO, OHIO
COLUMBUS, OHIO
DAYTON, OHIO
DALLAS, TEX.
EL PASO, TEX.
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HOUSTON, TEX.
PUEBLO, COLO.

DENVER, COLO.
ST. LOUIS, MO.
KANSAS CITY, MO.
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SAN DIEGO, CAL.
SYRACUSE, N. Y.
NEW ORLEANS, LA.
RICHMOND, VA.
BALTIMORE, MD.

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SPOKANE, WASH.
CHARLOTTE, N. C.
PORTLAND, ORE.
BILLINGS, MONT.
WASHINGTON, D. C.
CALGARY, CAN.
MONTREAL, CAN.

VICTORIA, CAN.

Products.

"WILSON" STEEL ROLLING DOORS and SHUTTERS.
"WILSON" STEEL ROLLING FIRE DOORS.
"WILSON" SLIDING SWING DOORS.
"WILSON" ROLLING WOOD DOORS and SHUTTERS.

Also, Wood Rolling Partitions, Folding Partitions, Wardrobes, Wood Block Flooring and Venetian Blinds.

Experience and Co-operative Service.

The standards of construction of "Wilson" products have been progressively developed during a period of nearly 40 years of manufacturing experience. This fact, together with the high records of service which can be shown for "Wilson" doors and shutters, offers effective assurance of their superiority.

While it is hoped that the data provided herewith will effectually assist in the full study of any door and window problem, and in making all necessary provisions for installation of the specified products, the experience and mass of scientific data in possession of this company are also gladly put at the disposal of users of this book.

"Wilson" Steel Rolling Doors and Shutters.

CLASSES OF SERVICE—"Wilson" steel rolling doors and shutters are designed to meet two classes of service: First, as an effective closure of openings against weather and intrusion.

Second, as approved underwriters' fire doors.

Closure Doors—The doors and shutters made for the closure of openings are strong and durable and have proved to be excellent fire retardants. They retain their shape under intense heat and will not warp or twist.

When made red hot they will still prove a perfect barrier to flames.

Fire Doors—The doors and shutters made for protection against fire (fire doors) are similar in construction to the closure doors above described.

They are automatic in operation and are designed to meet all of the requirements of, and are indorsed and labeled by, the National Board of Fire Underwriters, Inc.

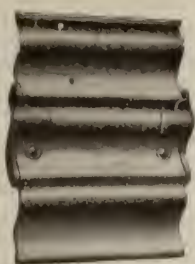
OPERATION—All doors are counterbalanced by either helical or flat springs so selected as to balance the door in all positions.

(1) *Spring Balanced or Self-coiling*—Operated by means of handles located at bottom of door, suitable for fire doors and closure doors not exceeding 80 sq. ft. in area.

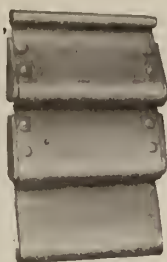
(2) *Gear Operation*—Operated by means of chain and sprocket, bevel or worm gear actuated by either hand chain or crank from either the inside or outside or both.

(3) *Power Operation*—Operated by electric motors fitted with suitable reduction gears and electric brakes. Alternate hand operating chain to be used in cases of emergency. Operation controlled by means of a drum-type controller located at a convenient point, or by means of push buttons located at any convenient point with the aid of electric or mechanical limit switches, which automatically make or break the power circuits. Doors may be operated independently, simultaneously or in groups.

STEEL ROLLING CURTAINS—Steel rolling curtains for closing the openings are furnished in one of four of the following types, depending upon the area of



Little 4



No. 2 with Fire Stop



Style Big 4



Big 4 with Safety Attached

TYPES OF INTERLOCKING SLAT STEEL ROLLING DOORS

opening and class of service to which the doors are to be put.

INTERLOCKING SLAT TYPE, STYLE LITTLE No. 4—Designed to secure maximum strength with a minimum depth of corrugation.

The design eliminates all sharp bends which would prove detrimental in the process of manufacture and to its durability.

Each square foot of assembled slats contains approximately 2 sq. ft. of steel, the metal so formed as to offer greatest resistance to wind pressure and to distortion when subjected to high temperatures.

Recommended for closure doors not over 12 ft. wide, made from No. 22 and No. 20 gauge stock.

When used for fire doors, see underwriters' size limitations.

INTERLOCKING SLAT TYPE, STYLE No. 2—For large openings and especially for fire doors.

Labelled by the National Board of Fire Underwriters, Inc., for closing openings in vertical shafts, room partitions and fire walls.

They are manufactured from stock No. 20, No. 18 and No. 16 gauge.

When used for fire doors, see underwriters' size limitation.

INTERLOCKING SLAT TYPE, STYLE BIG 4—Similar in design to the Little 4 type, having the advantage of a greater depth of corrugation, which materially increases its rigidity, placing it in a class by itself, when fitted with safety attachment for resisting wind pressure.

This construction is adapted to all classes of closures, manufactured from No. 22, No. 20, No. 18 and No. 16 gauge cold rolled stock, especially for openings up to 30 ft. wide.

Pilasters of the rolling or hinged type for openings over 25 ft. wide are preferred where conditions will permit.

GEARING—Of the cast iron type, so designed as to be accessible at all times for repair or lubrication. Journals are of cold rolled shaft; all gears 4 pitch.

Designs for special operation where worm and bevel gears are required will be supplied upon application. Ball bearings will be supplied when conditions justify them.

HOODS—Hoods are constructed of No. 24 gauge galvanized sheets with as few joints as possible, reinforced where necessary with steel angles. Hoods are optional where doors are placed on the inside of openings. They

are not furnished unless specified. Flashings should be provided by sheet metal contractor where hoods are exposed to the weather.

GUIDES, ANCHOR DEVICES, BOLTS, ETC.—All necessary guides, anchor, devices, bolts, etc., are furnished with each installation. Complete lintel, jamb and sill details should accompany each order.

LOCKING DEVICES—Locking devices are furnished in any one of the three methods of locking as shown in the illustration. The type desired should be specified.

WICKET DOORS—Hinged wicket doors, maximum size 2 by 5 ft., may be placed in any closure door at the side.

The doors are so designed that the wicket with its frame must be swung back out of the way before raising the large door.

INSTALLATION—"Wilson" work can be installed by workmen of ordinary skill in the various building trades. Drawings, full directions and all necessary parts for fitting are furnished with each shipment. This company, however, prefers to install its own work and then to assume full responsibility.

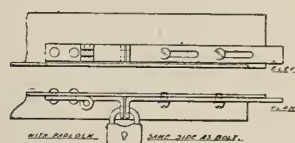
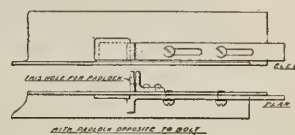
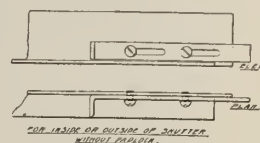
OFFICIAL INDORSEMENT—"Wilson" rolling steel fire doors are indorsed and labeled by the National Board of Fire Underwriters, Inc., for the following services:

Openings in Fire Walls—For openings not exceeding 80 sq. ft.; doors on both sides of wall; doors mounted on face of wall, only; construction, "Wilson" Interlocking Slat, No. 2, No. 16 gauge. Arrangement No. 1.

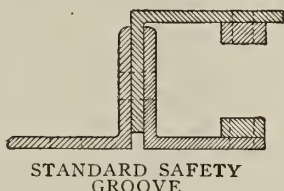
Openings in Vertical Shafts (Stairway and Elevator Openings)—For openings not exceeding 8 ft. by 10 ft.; construction, "Wilson" Interlocking Slat, No. 2, No. 20 gauge. Arrangement No. 1.

Door Openings in Corridor and Room Partitions—Openings not exceeding 8 ft. wide by 10 ft. high; construction, "Wilson" Interlocking Slat No. 2, No. 20 gauge. Arrangement No. 1.

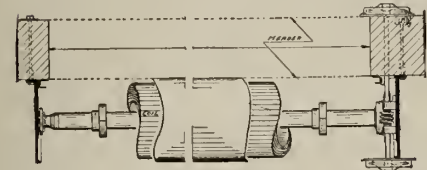
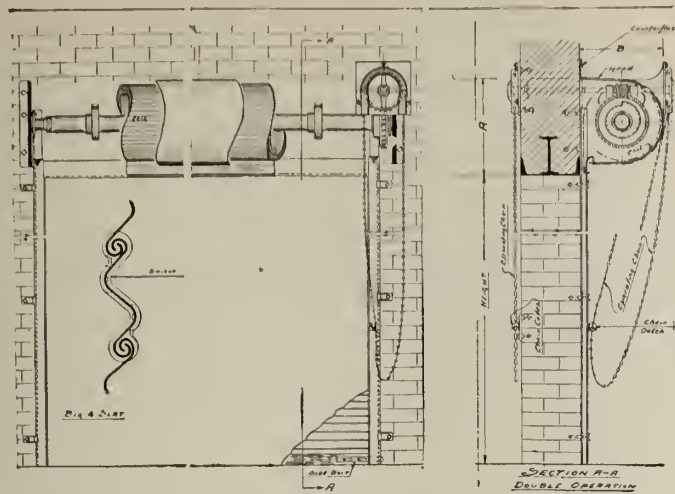
Exterior Openings—Openings not to exceed 10 ft. in width and 10 ft. in height; construction, "Wilson" Galvanized Interlocking Slat Little No. 4, No. 22 gauge. Operation may be either self-coiling, chain gear or bevel gear. Arrangement No. 1.



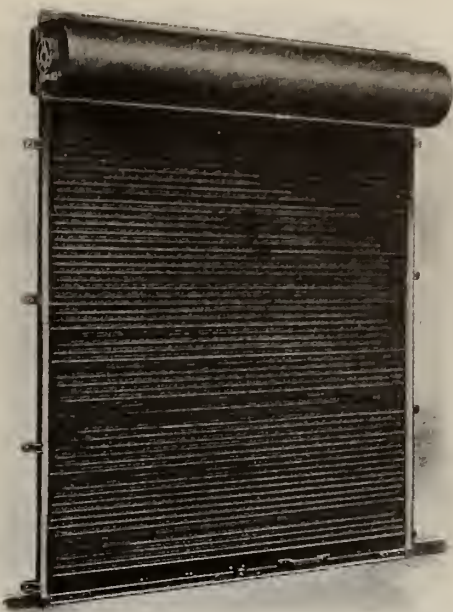
OPTIONAL SLIDE BOLT AND PADLOCK DETAILS



STANDARD SAFETY GROOVE

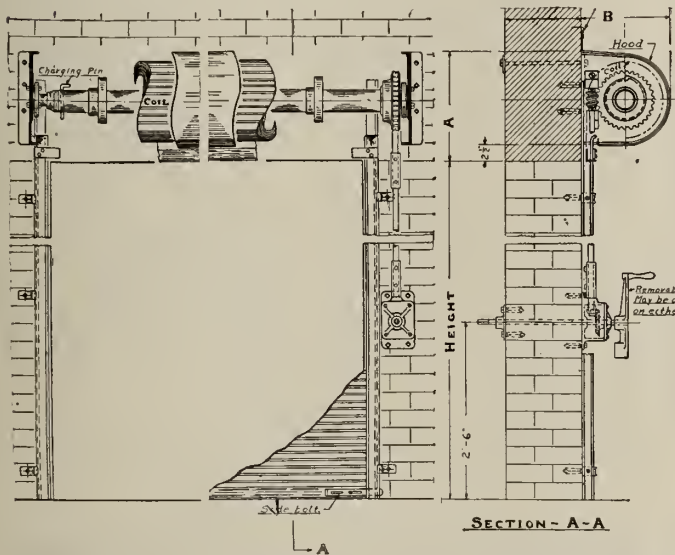


ELEVATION, SECTION AND PLAN OF WILSON STEEL ROLLING CLOSURE DOOR, MOUNTED ON FACE OF WALL, WITH CHAIN GEAR ON ONE OR BOTH SIDES

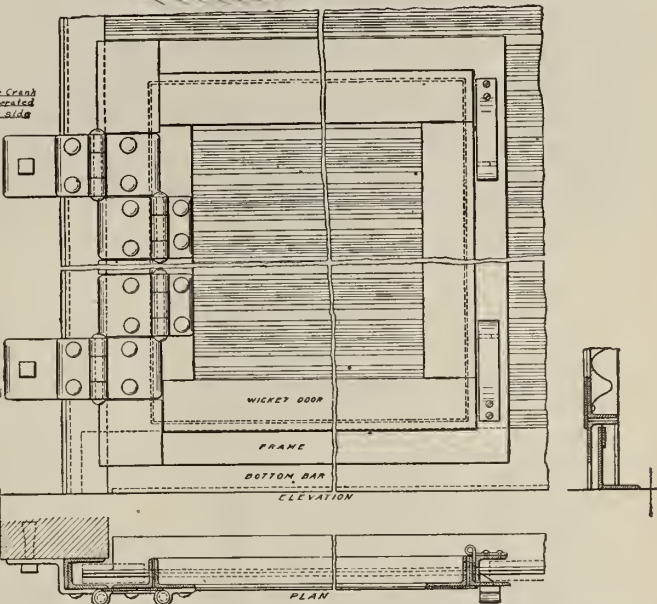
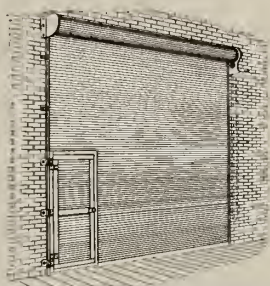


WILSON STEEL ROLLING FIRE DOOR, MOUNTED ON FACE OF WALL

Spring balanced and equipped with fusible link. Raised and lowered by hand without interference with spring release device, which only operates in case of fire. Approved and labeled by National Board of Fire Underwriters, Inc.



ELEVATION, SECTION AND PLAN OF "WILSON" STEEL ROLLING CLOSURE DOOR, MOUNTED ON FACE OF WALL, WITH WORM AND CRANK OPERATION, OPERATING ON ONE OR BOTH SIDES



ELEVATION, SECTION AND PLAN OF HINGED WICKET DOOR FOR ROLLING CLOSURE DOOR
Wicket doors preferably placed at side

SPACE REQUIREMENTS TO ACCOMMODATE DOOR HOODS

Height, ft.....	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A., in.....	17	17	18	18	19	19	20	20	21	23	23	24	24	25	25	26	27	27	29	29	29	31	31	31	31
B., in.....	14½	14½	15½	15½	16½	16½	17½	17½	18½	20½	20½	21½	21½	22½	22½	23½	24½	24½	26½	26½	26½	28½	28½	28½	28½

"Wilson" Sliding Swing Doors.

DESCRIPTION—These doors are made fireproof or not, as required.

The method of operation is entirely new, very simple and durable. The door can be raised or lowered with very little effort, with great rapidity and smoothness.

The advantages gained by the use of these doors are economy of space and a practically unlimited strength of construction. The construction is either tin clad or glazed.

This design lends itself admirably to the installation of wickets.

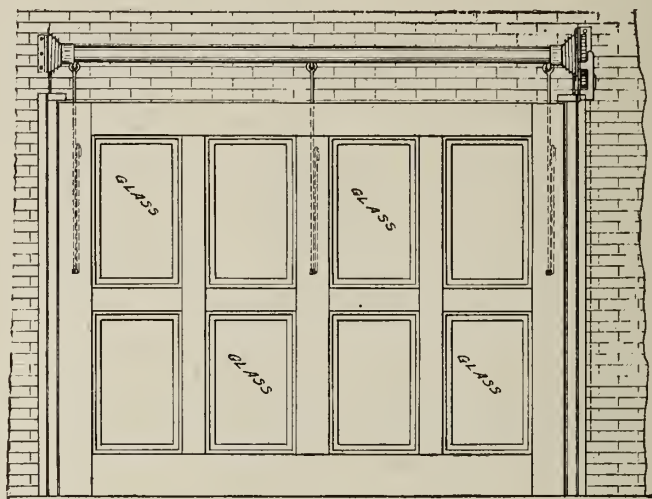
When applied to the exterior of openings, the raised door serves as a weather protector.

OPERATION—These doors can be operated direct by hand, by chain or bevel gear (with operation on inside or outside of opening or both), and motor driven gear.

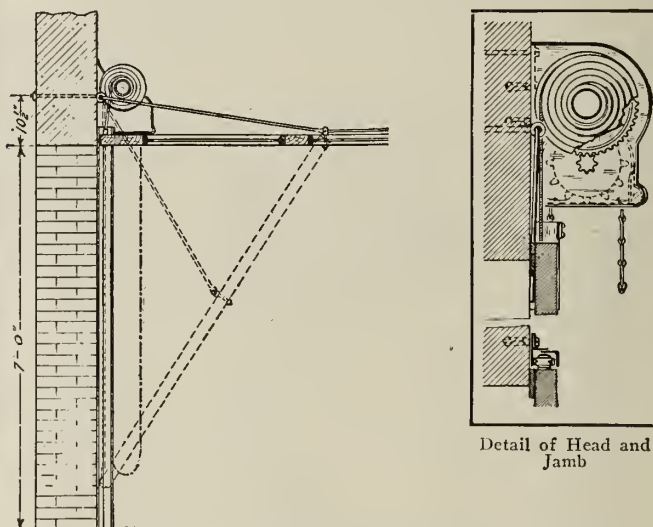
INSTALLATION—"Wilson" work can be installed

by workmen of ordinary skill in the various building trades.

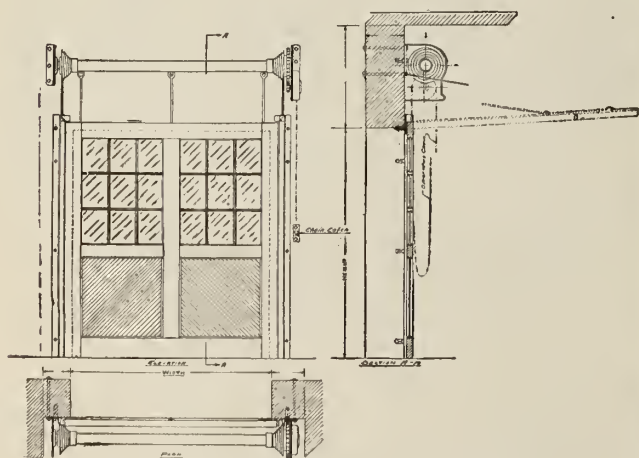
Drawings, full directions and all necessary parts for fitting are furnished with each shipment. This company, however, prefers to install its own work and then to assume full responsibility.



SLIDING SWING DOORS IN FREIGHT SHED OF CHICAGO & NORTHWESTERN R. R. CO., MADISON, WIS.



ELEVATION, VERTICAL SECTION AND DETAIL OF GARAGE APPLICATION OF SWING SLIDING DOOR



DETAILS OF CONSTRUCTION OF "WILSON" SLIDING SWING DOORS



SWING SLIDING DOORS, DUQUESNE FREIGHT SHEDS, PENNSYLVANIA RAILROAD, PITTSBURGH, PA.

"Wilson" Wood Rolling Doors and Shutters.

USES—These doors are especially made to withstand the corrosive fumes so destructive to iron and steel.

Their use is recommended especially for round-houses, powerhouses, engine rooms and other places where corrosive fumes are generated. They are also recommended for use as closure doors for wood constructed warehouses and the like.

CONSTRUCTION—These doors are made of wood slats 2 in. wide and about $1\frac{1}{8}$ in. thick, fitted together with rule joints, edge to edge, and threaded upon bands of bronze metal running from top to bottom about 18 in. apart. Each band is riveted to the top slat and attached at the bottom to a strong spiral spring anchor of phosphor bronze concealed in the baseboard or bottom bar.

The whole construction is exceptionally heavy and durable, and will stand any amount of hard wear.

OPERATION—The doors are spring counterbalanced and are easily operated by an endless chain attached to gear at end of shaft.

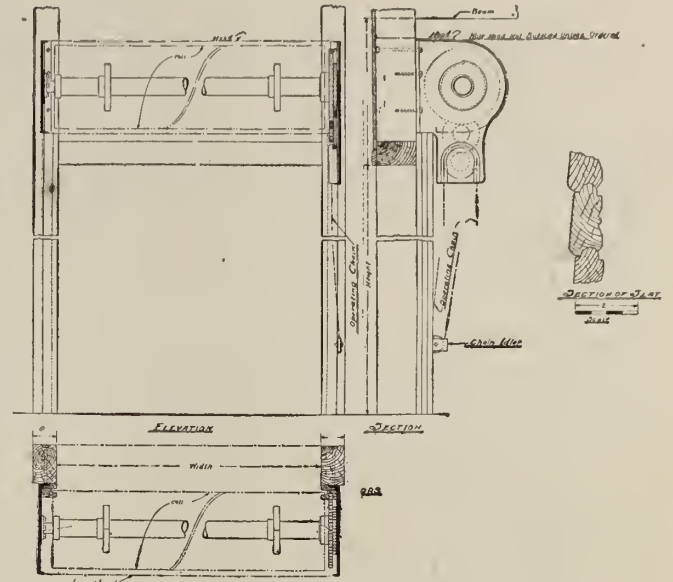
LIGHT OPENINGS—Openings to admit light can be provided in the doors when required, in the shape of wire glass panels. All the light needed can be obtained in this way.

WICKET DOORS—Wicket doors of the sliding and hinged type are provided where required. The swinging wicket doors are hinged to the grooves, the frames of which must be swung back before the large door is raised.

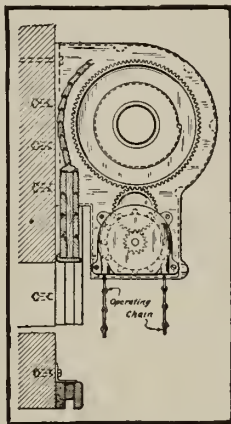
This type has given better satisfaction than any other design applied to wood doors.

INSTALLATION—"Wilson" work can be installed by workmen of ordinary skill.

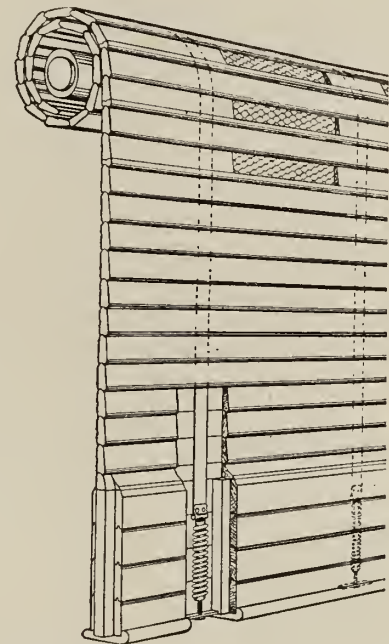
Drawings, full directions and all necessary parts for fitting are furnished with each shipment. This company, however, prefers to install its own work and then to assume full responsibility.



ELEVATION, SECTIONS AND PLAN OF "WILSON" WOOD ROLLING DOOR, SHOWING CHAIN OPERATOR AND DETAIL OF SLAT



Head and Jamb Detail, Wood Slat Rolling Door "Plan" of Construction, No. 1



DETAILS OF CONSTRUCTION OF WOOD ROLLING DOOR

RELIANCE FIREPROOF DOOR CO.

Manufacturers of Fire Retardant Specialties of Metal Covered Woodwork

OFFICE AND FACTORY

TELEPHONE:

GREENPOINT, 2211, 2212

West Street, Greenpoint Avenue and Milton Street

BROOKLYN, N. Y.

REPRESENTATIVES

PHILADELPHIA, PA., F. J. WILSON Co., Land Title Building
WASHINGTON, D. C., FIREPROOF PRODUCTS Co., Woodward Building
ROCHESTER, N. Y., BUILDING SPECIALTIES Co., 176 Clinton Avenue, South
ST. LOUIS, MO., J. R. HICKMAN, Chemical Building

BOSTON, MASS., SEELEY & LAWSON, 73 Tremont Street
PITTSBURGH, PA., ALL STEEL EQUIPMENT Co., Union Arcade Building
CINCINNATI, OHIO, BUILDERS MATERIAL Co., 310 Johnston Building
HOUSTON, TEX., F. B. WALCOTT, 305 Beatty Building

Products.

METAL COVERED DOORS, in Bronze, Copper, Sempermerus, Kalamein, Galvanized Iron and Furniture Steel drawn over white pine and hardwood cores.

Metal Covered Windows and Interior Trim.

Metals Used.

Bronze from Nos. 16 to 26 gauge; copper from 14 to 24 oz. to the sq. ft.; sempermerus, kalamein and galvanized iron, Nos. 22 to 28 gauge; furniture steel, Nos. 12 to 22 gauge.

Underwriters' Kalamein Doors.

The Reliance underwriters' kalamein doors, for elevator shafts, stairways, corridors and partitions, fire escapes and fire tower openings, when installed in accordance with the following specifications and details (Figs. 1, 2 and 3), will procure a minimum insurance rate for the building and contents.

SPECIFICATIONS—Stair and Elevator Doors—Labeled for single doors up to 48 in. wide and in pairs up to 96 in. wide; made with solid panels hung in channel iron or wrought steel frames with 5 by

5-in. surface butts, mortise cylinder locks and $\frac{3}{4}$ -in. throw bolt; stair doors should be made self-closing, either by coil spring or door check, the latter preferable as shown by Fig. 2; combination slide and swing elevator doors shown by Fig. 1.

Fire Escape and Tower Doors—Labeled for the same size openings as stair and elevator doors, and can be constructed to receive wire glass, not exceeding 5 sq. ft.; hung in the same manner as stair doors, shown by Fig. 3.

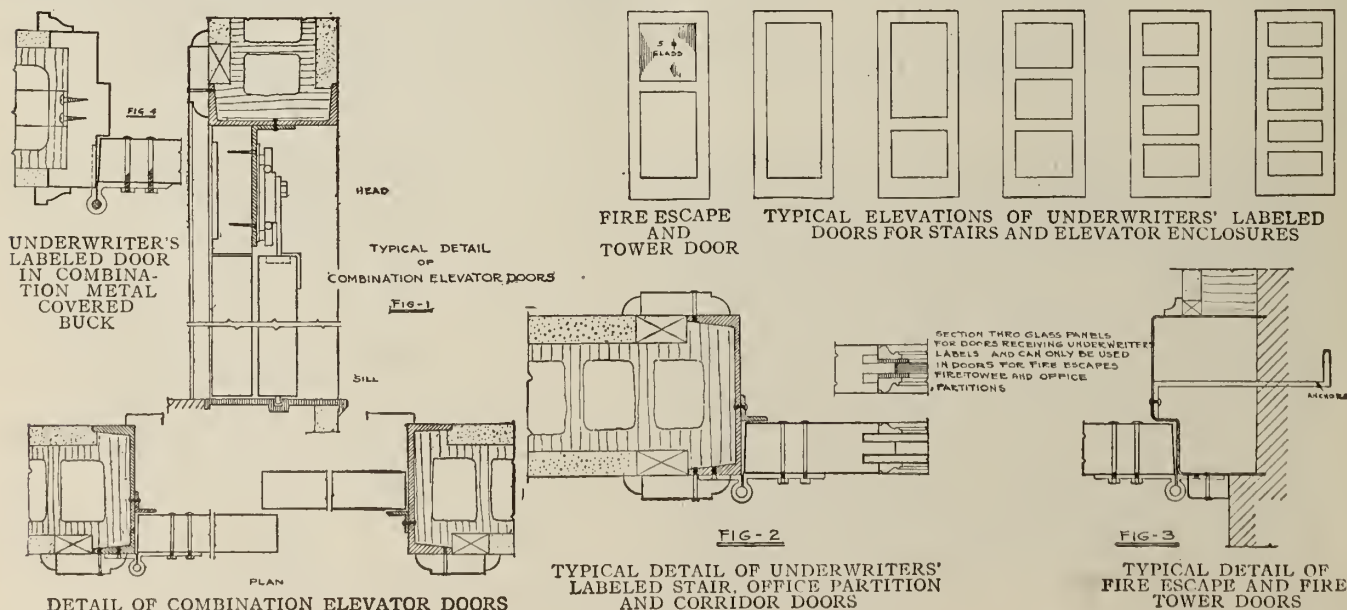
Corridor and Partition Doors—Constructed to receive 8 sq. ft. of wire glass and bearing the underwriters' label; may be hung to metal covered combination bucks when stair and elevator doors are labeled. This type of construction is also approved by the Labor Department (Fig. 4).

PRICES—Prices furnished on receipt of schedule covering the following data (unless plans and specifications are furnished to the company):

Doors—Size and style of each.

Jambs—Width and thickness required.

Casing—Moulded or flat; stating width, and whether one or both sides of opening.



DAVID LUPTON'S SONS CO.

Daylight and Ventilation for Buildings

Allegheny Avenue and Tulip Street
PHILADELPHIA, PA.

SALES OFFICES

NEW YORK, N. Y., DAVID LUPTON'S SONS Co., 50 Church Street
CHICAGO, ILL., DAVID LUPTON'S SONS Co., 743 Insurance Exchange Building
PITTSBURGH, PA., DAVID LUPTON'S SONS Co., 1415 Oliver Building
BALTIMORE, MD., WALTER

CLEVELAND, OHIO, DAVID LUPTON'S SONS Co., 906 Sweetland Building
BOSTON, MASS., DAVID LUPTON'S SONS Co., 88 Broad Street
SAN FRANCISCO, CAL., WATERHOUSE-WILCOX Co., 523 Market Street
DETROIT, MICH., MALCOLM J. McLEOD, Majestic Building
S. BRAUNS, Munsey Building

Products.

LUPTON STEEL SASH: PIVOTED FACTORY TYPE, POWER HOUSE TYPE, COUNTERBALANCED TYPE, COUNTERWEIGHTED TYPE; POND CONTINUOUS SASH; POND OPERATING DEVICE; POND TRUSS; LUPTON STEEL PARTITION; LUPTON STEEL TUBE DOORS; LUPTON ROLLED STEEL SKYLIGHT; WALDMIRE LOUVER.

Lupton Sheet Metal Fireproof Window; Lupton Steel Shelving.

Designing for Unusual Ventilation.

For a number of years DAVID LUPTON'S SONS Co. has specialized in applying sash to difficult ventilating requirements. This practical study has resulted in evolving two forms of sash—namely, Lupton Counterbalanced Sash and Pond Continuous Sash—which give unusually effective ventilation.

Lupton Counterbalanced Sash has the upper and lower sash hung over a single pair of pulleys. This insures equal top and bottom openings as close to the ceiling and floor as possible, and makes it impossible for workers opening the lower sash to neglect the top sash.

Pond Continuous Sash accomplishes two purposes: First, it gives effective weather protection when open; its 20-foot units are connected in long unbroken lines outside of structural work, and the details prevent rain from entering at the top or ends. Second, it gives mass control of ventilation. One man can open more than a thousand square feet in a few moments by hand power, or several thousand if electric motors are used. Pond Continuous Sash was originally designed for sawtooth roofs, but was soon applied to foundry monitors, and to side walls.

The ventilating possibilities of Lupton Counterbalanced Sash and Pond Continuous Sash go much beyond what can be realized with conventional building designs. By planning the buildings so that the sash and the floor layout fit each other, results can be secured which would be impossible otherwise. The effect has been practically to rewrite the science of ventilation as applied to large industrial buildings.

The following principles govern the successful use of these sash:

(1) The balanced top and bottom openings of Lupton Counterbalanced Sash make it for industrial buildings preferable to pivoted or counterweighted sash. The average factory worker does not recognize "stale air," and opens the windows only if the temperature becomes oppressive. In that case only the top or bottom sash is usually touched, though either alone is useless without a wind. By using Lupton Counterbalanced Sash the building may be made wider than usual, with reasonable assurance of fresh air reaching the center

bays. In this way the rental charge is reduced and the sash becomes a profitable investment.

(2) The weatherproof details of Pond Continuous Sash adapt them especially to sawtooth and monitor roofs. Sash that must be shut for every shower are often left shut when they should be open.

(3) In certain industries Pond Continuous Sash is as useful in the side walls as in the roof. Among such are the rubber goods industry, foundries, chemical works, etc., where abundant ventilation is constantly demanded, and where entering rain would cause damage to equipment or to product.

(4) Mass control of sash is especially desirable for large floor areas with many workers or heat-producing processes, since its practical effect is to place control in the hands of a responsible foreman who will attend to it. Instead of scattered workers each opening (or more likely neglecting) a few square feet of sash, one man should be able to open at least a thousand square feet at once.

(5) Where hundreds of workers are employed under a sawtooth or monitor roof, ventilation should be uniform for the entire floor. This is best done by operating Pond Continuous Sash in long lines or groups by electric motors, using Pond Operating Device, motor driven. Thus the air movement over many thousand square feet of floor may be regulated by a single switch; and by suitably locating switches, floor areas of any extent can be controlled from any desired points.

In designing a building to utilize the ventilating capabilities of the sash, the following points in particular must be observed:

(a) Inlet and outlet openings must be properly balanced. Either is useless without the other.

(b) A weak ascending air stream will not drag a long horizontal stream. Very wide sawtooth buildings are defective both in this and in the point just mentioned. Such air as enters from the side escapes before reaching the center if the roof sash be open, or remains stagnant if the sash be closed, as is too often the case.

(c) Where the roof is used, it must be formed to stimulate air movement. The sawtooth roof fails in this, because of the uniform level of its outlets; the conventional monitor roof fails to provide sufficient outlet in the right places, and the peak tends to pocket and chill the air or gases.

The Pond Truss roof avoids all three faults.

(d) Any heat-producing elements (furnaces, ovens, etc.) must be so located as to cause air currents to rise at or near the outlet points. Inlets in the roof must be kept free from heat.

(e) With wide sawtooth roofs, especially where

the workers are crowded or heat is produced, individual openings of sash result in "spotty" outflow, and therefore an irregular distribution of fresh air. The way to get uniform distribution is to operate the roof sash simultaneously in groups by electric motors, and to provide correspondingly uniform inlets in the side walls by means of Pond Continuous Sash suitably located and operated.

(f) For very wide buildings, the sawtooth and conventional monitor should not be used. The only effective way to ventilate the center is by alternate raised outlets and low inlets in the roof. Such a building, embodying the Pond Truss type for outlets and Pond A-frames for inlets, is shown on a page following. This roof gives also much better light distribution than the sawtooth, and is adapted to nearly all classes of industrial buildings. It usually costs less than a sawtooth.

(g) The old conception of stale air rapidly escaping from small outlets is illusory and misleading. Rapid air flow can only result from a considerable difference in pressure. This difference, unless forced draft is used, can only come from a corresponding difference in temperature. The idea of treating a foundry or forge shop as a "chimney" can only be realized in practice by raising the inside temperature to an unbearable extent. The proper way to ventilate such buildings is to use large inlet and outlet areas, so that a slow movement is sufficient, and to locate them so as to produce that movement over the entire floor. For this, a correctly designed roof and correctly placed inlets are just as necessary as correct type and arrangement of sash. The Pond Truss roof was originally designed for foundries and forge shops, and has been found to accomplish its object perfectly.

This company does not design complete buildings or sell designs, but assists engineers and architects in every way to get maximum lighting and ventilating results from the use of Lupton products, maintaining a large engineering department, and adapting each design which is recommended to the individual requirements of the customer's business. No charge is made for this

service, and engineers and architects are invited to use it freely.

Lupton Factory Sash (Patented and Patents Pending).

Has certain features which are deemed fundamental, namely: solid 1-piece rolled steel members, joints which resist corrosion and do not impair effective strength of sash, permanently weathertight ventilators and simple glazing. The members of Lupton Sash are specially rolled to give maximum strength without excessive weight. The muntin joints give maximum strength against wind, and are readily protected by painting. The muntins are fitted into frames and solidly riveted.

Ventilators make a close 2-point contact at all sides; placed one above the other, they are operated by a double arm connection, which closes them tight without slamming.

STANDARD AND STOCK SIZES—For quick delivery all commonly-used sizes of Lupton Factory Sash are

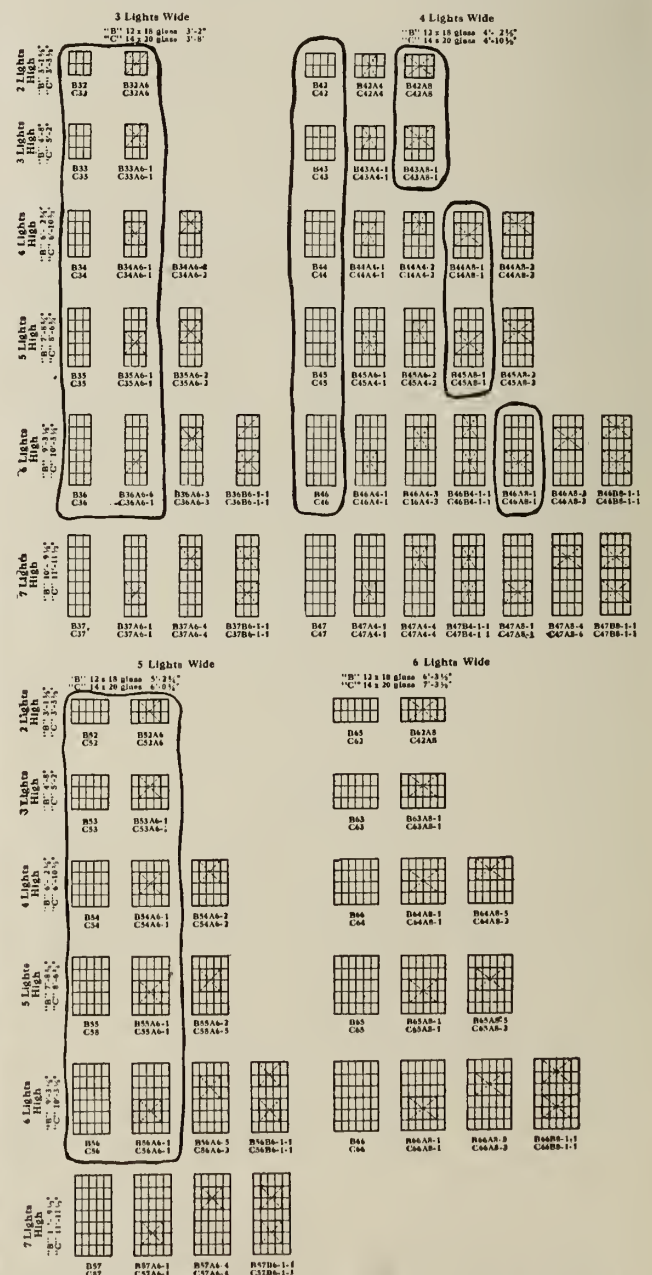
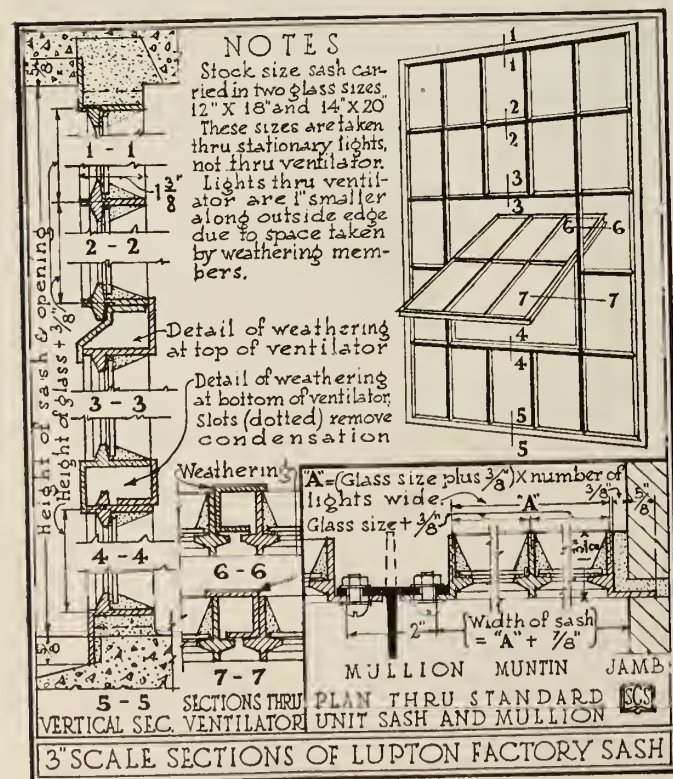


DIAGRAM SHOWING STANDARD AND STOCK SIZES OF LUPTON FACTORY SASH

carried in factory stock in the shape of pre-cut bars ready for assembling. The sizes most in demand are also carried in warehouse stock in various cities, fully assembled. Glass for these "Standard" and "Stock" sizes are 12 by 18 and 14 by 20 in. Angle frame members and T-bar mullions are used.

The diagram on preceding page shows the "Standard" sizes. Those circled are also classed as "Stock" sizes, and are carried in warehouse stock ready for shipment.

Lupton Counterbalanced Sash (Patented and Patents Pending).

Has the upper and lower sash balanced over a pair of pulleys, so that the upper sash descends as the lower sash is raised. Up to 12 ft. in height the windows are 2-sash high. From 12 to 18 ft., 3 sash are used, the



LUPTON COUNTERBALANCED SASH
2-sash and 3-sash high

middle one being stationary. Window units are made up to 6 ft. wide and may be used singly or in multiple. Heads and sill are formed of No. 12-gauge steel. Jambs and mullions are 1-piece rolled steel sections. Sash members are heavy rolled steel sections, oxy-acetylene welded at the joints. No horizontal muntins are used unless specified. Heavy chains and roller bearing pulleys are used. Glazing angle frames are recommended. Wind shields may be added if desired. Sash will be made to bear underwriters' label if desired, at an extra cost.

Lupton Power House Sash (Patented and Patents Pending).

Has the following features:

(1) The mullions and imposts are of unusual width for architectural effect and are formed from No. 12-gauge steel plate.

(2) All the sash are pivoted, except those having curved heads.

(3) All the sash in each wall are usually operated simultaneously by Pond Operating Device. The frames are formed of No. 12-gauge steel plate. The sash members are heavy 1-piece rolled steel sections and are oxy-acetylene welded. All pivoted sash are double weathered.

Sizes are made to suit engineer's specifications.



POWER HOUSE
INSTALLATION

Lupton Counterweighted Sash (Patents Pending).

Each sash is balanced by its own pair of weights. Special weather tightness is assured by having sash run in sheet bronze weathering members attached to the jambs. Sash members are oxy-acetylene welded. Heavy chains and roller bearing pulleys are used. Glazing angle frames and suitable hardware are included.

Pond Continuous Sash (Patented by Clarke P. Pond and Patents Pending).

Used in monitors, side walls, Pond Truss and Pond A-frames, to give weather protected ventilation with mass control. See illustrations under Pond Truss.

Hung under a continuous overhanging angle. At the ends it overlaps rain-excluding stationary panels 2 ft. wide. Its 20-ft. sections are connected by expansion joints, which exclude weather while giving flexibility for faulty alignment of structural work.

All the members are rolled 1-piece sections, and are much heavier than ordinary factory sash. They are welded at all joints, making each section a permanently rigid unit and preventing glass breakage.

Pond Continuous Sash is controlled by Pond Operating Device, which gives exceptional width of opening with minimum applied power. See table.

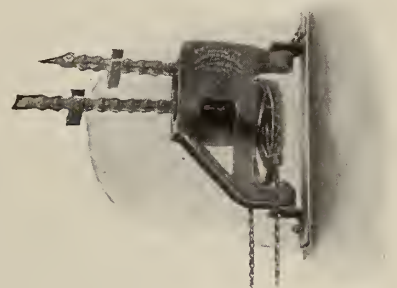
For factory buildings and power houses, Pond Continuous Sash is made in short lengths to fit window openings, and is operated in lines or groups as desired by Pond Operating Device.

OPENINGS FOR TOP-HUNG SASH CONTROLLED BY POND OPERATING DEVICE

No. 3 sash	3 ft. high	46°	28 in.
No. 4 sash	4 ft. high	47°	38 in.
No. 5 sash	5 ft. high	42°	43 in.
No. 6 sash	6 ft. high	36°	44 in.

Pond Operating Device (Patented by Clarke P. Pond and Patents Pending).

Pond Operating Device is guaranteed to open long lines of sash wider, with less friction and wear, than any other device. It works on the principle of tension transmission, and applies increasing leverage as the sash is raised. It may be used to control any form of sash in long lines; but its advantages are most conspicuous with top hung sash. Power is transmitted by 2 lines of steel rods, connected by chains operating over a sprocket at one end and an idler at the other. These rods actuate the sash arms through compound levers, the increasing leverage being due to the varying angles of the levers and sash arms.



POND OPERATING DEVICE WITH
HAND CHAIN

All hinged connections are bronze bushed.

The sprocket is driven by a worm gear and a hand chain. The worm gear is enclosed and runs in oil, hence has minimum friction and requires no attention.

For long lines of sash, a spiral and counterweight are advised in place of the idler pulley. The varying radius of the spiral balances the varying load of the sash.

Pond Operating Device, motor driven, is recommended for extra long lines, or for simultaneous control of several lines. It uses a 3-phase, 60-cycle alternating current motor, specially designed and furnished by this company.

Pond Truss (Patented by Clarke P. Pond).

For foundries and other industrial buildings, Pond Truss construction allows the use of 1-story buildings of practically unlimited width, with perfect light and ventilation throughout. If the building is of extreme width, two or more Pond Trusses in the roof are

arranged to alternate with Pond A-frames. The latter are lines of A-shaped frames, running the length of the building, on which Pond Continuous Sash are hung. Being located over the low sections between the Pond Trusses, they supply fresh air and light in all weathers.

In industries where certain processes, such as assembling, require unusual skill or many workers, a Pond Truss Roof on a multistory building gives ideal conditions for that work.

The use of Pond Truss is licensed where Lupton products are exclusively used. Its correct use is a matter of experience, and each roof is specially designed. This company should always be consulted before final plans are made.



GENERAL ELECTRIC CO., BUILDING NO. 5, ERIE, PA.

Building is 172 ft. wide, 800 ft. long, with Pond Truss roof, using Pond Continuous Sash, and Lupton Counterbalanced Sash in the side walls. East half has a gallery floor. Building was designed for making steam turbines

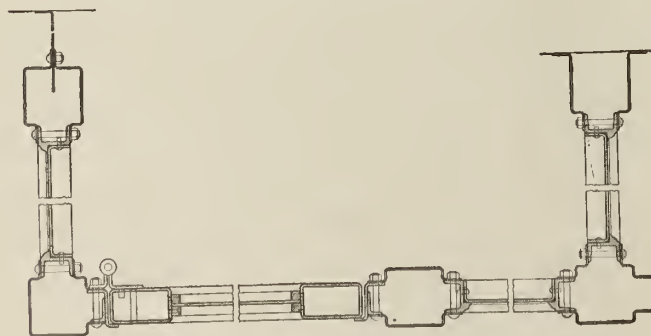
Lupton Steel Partition (Patents Pending).

SPECIAL—Lupton Special Steel Partitions consist of units of rolled steel members, set in and supported by heavy plate steel framing.

The units are of standard widths, 2, 4, and 6 ft. center to center of mullions, and 8, 9, 10, 11 or 12 ft. high. Each unit has a base of steel plate 4 ft. high; the upper part is glazed or filled with wire screen.

Mullions are set over and conceal standards secured to floor. Both mullions and head rails are formed of No. 14-gauge steel plate to receive partition units.

All units of like size are interchangeable.



LUPTON SPECIAL STEEL PARTITION

Horizontal section, showing interchangeability of section units, including door section. A door section may be moved, by interchanging it with a standard section

STANDARD—Lupton Standard Steel Partitions are made up of standard Lupton Factory Sash units, with channel instead of angle frame members, and with

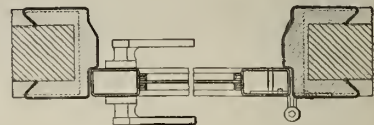
mullions of structural steel sections and formed plate. The doors are similarly made up from structural sections, welded to formed plate and welded at the corners. This type of partition is intended for factory and warehouse use, and units have a limited interchangeability.



AMERICAN EVER-READY CO., LONG ISLAND CITY, N. Y.
Lupton Steel Partition and Doors in office

Lupton Steel Tube Doors.

These are made with stiles of seamless rectangular steel tube, welded at the corners. The lower part of the door has a steel panel, and the upper part is filled with glass or a steel panel as desired. These doors are made in all sizes from partition doors up to craneway and locomotive doors, and in many styles suitable for factory or office use.



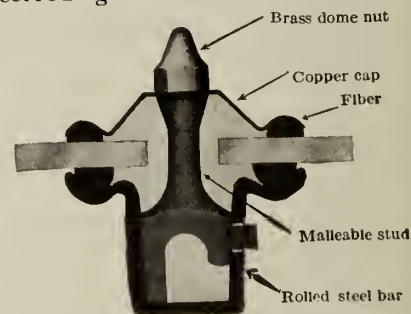
LUPTON STEEL TUBE DOORS
Horizontal section showing heavy formed steel jambs

Lupton Rolled Steel Skylight (Patented by Joah Brogden)

The construction of Lupton Rolled Steel Skylight prevents breakage of glass, leakage and corrosion. The glass is held between strands of specially saturated fiber, which permits some movement of the glass and eliminates leakage due to drying of putty. All exposed metal parts are non-corroding.

The cap is of copper, and both it and the bar are offset as required for the overlap of the lights.

Condensation is carried by the diagonal strands of fiber into the nearest bar, and drained to the roof by drip holes in the copper curb apron.



LUPTON STEEL SKYLIGHT
Showing skylight bar, stud and copper cap, also method of holding glass

Waldmire Louver (Patented).

Waldmire Louvers are made of No. 22-gauge galvanized Keystone metal. The slats are spaced 6 in. and are 10 ft. long, requiring vertical wood or steel supports on centers of 59½ in.

Literature.

No. 10 Catalogue.

Air, Light and Efficiency (on Factory Design).

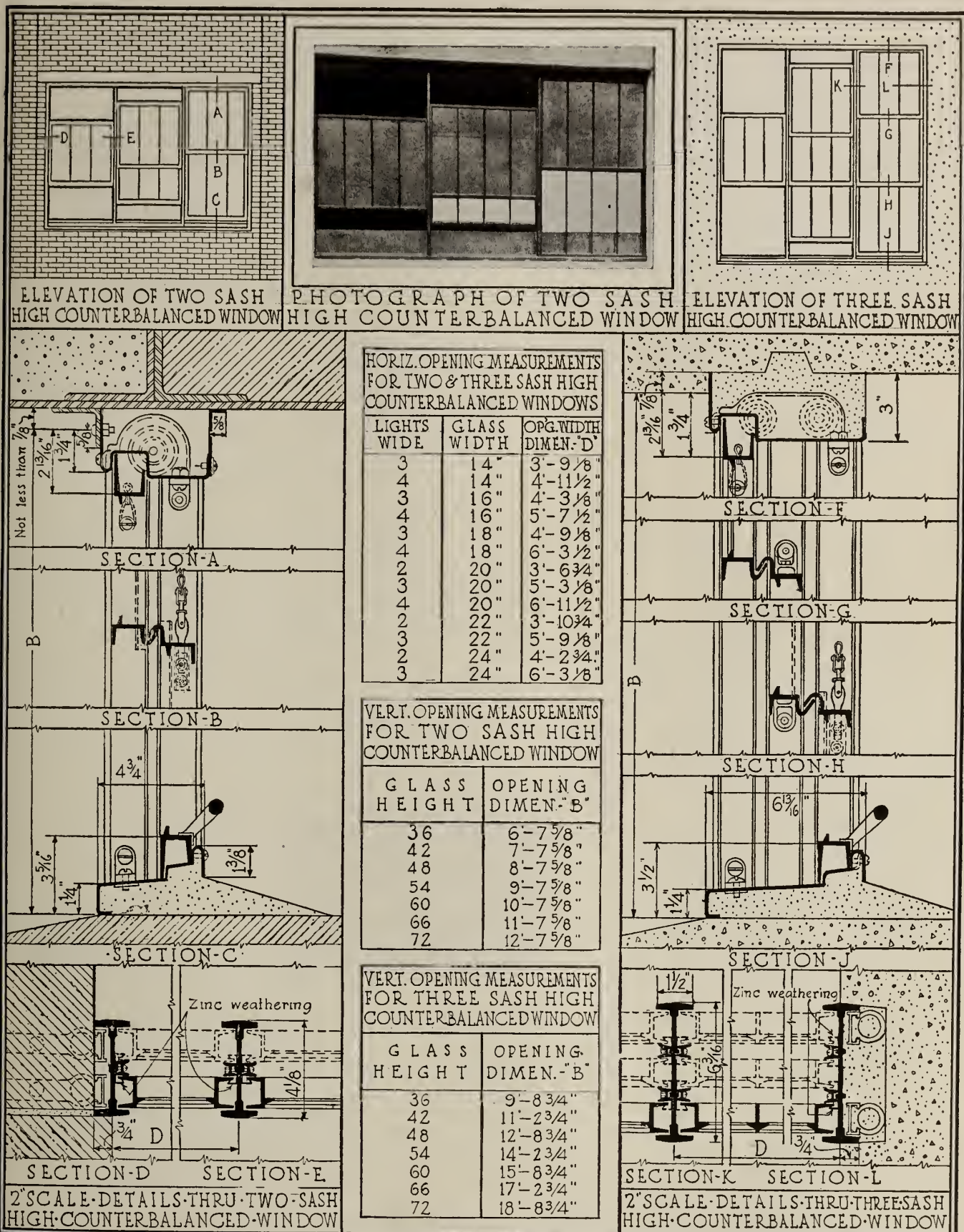
Air and Light in Foundries and Forge Shops.

Air and Light in Power Houses.

Lupton Steel Factory Equipment (Shelving, Trucks, etc.) for factories and warehouses.

Sent free on request.

Continued on next page

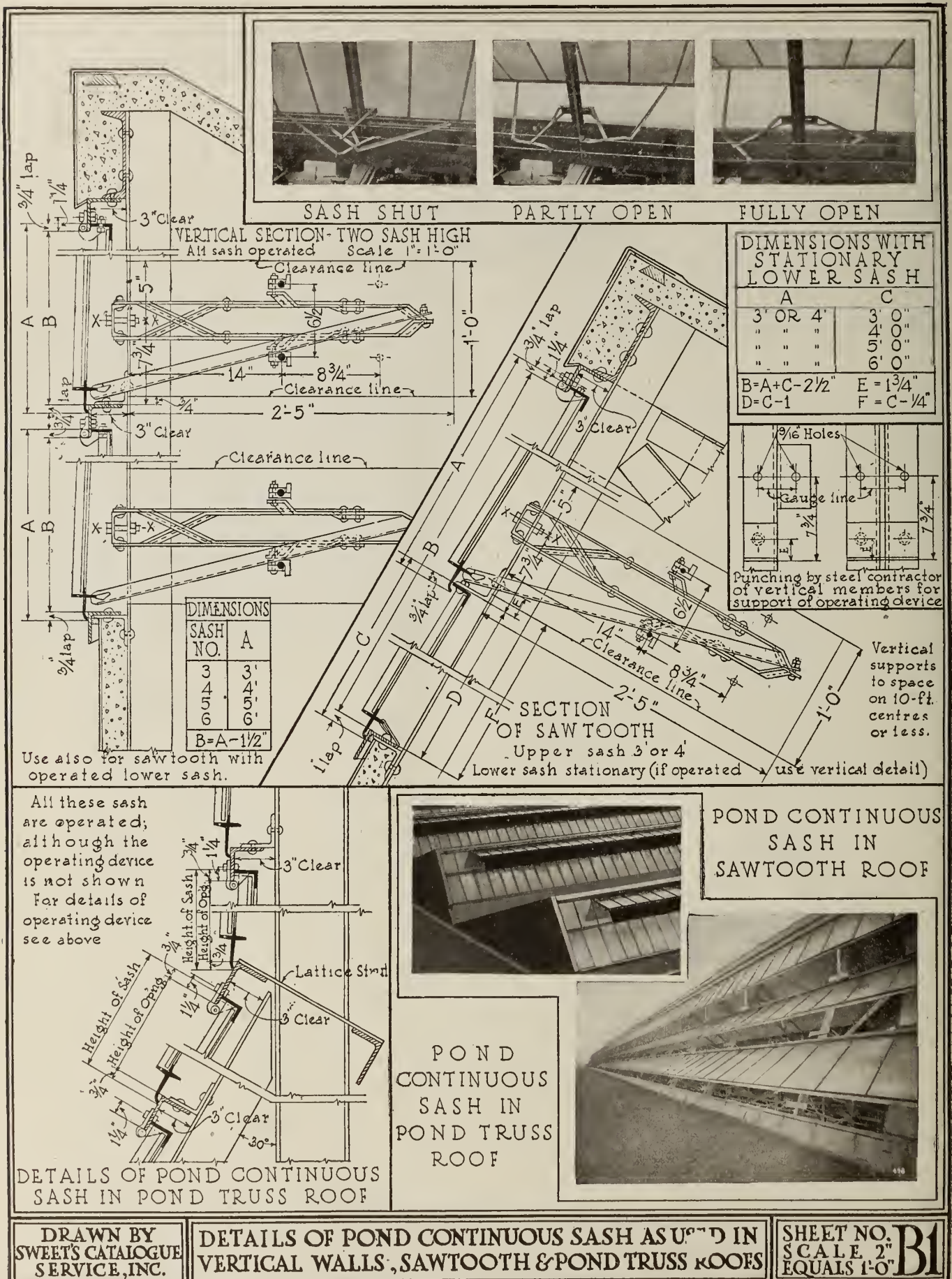


DRAWN BY
SWEET'S CATALOGUE
SERVICE, INC.

DETAILS OF LUPTON COUNTERBALANCED SASH
TWO SASH AND THREE SASH HIGH

SHEET NO. **A1**
SCALE 2"
EQUALS 1'-0"

IMPORTANT—Opening heights "B" depend on sash sections used. Write for data sheet showing current practice

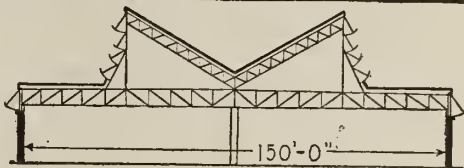
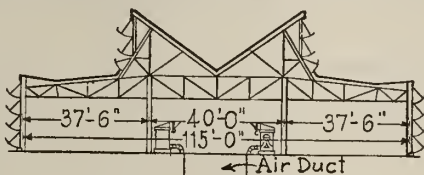
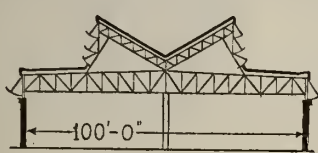


Roof openings measure 14, 16, etc., wide, to any even number of feet desired—no inches. Between pilasters, ends of sash overlap weathering formed by Lupton to suit engineer's specifications, and set in brickwork. Opening widths are 10, 12, 14, etc., even feet, plus 3 in.

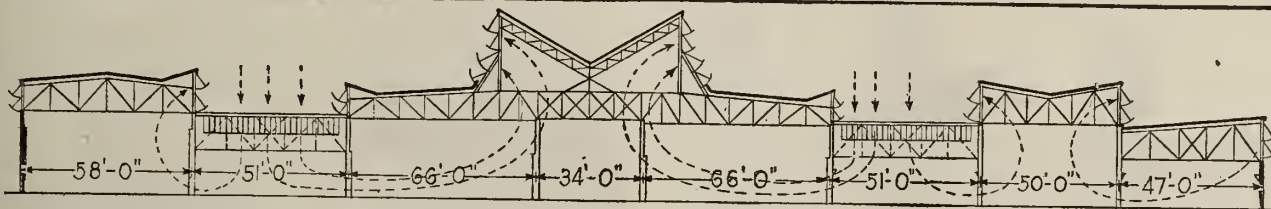


Pond Truss over Savage Arms Corporation Machine Shop, Philadelphia, Pa.

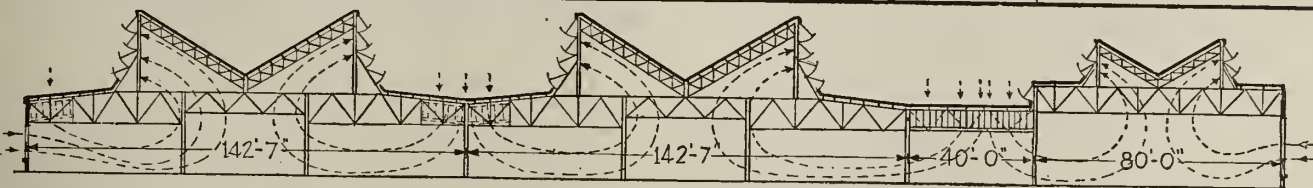
Pond Truss over Domestic Engineering Co. Building, Moraine (near Dayton) Ohio.



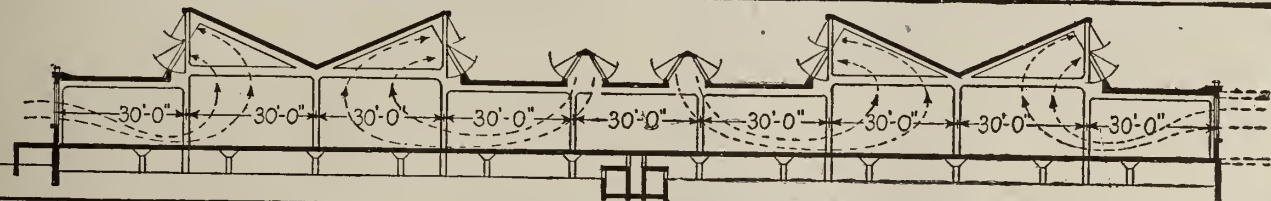
Sections showing the use of simple Pond Truss for ventilation and light.



Large Foundry: The dotted lines indicate how air enters at low sections in the roof and moves to areas where heat is produced.



Large Foundry: The dotted lines indicate how air enters at low sections in the roof and moves to areas where heat is produced.



Cross Section of Domestic Engineering Company's Building showing course of air currents. Two Pond 'A' Frames in center admit light and air.

IMPORTANT NOTE No attempt is made to give detailed information on these sections. The design of Pond Trusses for ventilation as well as light is an engineering problem to be solved for building.

DRAWN BY
SWEET'S CATALOGUE
SERVICE, INC.

SECTIONS SHOWING USE OF POND TRUSS
FOR VARIOUS TYPES OF BUILDINGS

SHEET NO.
NOT DRAWN
TO SCALE **C1**

THE BOGERT & CARLOUGH CO.

Manufacturers of Steel Sash, Doors and Partitions

PATERSON, N. J.

BRANCH SALES OFFICES
 NEW YORK, N. Y. BOSTON, MASS. PHILADELPHIA, PA. HARTFORD, CONN. NEW HAVEN, CONN.
 SYRACUSE, N. Y. BALTIMORE, MD. NORFOLK, VA. WILKES-BARRE, PA. RICHMOND, VA.
 REPRESENTED IN CANADA

Products.

BOCA SOLID STEEL SIDE WALL SASH.

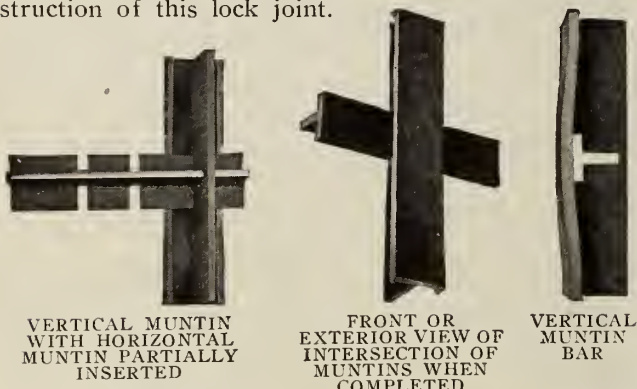
TOP HUNG and CENTER PIVOTED CONTINUOUS MONITOR SASH with Continuous Mechanical Operator.

BOCA TUBULAR STEEL DOORS and PARTITIONS.

Boca Solid Steel Sash.

Manufactured from heavy, specially rolled solid steel members, $1\frac{1}{4}$ in. in depth. These sash are adapted to all types of construction—industrial buildings, schools, office buildings, etc.—whether of brick, concrete, terra cotta, steel or wood.

PATENTED BOCA LOCK JOINT—Illustrations shown below indicate the rigid construction of this lock joint.



VERTICAL MUNTIN WITH HORIZONTAL MUNTIN PARTIALLY INSERTED

FRONT OR EXTERIOR VIEW OF INTERSECTION OF MUNTINS WHEN COMPLETED

VERTICAL MUNTIN BAR

The metal is not distorted and the surface has a smooth and neat appearance.

This joint produces a rigid sash that does not get out of square.

VENTILATORS—Equipped with specially patented 3-point weathering members.

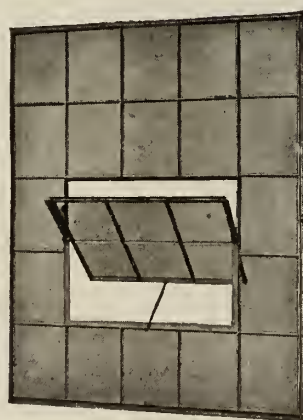
This 3-point contact is new and has proven its worth as a positive weatherproof and windproof feature.

A special section is supplied at head of ventilator, forming a drip.

GLASS FOR VENTILATORS—Glass must be trimmed $1\frac{1}{8}$ in. at top and sides, and $\frac{3}{4}$ in. at bottom of ventilators.

PUTTY CUSHION—The grooves in the vertical muntin bar afford the best conditions for back puttying the glass. The smooth putty cushion absolutely prevents leakage and protects the glass from the usual breakage.

GLAZING—Four special steel wire glazing clips are supplied for each light of glass. Glass is not included



SASH UNIT OPERATED BY PUSH BAR



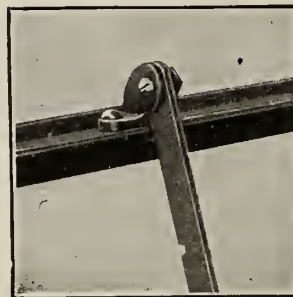
unless by special arrangement.

BOCA HINGE—This type of hinge permits a continuous weathering of ventilator, as the upper portion of weathering laps inside the lower.

HARDWARE—A notched push bar with attachment and catch for lower end are regularly supplied with sash. Other devices for operating ventilators, such as spring catch and chain, will be supplied where specified.



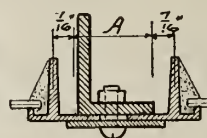
BOCA HINGE AND CLIP



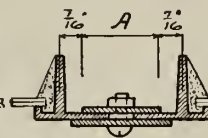
PUSH BAR ATTACHMENT



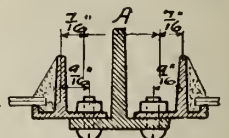
SPRING CATCH



Standard Mullion 107

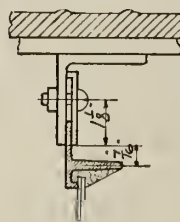


Special Mullion 108
BOCA MULLIONS



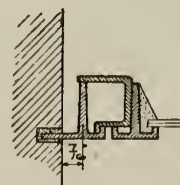
Standard Mullion 109

Mullion section 107	Dim. "A"	Mullion Section 108	Dim. "A"	Mullion Section 109	Dim. "A"
3 by 2-in. angle and 2-in. flat 2½ by 2-in. angle and 2-in. flat 2 by 1½-in. angle and 1½-in. flat	2 in. 2 in. 1½ in.	2 flats 2 in. wide 2 flats 1½ in. wide	2 in. 1½ in.	2½ by 2½-in. tee 2½ by 2½-in. tee 2 by 2-in. tee	2 in. 1½ in. 1½ in.



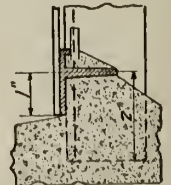
SECTION AT HEAD (STEEL)

Angle under lintel provided with $\frac{3}{8}$ -in. holes, 1 ft. 6 in. centers (by others)



SECTION AT JAMB (BRICKWORK OR TERRA COTTA)

Showing sash built in joint of brick



SECTION AT SILL (CONCRETE)

Finished sill formed after sash is set

Designs, suggestions and prices will be sent on receipt of the necessary details and information.

DETROIT STEEL PRODUCTS COMPANY

Manufacturers of Solid Steel Windows

2250 East Grand Boulevard

DETROIT, MICH.

BOSTON

NEW YORK
BUFFALO

PHILADELPHIA
NEWARK

WASHINGTON
RICHMOND

CHICAGO
BALTIMORE

SAN FRANCISCO
HARTFORD

Branch Offices and Distributing Agents in all Principal Cities

Products.

The FENESTRA LINE of SOLID STEEL WINDOWS: Standard Horizontally Pivoted Sash for side walls and monitors; Counter-balanced Sash; Center Pivoted Continuous Sash and Top Hung Continuous Sash.

Fenestra Mechanical Operator for continuous sash; and 1-in. Worm and Gear for standard pivoted sash.

Fenestra Stock Sash.

Thirty types and sixty sizes of Fenestra solid steel windows are carried in stock. These types are listed below and can be obtained in either Y—12 by 18-in. or Z—14 by 20-in. glass sizes. Representatives in any of the cities listed above will gladly help to secure the most practical and economical layout.

2 PANES HIGH Y Height 3'1½" Z Height 3'3½" 32 32160	33 33161	42 42180	52 52160
3 PANES HIGH Y Height 4'8" Z Height 5'2" 33 33161	43 43181	53 53161	
4 PANES HIGH Y Height 6'2½" Z Height 6'10½" 34 34161	44 44181	54 54161	
5 PANES HIGH Y Height 7'8½" Z Height 8'6½" 35 35161	45 45181	55 55161	
6 PANES HIGH Y Height 9'3½" Z Height 10'3½" 36 36161	46 46181	56 56161	
3 PANES WIDE Y Width 3'2" Z Width 3'8" 36 36161	4 PANES WIDE Y Width 4'2½" Z Width 4'10½" 46 46181	5 PANES WIDE Y Width 5'2½" Z Width 6'0½" 56 56161	

Y=12"x18" Glass. Combine Y Widths with Y Heights
Z=14"x20" Glass. Combine Z Widths with Z Heights

CHART OF FENESTRA WAREHOUSE SASH

Fenestra Specifications.

All windows to be of Fenestra solid steel type, as manufactured by the DETROIT STEEL PRODUCTS COMPANY, Detroit, Michigan.

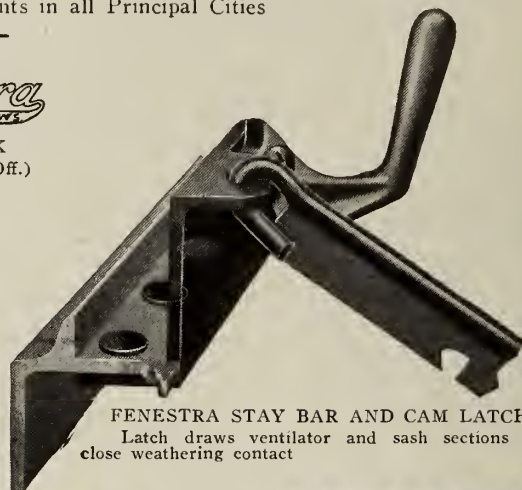
All sash muntin bars to be 1½ in. deep and to be made of rolled solid steel sections. No more than 20% of the cross-sectional area of both muntin bars to be cut out at each intersection of the vertical and horizontal bars.

All ventilators to be hung on external adjustable butts riveted to the vertical bars and the weathering of sash and ventilators.

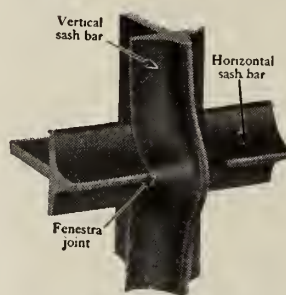
All ventilators to be provided with a cam handle locking device; those within reach of the floor with notched stay bar and all others with chain and cleat for holding the vent open at any angle.

T-bar mullion shall be used between units where more than one unit of sash is used in an opening.

Fenestra
SOLID STEEL WINDOWS
TRADE-MARK
(Reg. U. S. Pat. Off.)

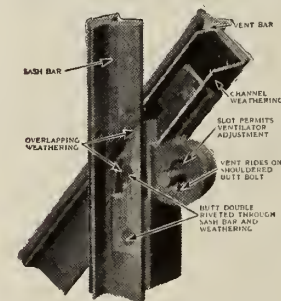


FENESTRA STAY BAR AND CAM LATCH
Latch draws ventilator and sash sections into close weathering contact



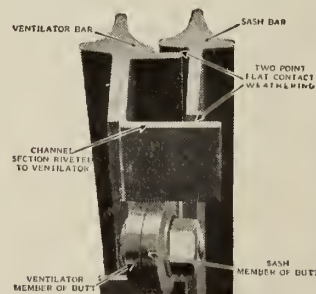
PATENTED INTERLOCKING FENESTRA JOINT

Retains 80% of the combined section of the two bars at point of intersection

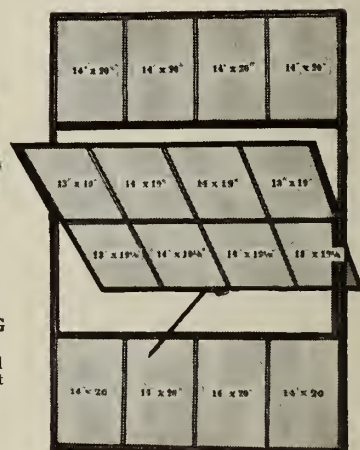


EXTERNAL ADJUSTABLE FENESTRA BUTT

Strongly attached by being double riveted through the sash bar and weathering



FENESTRA DOUBLE FLAT SURFACE CONTACT
Insures efficient weathering



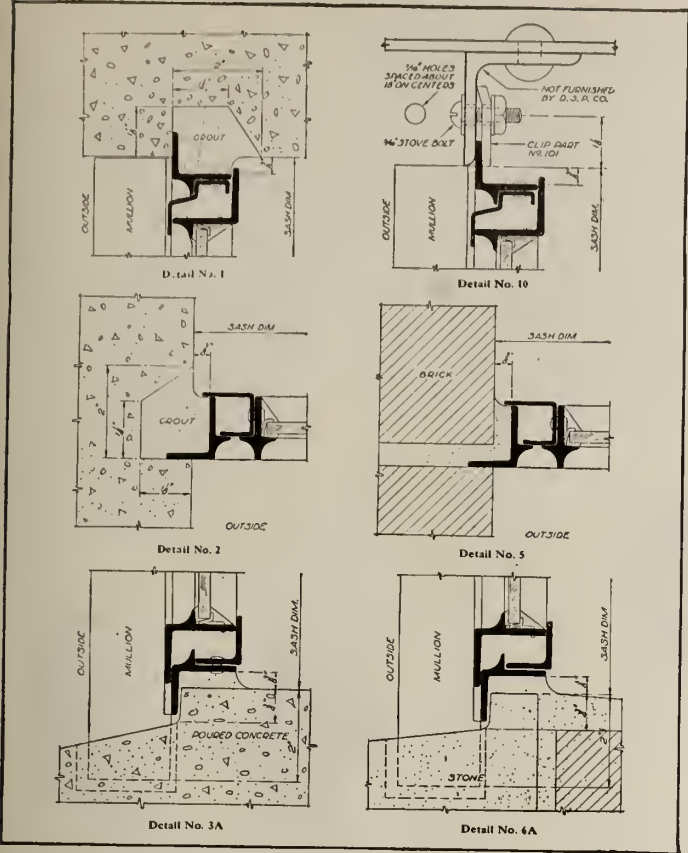
TYPICAL FENESTRA SOLID STEEL WINDOW

Ventilator lights which abut on top or side must be trimmed 1 in. along abutting edge. Ventilator lights which abut on sill must be trimmed ¾ in. along abutting edge

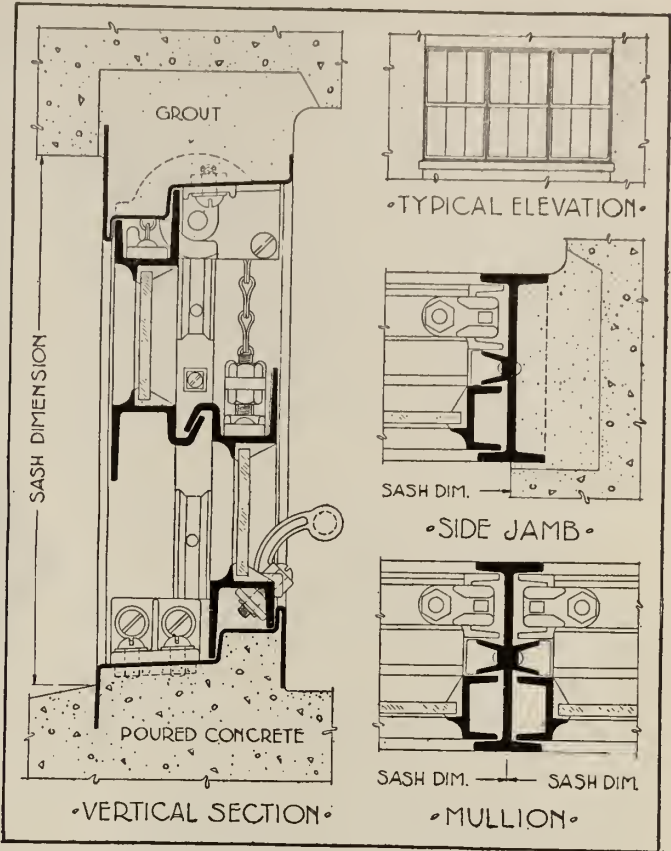


T-BAR MULLION

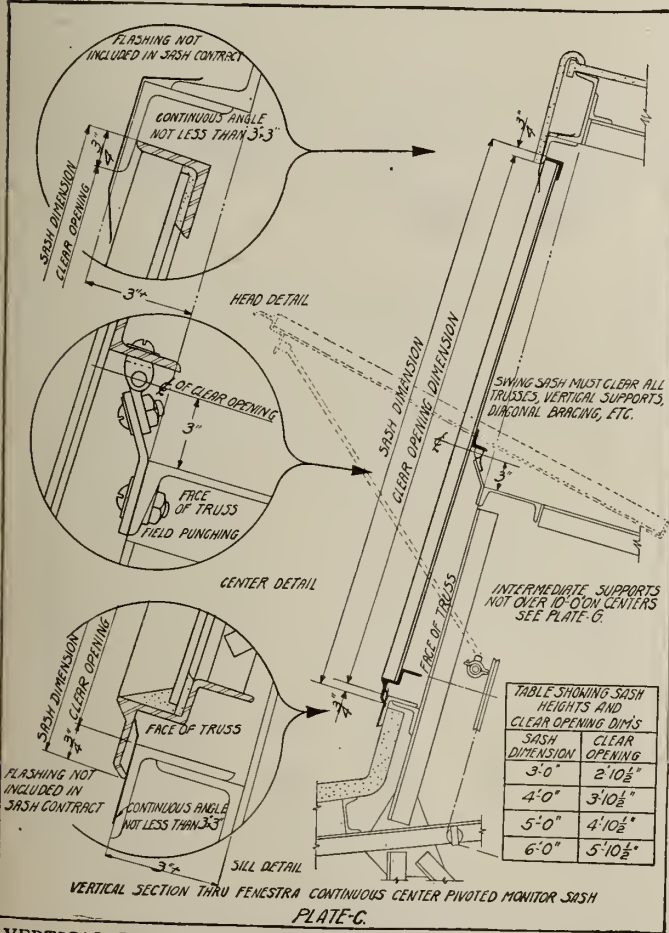
Used as standard in combining two or more units of Fenestra sash. Insures good weathering and rigidity



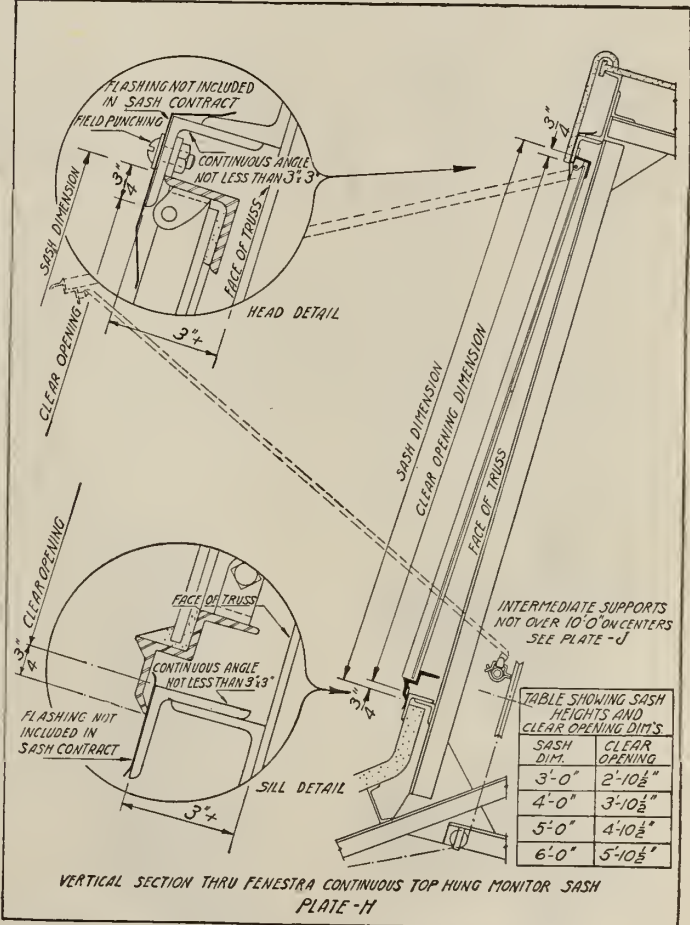
HORIZONTAL AND VERTICAL SECTIONS THROUGH FENESTRA HORIZONTALLY PIVOTED SASH



INSTALLATION DETAILS OF FENESTRA COUNTERBALANCED SASH



VERTICAL SECTION THROUGH FENESTRA CONTINUOUS CENTER PIVOTED MONITOR SASH



VERTICAL SECTION THROUGH FENESTRA CONTINUOUS TOP HUNG MONITOR SASH

TRUSCON STEEL COMPANY

(TRUSSED CONCRETE STEEL COMPANY)

Manufacturers of Steel Windows

YOUNGSTOWN, OHIO

REPRESENTATIVES IN THE FOLLOWING CITIES

ATLANTA, GA.
BALTIMORE, MD.
BIRMINGHAM, ALA.
BOSTON, MASS.
CHICAGO, ILL.
CINCINNATI, OHIO
CLEVELAND, OHIO
COLUMBUS, OHIO
DALLAS, TEX.
DAYTON, OHIO

DENVER, COLO.
DETROIT, MICH.
EL PASO, TEX.
INDIANAPOLIS, IND.
KANSAS CITY, MO.
LOS ANGELES, CAL.
LOUISVILLE, KY.
MEMPHIS, TENN.
MILWAUKEE, WIS.

MINNEAPOLIS, MINN.
NEW ORLEANS, LA.
NEW YORK, N. Y.
NORFOLK, VA.
OKLAHOMA CITY, OKLA.
OMAHA, NEBR.
PHILADELPHIA, PA.
PITTSBURGH, PA.
PORTLAND, ORE.

ROSWELL, N. M.
ST. LOUIS, MO.
SALT LAKE CITY, UTAH
SAN ANTONIO, TEX.
SAN FRANCISCO, CAL.
SEATTLE, WASH.
SPOKANE, WASH.
SYRACUSE, N. Y.
TOLEDO, OHIO
WASHINGTON, D. C.

Products.

All types of TRUSCON STEEL WINDOWS, including Pivoted Side Wall Sash, Continuous Sash, Sliding Sash, Partitions, Doors, etc.

For Standard Buildings, see page 28; for Reinforcing Steel and Metal Lath, see pages 184-86.

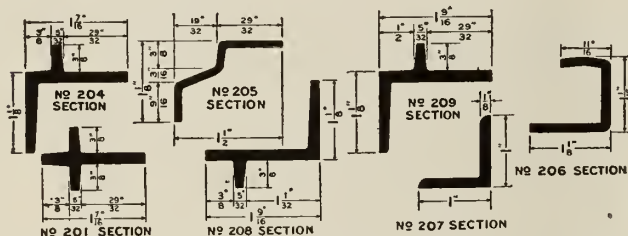
Service.

This company's specialists co-operate fully with engineers, architects, owners and contractors in selecting the proper window for any condition.

Truscon Steel Windows (Pivoted Types.)

For industrial and commercial buildings.

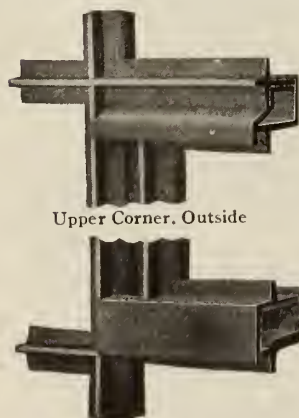
SECTIONS—Deep, heavy, solid, one-piece, rolled, new billet steel sections. They are weatherproof and on good architectural lines.



SECTIONS USED IN PIVOTED TYPES OF TRUSCON STEEL WINDOWS

- No. 201—Interior vertical and horizontal muntin bars.
- No. 204—Vertical and horizontal outside bars.
- No. 205—Weathering section of window frame above ventilator.
- No. 206—Weathering section at both jambs of ventilators.
- No. 207—Angle section of window frame below ventilator.
- No. 208—Upper bar of ventilator.
- No. 209—Lower bar of ventilator.

VENTILATORS—Continuous double contact weathering; deep, heavy sections at top and bottom form drip.



Upper Corner, Outside

Lower Corner, Outside

VENTILATOR



Inside View at Pivot



TRADE-MARK

JOINT—Horizontal and vertical muntin joints have dovetailed miter interlocking the bars, accurately formed by machine dies and assembled with a driving fit.

GLAZING—Each light held by four special spring steel wire glazing clips, each of

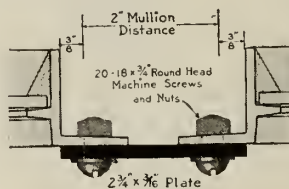
which supports the glass at two points. Sufficiently elastic to absorb vibration shocks. Glass must be thoroughly bedded in Truscon steel sash putty and neatly face puttied.



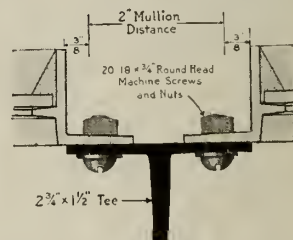
JOINT



SPRING STEEL WIRE GLAZING CLIP



Type T1 Mullion



Type T2 Mullion

DIMENSIONS MULLION BARS

T1, mullions are used with windows less than 6 ft. 3 in. high
T2, mullions are used with windows from 6 ft. 3 in. to 13 ft. 10 1/2 in. high

STOCK UNITS OF TRUSCON PIVOTED WINDOWS—Pivoted windows are carried in warehouse stock in 30 types, each in 2 glass sizes 12 by 18 in. and 14 by 20 in., meeting practically all building requirements. Their use insures quick shipment, low cost and speedy building.

STANDARD UNITS OF PIVOTED WINDOWS—Large quantities of finished ventilators and machined muntin bars are carried in stock ready to be made up into standard units. These are stocked in 2 glass sizes: 12 by 18 in. and 14 by 20 in. Ventilators are stocked in 3 sizes: 4, 6 and 8 lights. The standard members are assembled to meet particular requirements of each building operation.

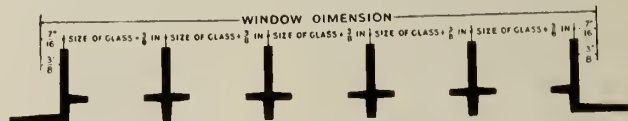


DIAGRAM FOR COMPUTING WINDOW DIMENSIONS FROM GLASS SIZES

Width or height dimension of a single window is the same as width or height of window opening. These dimensions may be computed from glass sizes by the following formula:

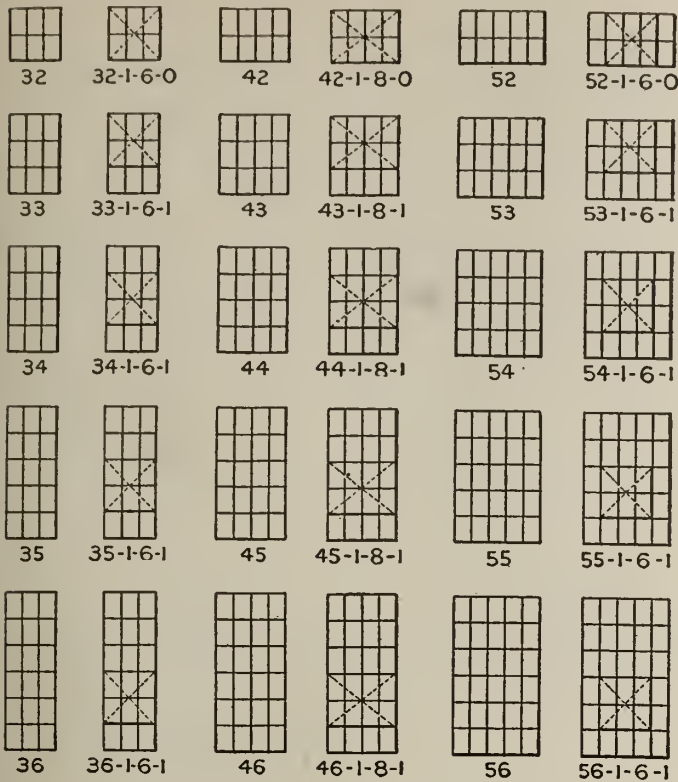
$$W = n(s + \frac{3}{8} \text{ in.}) + \frac{7}{8} \text{ in.}$$

where n = number of lights

s = size of light; W = width or height of window

For window opening containing more than one unit add together dimensions of units as computed above plus mullion distances.

Continued on next page



STOCK UNITS OF TRUSCON STEEL WINDOWS

Ventilators (indicated by crossed dash lines) are horizontally pivoted 2 ins. above center.

IMPORTANT NOTE—Stock units are made in 2 glass sizes: 12 by 18 in. and 14 by 20 in. The 12-in. width of glass can be used only with 18-in. height of glass; 14-in. width of glass can be used only with 20-in. height of glass. For any one window opening, 12 by 18-in. glass sizes can not be combined with 14 by 20 in.

HEIGHTS OF WINDOW OPENINGS USING STOCK UNITS

Heights of openings		Lights high
12" x 18" glass	14" x 20" glass	
3'-1 1/8"	3'- 5 5/8"	2
4'-8"	5'- 2"	3
6'-2 3/8"	6'-10 3/8"	4
7'-8 3/8"	8'- 6 3/8"	5
9'-3 1/8"	10'- 3 1/8"	6

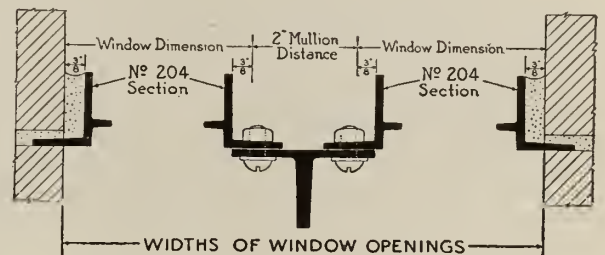
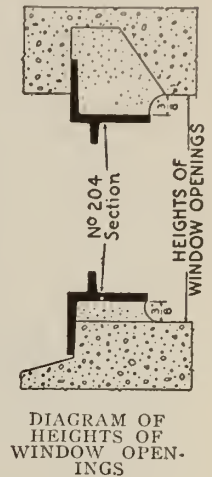
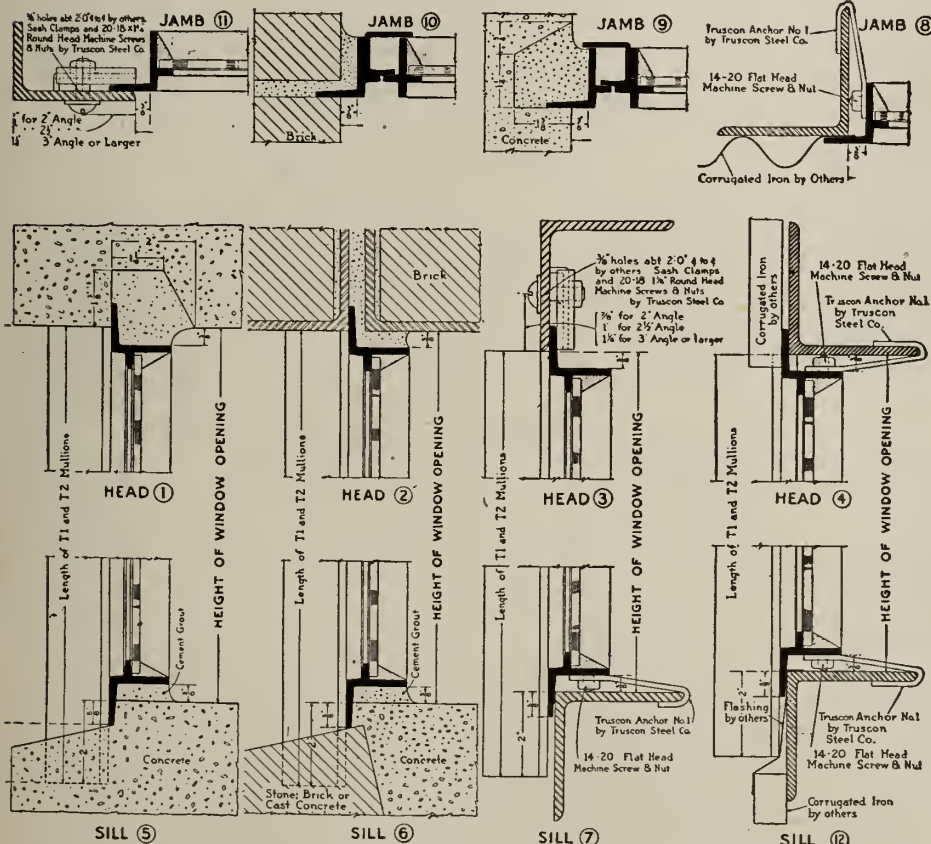


DIAGRAM OF WIDTHS OF WINDOW OPENINGS



Concrete Sills and Lintels Steel Lintels and Masonry Walls Structural Steel Structural Steel with Corrugated Iron Sidings

DETAIL OF TYPICAL CONNECTIONS

WIDTHS OF WINDOW OPENINGS USING STOCK UNITS

Widths of openings		Lights wide	Units	Mullion Distance
12" x 18" glass	14" x 20" glass			
3'- 2"	3'- 8"	3	1	.....
4'- 2 3/8"	4'-10 3/8"	4	1	.....
5'- 2 3/8"	6'- 0 3/8"	5	1	.....
6'- 6"	7'- 6"	6	2	2"
8'- 6 3/4"	9'-10 3/4"	8	2	2"
9'- 10"	11'- 4"	9	3	2"
10'- 10 1/2"	12'- 3 1/2"	10	2	2"
10'-10 3/8"	12'- 6 3/8"	10	3	2"
11'-10 3/4"	13'- 8 3/4"	11	3	2"
11'-10 3/8"	13'- 8 3/8"	11	3	2"
12'-11 1/8"	14'-11 1/8"	12	3	2"
13'- 2"	15'- 2"	12	4	2"
13'-11 1/2"	16'- 1 1/2"	13	3	2"
13'-11 3/8"	16'- 1 3/8"	13	3	2"
14'-11 3/8"	17'- 3 3/8"	14	3	2"
15'- 2 3/8"	17'- 6 3/8"	14	4	2"
16'- 0 1/4"	18'- 6 1/4"	15	3	2"
16'- 6"	19'- 0"	15	5	2"
17'- 3 1/2"	19'-11 1/2"	16	4	2"
17'- 6 3/8"	20'- 2 3/8"	16	5	2"
18'- 6 3/8"	21'- 4 3/8"	17	5	2"
18'- 6 3/8"	21'- 4 3/8"	17	5	2"
19'- 4 3/8"	22'- 4 3/8"	18	4	2"
19'- 7 1/8"	22'- 7 1/8"	18	5	2"
19'- 10"	22'-10"	18	6	2"
20'- 7 1/8"	23'- 9 1/8"	19	5	2"
20'- 7 1/2"	23'- 9 1/2"	19	5	2"
21'- 5"	24'- 9"	20	4	2"
21'- 7 7/8"	24'-11 7/8"	20	5	2"
21'-10 3/8"	25'- 2 3/8"	20	6	2"
22'- 8 1/8"	26'- 2 1/8"	21	5	2"
22'- 8 1/8"	26'- 2 1/8"	21	5	2"
23'- 8 3/8"	27'- 4 3/8"	22	5	2"
23'-11 1/2"	27'- 7 1/2"	22	6	2"
23'-11 1/2"	27'- 7 1/2"	22	6	2"
24'- 9"	28'- 7"	23	5	2"
24'- 9"	28'- 7"	23	5	2"
25'- 9 3/8"	29'- 9 3/8"	24	5	2"
26'- 0 1/4"	30'- 0 1/4"	24	6	2"

Other Types of Sash.

The complete line of Truscon Steel Windows includes pivoted windows, continuous sash, counterbalanced sliding sash, steel and glass partitions, steel doors, steel fire windows and special types.

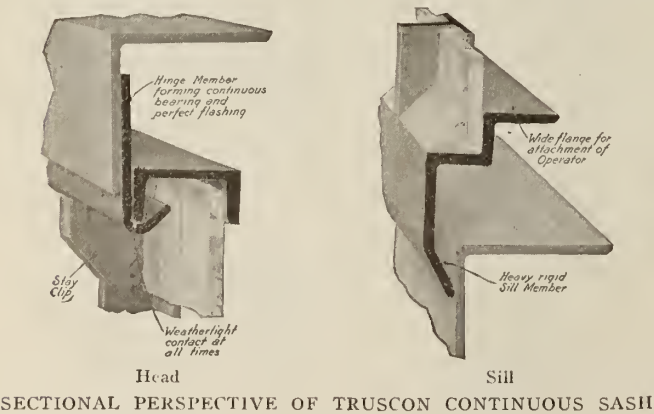
Truscon Continuous Sash.

For monitors and sawtooth roofs. Improved method of support which consists of a continuous bearing, thereby eliminating the old style hinges which only supported the sash at wide intervals. There are no openings above the sash for rain or snow to enter as the contact is absolutely weathertight. This continuous bearing distributes the weight of the sash evenly throughout its length, thus increasing its rigidity and ease of operation. At the end of a run of continuous sash perfect weathering is obtained by the combination of fixed and storm panels. A storm panel is placed behind each end light of the swinging sash, and thus prevents rain or snow from blowing in.

SECTIONS—Formed of solid rolled sections of highest grade steel, being abundantly heavy to stand any strain to which a sash would be subjected. The supporting member which is attached to the building is especially formed of heavy steel, providing accurate bearing and perfect flashing for the sash. The top member of the sash is of a heavy channel section, of which the outside flange bears evenly on the supporting member. The sill member is of special design with a wide projecting flange to insure greatest rigidity in the sash and to provide for the attachment of the operator. Formed with a bent flange to provide a weathertight contact at the sill. The vertical muntins are T sections, and the vertical end members are angle sections, all of ample weight. The storm panel is made of heavy solid members of the same construction as the sash. The connection with the fixed steel panel is weathertight, the swinging sash has a continuous contact weathering, and a drip sill is provided in the storm panel itself, thus giving thorough protection against the severest rains and storms.

As an additional safeguard, occasional stay-clips are rigidly attached to the vertical muntins to prevent displacement of the sash through misuse. JOINTS—The assembling of these members is by means of mortise and tenon joints, accurately punched and fitted. All joints are welded into a solid unit by the oxy-acetylene process to insure a connection of unquestioned strength and weathertightness.

SIZES—Truscon continuous sash are made in stand-

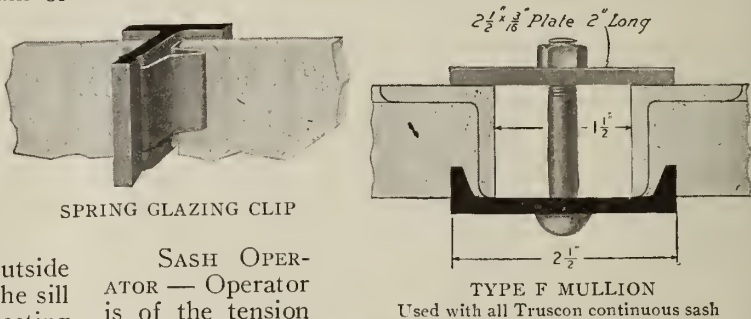


ard heights as shown in the table below. The units are designed for a truss spacing of 20 ft. on centers. The various units, however, can be combined to fit any length of run.

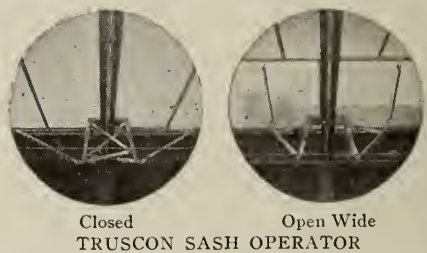
DATA, TRUSCON CONTINUOUS STEEL SASH

Sash number	Height of sash, ft.	Height of opening, ft. in.	Glass size, in.
3	3	2 10 1/2	23 3/4 x 32 3/4
4	4	3 10 1/2	23 3/4 x 44 3/4
5	5	4 10 1/2	23 3/4 x 56 3/4
6	6	5 10 1/2	23 3/4 x 68 3/4

GLAZING—Truscon continuous sash are glazed by means of heavy spring clips as illustrated. Note particularly that these clips are so designed as to give a substantial bearing—approximately 1 in. in width—against the sash as well as the glass. The glass should be bedded in Truscon Sash Putty, and face puttied along the bottom section. No face putty is required at the sides or top.



SASH OPERATOR — Operator is of the tension type, with lever arms, continuous connecting rods and operating station. Toggle arrangement of operating arm gives 60% to 100% additional power.



DATA, SASH OPERATOR

Sash number	Height of sash, ft.	Opening, degrees	Opening, in.
3	3	45	28
4	4	45	37
5	5	42	43
6	6	36	44

Counterbalanced Truscon Steel Windows.

In Truscon sliding windows the lower sash is counterbalanced against the upper. The outside members are especially heavy sections of rolled steel welded at the corners, thus giving the sash exceptional rigidity and ease of operation. Counterbalanced windows are furnished in 2 types: TYPE G—Consisting of 2 sash to a window, one balanced against the other, giving a maximum ventilation of 50%. TYPE H—Consisting of 3 sash, the center third of which is fixed while the upper and lower sash are balanced against each other, giving a maximum ventilation of 66 2/3%.



THE AEROSHADE COMPANY

Ventilating Window Shades

193 Oakland Avenue
WAUKESHA, WIS.

Products.

AEROLUX VENTILATING WINDOW SHADES for factories, offices, stores, schools, public buildings, living porches, sun parlors and sleeping porches.

AEROLUX
VENTILATING WINDOW SHADES
TRADE-MARK

Construction.

All Aerolux Shades are constructed from a splint fabric composed of tough, weather resisting linwood splints which are woven together with a hard twist seine twine. The shades are adjusted by means of cords and pulleys.

Advantages.

Aerolux Shades have these advantages:

They admit a good working light. Exclude the sun's direct rays. Diminish glass intensified heat.

Permit ventilation even when the shade entirely covers the window.

Are durable enough to withstand many years of hard industrial usage with no expensive upkeep or replacements.

A well diffused working light is admitted through the spaces, the splint edges operating as hundreds of miniature reflectors in spreading an indirect light throughout the room. When the windows are opened these spaces also permit ventilation.

Such a system of shading not only raises the standards of workmanship through its provisions for a soft, well diffused and restful working light, but, because the temperature of sun-exposed workshops may be reduced from 10° to 15° and an ample supply of fresh outside air admitted, employees work with greater comfort and production is thereby increased.

There is no sun-ruined merchandise and no time is lost changing mechanical adjustments which are disturbed by great heat variations.

Types.

For factory use the three types of shades most commonly employed are those illustrated.

SINGLE TYPE WITH REGULAR HANGINGS—Equipped to hang at the top and roll up from the bottom. May be used wherever the shades hang far enough away from the windows to clear opened ventilators without interfering with workmen.

SINGLE TYPE WITH TOP DROP—Especially adapted to very wide rooms. Workers close to the windows are protected from sun's heat and glare without cutting off light farther back in the room. The shades will also cover the entire window or roll clear to the top as desired.

DUPLEX TYPE—A type to use where open ventilators extend inside of wall line and where shades must occupy a minimum of room space. Upper section clears ventilator but does not interfere with workers or machines. The two sections operating independently permit any desired lighting effect.

For schools, offices and stores a somewhat finer fabric is used than in factory shading but the lighting and ventilating effects are equally satisfactory.

Service.

Efficient window shading is often more complex than appears on the surface and our service department with several years of industrial shading experience is ready to assist in solving problems.



Single Type, Regular Hangings



Single Type, Top Drop



Duplex Type
AEROLUX VENTILATING WINDOW SHADES

LORD & BURNHAM COMPANY

Manufacturers of Sash Operating Apparatus for Hinged and Pivoted Sash
IRVINGTON-ON-HUDSON, N. Y.

Products.

CONTINUOUS SASH OPERATING APPARATUS in various styles and sizes for Operating Hinged and Pivoted Sash in factories, foundries, car barns, roundhouses, powerhouses, machinshops, steamers, banks, churches, prisons, greenhouses, etc.; TRANSOM OPERATORS for Heavy Transoms in such places as store fronts, hotels, public buildings, etc.

Sash Operating Apparatus.

We make three distinct types of apparatus. There is hardly a sash operating requirement that can not be met satisfactorily by one of them. In cases, however, where unusual conditions make it desirable, we will make such modifications in our standard type as are necessary to meet requirements in the most efficient manner.

Rocker Shaft Apparatus.

For short and medium length runs. Arms are attached to shaft that act directly on sash, through suitable rods. Self-locking at any point. No complicated mechanisms. Easy to erect and simple and easy to operate.

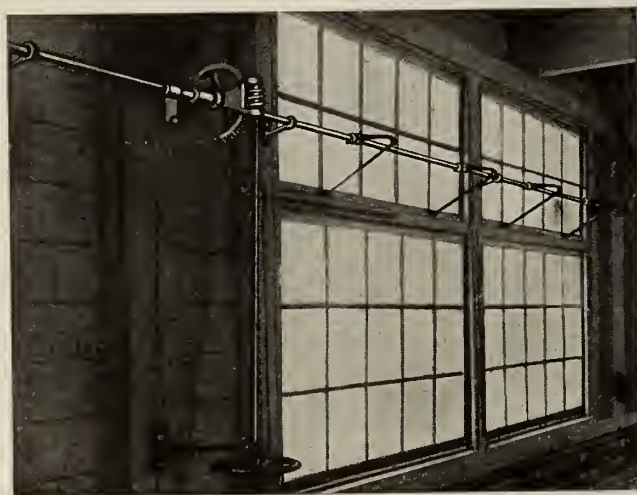


FIG. 1. ROCKER SHAFT APPARATUS

The worm gear mounted in a yoke and collar imparts the rocker motion to the shaft. This motion is transmitted to the sash by means of arms and rods, the arms being attached to the shaft and the rods to the sash by means of small rod hangers

Rack and Pinion Apparatus.

Particularly adapted to long runs of heavy hinged sash. The direct horizontal thrust given to sash, by racks running over the shoulders of the pinions, minimizes the leverage which reduces the torsion. Its simplicity is a strong point in its favor.

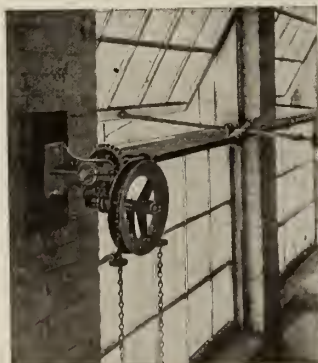


FIG. 2. RACK AND PINION APPARATUS

Tension Lever Apparatus.

We advocate the use of this type of apparatus on runs of over 140 ft. in length. It consists of two rods moving in opposite directions, a few inches in front of sash. There is minimum friction and minimum backlash throughout. It is light, yet strong.



FIG. 3. TENSION LEVER APPARATUS

The two tension rods move horizontally in opposite directions a few inches in front of sash. The gear power consists of standard worm gear and sprocket wheels. At other end from gear power is an idle pulley, over which runs chain connecting ends of rod to reverse their motion

Transom Operators.

Adapted to the opening and closing of any transom sash. Consists of 2 miter gears enclosed in metal box. Hub of horizontal gear is threaded and engages with a threaded vertical steel rod, which has a vertical movement as threaded miter gear is turned. Powerful, smooth running and non-sticking. Self-locking at any point. Simple and neat in appearance.

FIG. 4
DETAIL
OF
TRAN-
SOM
OPER-
ATOR



FIG. 5. TRANSOM OPERATOR

By means of suitable arms and rods motion is transmitted from vertical rod to the transom through a rocker shaft in heavier forms of transom operators and directly by bent steel rod in lighter forms

Estimates and Co-operative Service.

On receipt of data giving description of sash and surrounding construction, the designing department will gladly submit sketches, suggestions and estimates for furnishing either standard or specially designed apparatus to exactly meet individual conditions; also estimates for erecting the apparatus.

Catalogue.

Our Catalogue illustrates and describes more fully our types of sash operating apparatus. It will be sent on request.

METALLIC SASH-OPERATOR CO.

23rd and Chestnut Streets
ST. LOUIS, MO.

CHICAGO REPRESENTATIVES: UNIVERSAL STEEL PRODUCTS COMPANY, 939-40 Webster Building

Products.

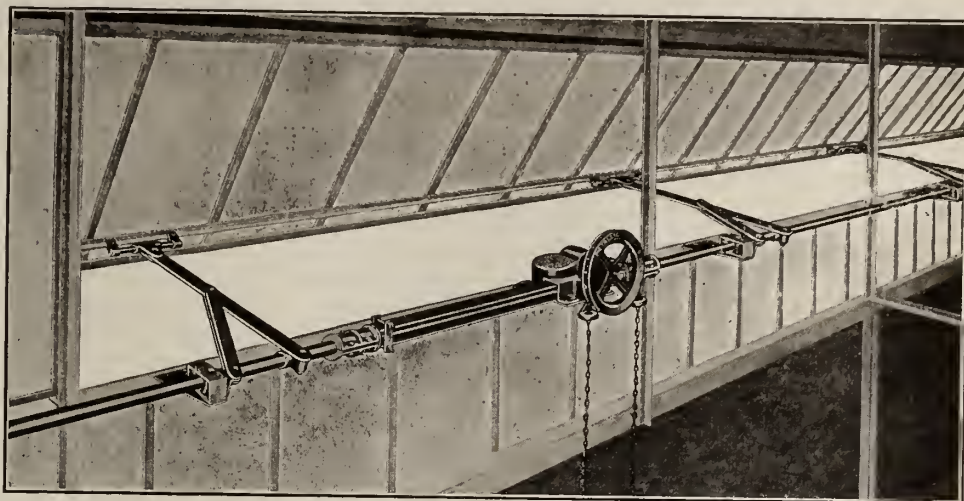
GEARED SASH OPERATORS.

Adaptability.

A complete line of these devices is manufactured by the company, to control any style or arrangement of solid steel, sheet metal or wood sash.

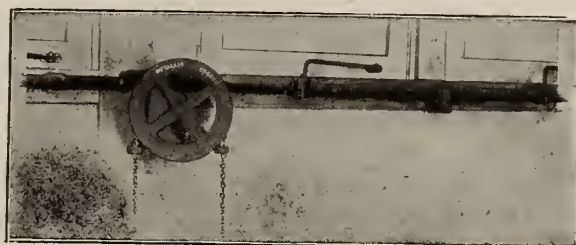
Co-operative Service.

A fully equipped engineering organization will, without charge, co-operate with engineers, architects, etc., in designing most economical and efficient sash operating equipment for individual or special installation anywhere. Inquiries are solicited. Further information, catalogues and *full sized details* furnished on request.



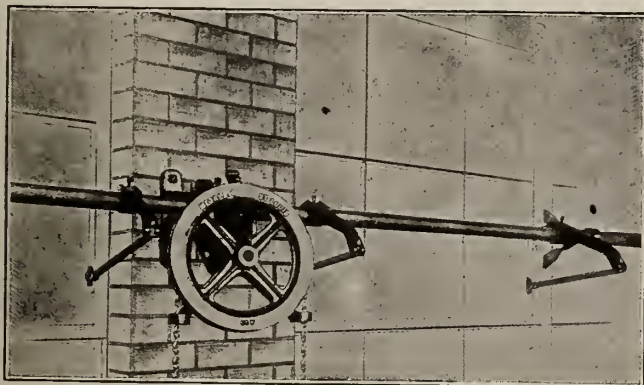
TENSION SASH OPERATOR, STYLE NO. 9

Designed for heavy top hung or continuous sash, or center pivoted sash in long runs. Construction of gear stations provides that shaft may twist at will without causing a binding action in rack and gear; thrust ball bearings reduce friction; erection costs are minimized by reason of simplicity of design. Made in 2 sizes.



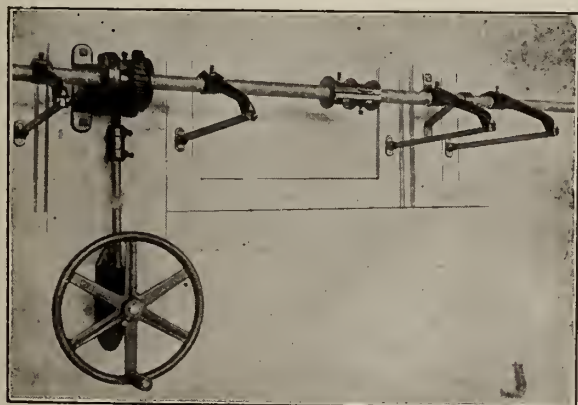
SASH OPERATOR, STYLE NO. 4

For controlling top and bottom pivoted or side hinged sash, 200 ft. of either; shaft supported by roller brackets; power transmitted to gear by endless chain



SASH OPERATOR, STYLE NO. 1

For controlling side pivoted and top or bottom hinged sash, 100 ft. or less, according to weight and position; continuous chain transmission of power from hand to gear; 3 sizes of gears; 2 sizes of connecting arms; wrought shaft brackets, of any length



SASH OPERATOR, STYLE NO. 3

Same as style No. 1, except a hand wheel, bevel gear and $\frac{3}{4}$ -in. rod to transmit power from hand to gear

Some Installations.

Hooker Electro Chemical Co., Echote, N. Y.
Parish & Bingham Co., Cleveland, Ohio
Western Cartridge Co., East Alton, Ill.
Phillips Sheet & Tin Plate Co., Weirton, W. Va.
Berlin Machine Co., Beloit, Wis.
Monsanto Chemical Works, St. Louis, Mo.
National Malleable Casting Co., Chicago, Ill.
Hupp Motor Car Co., Detroit, Mich.
Otis Steel Co., Cleveland, Ohio
Merchants Central Heating Co., Spokane, Wash.
Great Western Smelting & Refining Co., Chicago, Ill.
Tallahassee Power Co., Baden, N. C.
Busch-Sulzer Bros. Diesel Engine Co., St. Louis, Mo.
White Automobile Co., Cleveland, Ohio
Aluminum Ore Co., East St. Louis, Ill.
American Steel & Wire Co., Cleveland, Ohio, and Donora, Pa.
Goodyear Tire & Rubber Co., Akron, Ohio
Hoyt Metal Co., Granite City, Ill.
Sante Fe Shops, Albuquerque, N. Mex.
Holt Mfg. Co., East Peoria, Ill.
Canedy Otto Mfg. Co., Chicago Heights, Ill.
Missouri Pacific R. R. Roundhouses at Texarkana, Ark., and Newport, Ark.
Fairbanks, Morse & Co., Beloit, Wis.
Acme Steel Goods Co., Chicago, Ill.
Haughton Elevator Co., Toledo, Ohio
Springfield High School, Springfield, Ill.
Watervliet Paper Co., Watervliet, Mich.
Roundhouses, Schools, Shops, etc.

ESTABLISHED 1875

THE PAYSON MANUFACTURING COMPANY

Manufacturers of Sash Operating Devices and Builders' Hardware

2920 Jackson Boulevard
CHICAGO, ILL.

Products.

SASH OPERATING DEVICES as follows:

Duplex Operator, for heavy transoms.

Ideal Operator, chain control, for pivoted sash.

Superior Operator, hand wheel control, for pivoted sash.

Triumph Operator, hand wheel control, for pivoted sash, monitor type.

Victor Operator, chain wheel control, for vertically pivoted sash.

Monarch Operator, for single vertically pivoted sash.

Reliance Operator, chain or hand wheel control, for top or bottom hinged or heavy pivoted sash.

Peerless Operator, chain control, for top hinged continuous steel sash.

Simplex Transom Lifter, for all types of transoms;

Payson No. 1 Casement Adjuster, for all types of casement sash;

Payson Signal Sash Lock, for double hung windows;

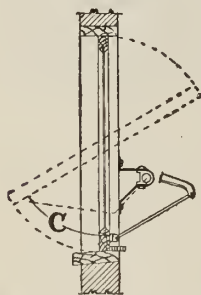
Payson No. 50 Concealed Transom Lifter, for transoms where concealed device is required.

Specifications.

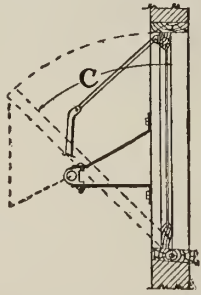
This list of Payson products is selected with the hope that it may be used freely by architects in writing specifications. The list contains standard articles that are guaranteed to give perfect satisfaction.

Torsion Operators.

Detail drawings and cuts are shown of four of the most generally used of the many types of operators we manufacture. So far as general design is involved, one of these four is almost certain to fulfil the requirements of any sash operating problem. The Ideal is used where chain control is required; and chain control is recommended because of its simplicity and ease of erection. The Superior, where a hand wheel must be used. The Triumph, for all monitor work where a hand chain hanging straight down can not be used. The Reliance, for lifting heavy loads and giving maximum ventilation.



Horizontally Pivoted Sash
DUTY DETAILS OF TORSION SASH OPERATORS



Bottom Hinged Sash
DUTY DETAILS OF TORSION SASH OPERATORS

X	Standard			Extra Heavy			X	Standard			Extra Heavy		
	A	B	C	A	B	C		A	B	C	A	B	C
2' 0"	130'	75'	60°	150'	85'	60°	2' 0"	60'	40'	50°	90'	55'	50°
2' 6"	120'	75'	60°	150'	85'	60°	2' 6"	54'	40'	45°	81'	50'	45°
3' 0"	110'	60'	45°	150'	85'	60°	3' 0"	48'	30'	30°	72'	48'	30°
3' 6"	100'	60'	45°	140'	75'	45°	3' 6"	40'	25'	30°	66'	36'	30°
4' 0"	90'	50'	45°	130'	70'	45°	4' 0"	30'	20'	30°	50'	30'	30°
4' 6"	80'	45'	45°	120'	65'	45°	4' 6"	24'	15'	25°	40'	25'	25°
5' 0"	70'	40'	45°	100'	55'	45°	5' 0"	16'	10'	25°	28'	16'	25°
5' 6"	60'	40'	30°	90'	50'	30°	5' 6"	12'	6'	20°	21'	12'	20°

X—Height of sash. A—Maximum length of run. B—Maximum distance from power to end of run. C—Standard opening in degrees.

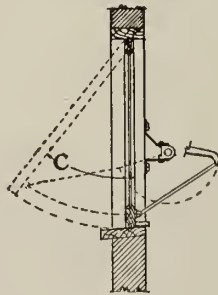
Tension Operators.

Tension devices, Peerless "A" and "B," are fully described in our catalogue, which we would like to send if one is desired. We have worked for a number of years on tension devices to operate long runs of sash, and have finally accomplished two things: that most dangerous of all makeshifts, the counterweight, has been eliminated and we have invented and perfected the only tension device where the leverage power increases as the load increases. If architects want these improvements embodied in tension devices, specify the "Peerless" manufactured by THE PAYSON MANUFACTURING COMPANY.

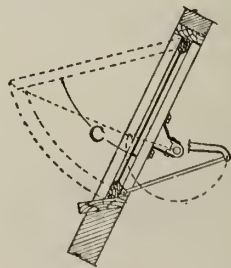
Service.

Payson sash operating devices are *made to order*, using measurements taken from the plans and checked at the building. Every job is exhaustively studied by Payson engineers, and a drawing showing the scheme thought most satisfactory is prepared and submitted to the architect for approval as to layout and general design. After this approval is obtained, if there is any question as to measurements, drawings are forwarded to the building to be checked. Time is really saved in this way, because the operators can then be erected from the blue print with the certainty that every part will fit the place for which it is intended.

The architect should make liberal use of Payson service, as many times minor construction details make it necessary to change entire layouts, even to altering type of operator. For example, an interference by sway bracing may require change from the Peerless operator to the Reliance or Peerless "B." This should be determined, if possible, before specifications and plans have been sent out for estimates. By consulting with us the architect can be certain that the type of device named in his specification will fulfil all requirements, and often slight changes in construction are suggested which result in lowering cost.



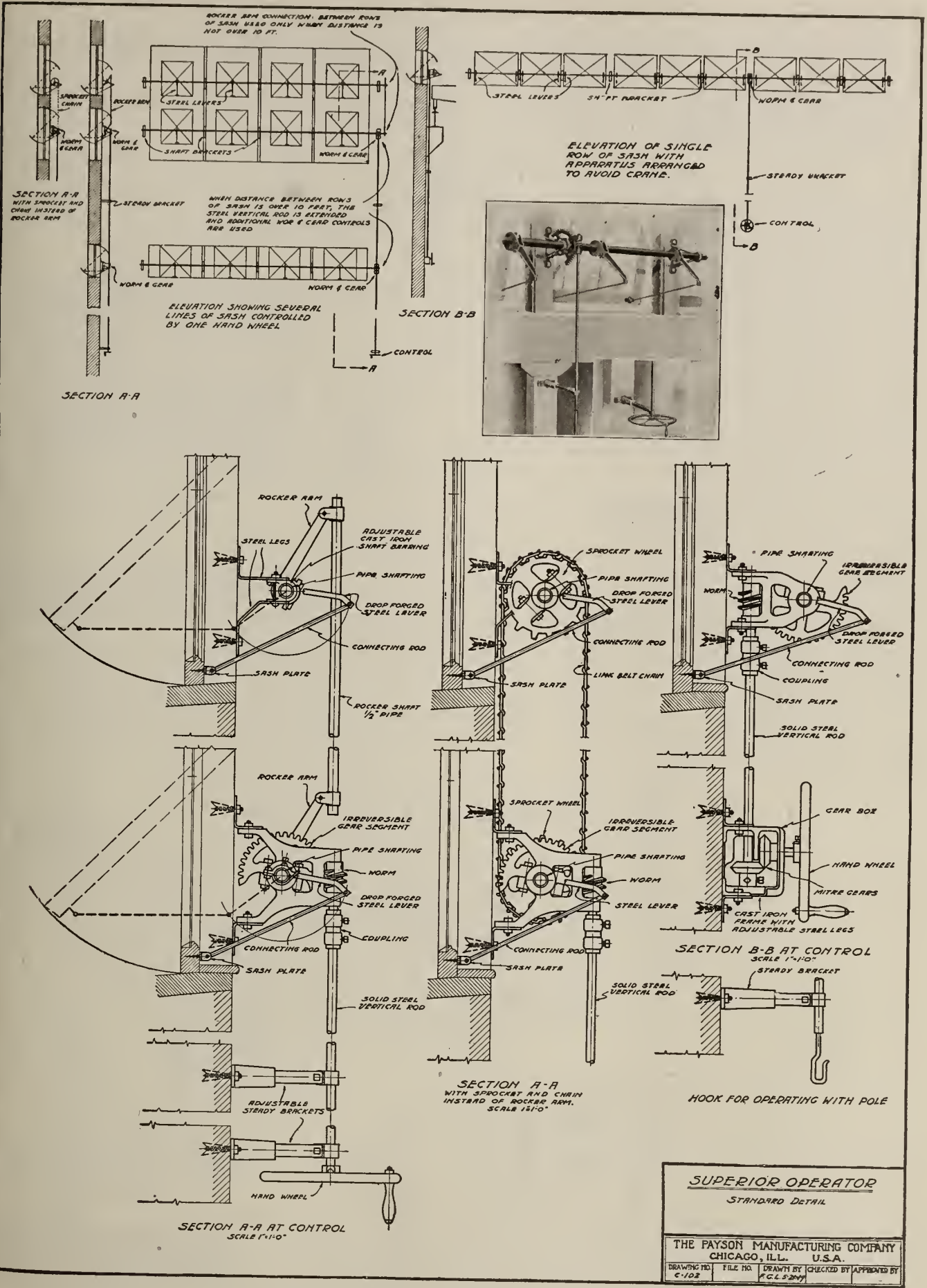
Top Hinged Sash Hung Vertical
DUTY DETAILS OF TORSION SASH OPERATORS



Top Hinged Sash at an Angle
DUTY DETAILS OF TORSION SASH OPERATORS

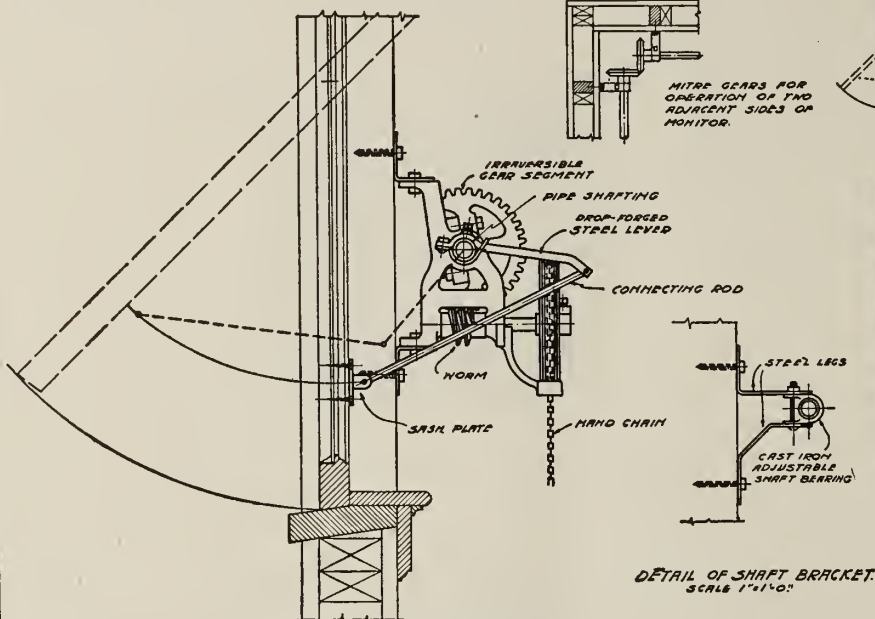
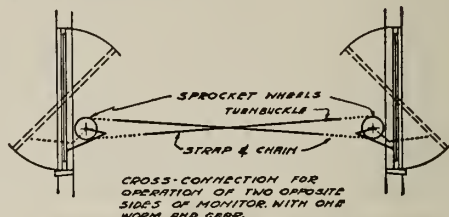
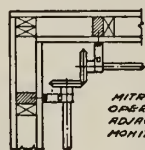
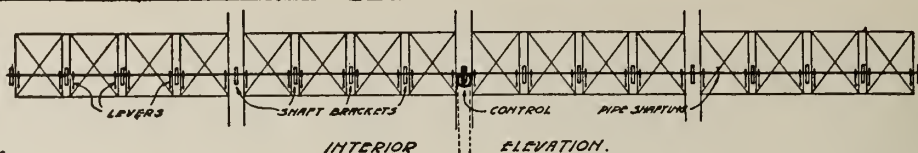
X	Standard			Extra Heavy			X	Standard			Extra Heavy		
	A	B	C	A	B	C		A	B	C	A	B	C
2' 0"	70'	40'	60°	100'	60'	60°	2' 0"	40'	20'	60°	60'	40'	60°
2' 6"	60'	40'	45°	90'	55'	45°	2' 6"	34'	20'	45°	50'	40'	45°
3' 0"	50'	30'	45°	80'	50'	45°	3' 0"	30'	20'	45°	44'	30'	45°
3' 6"	40'	25'	45°	70'	45'	45°	3' 6"	26'	15'	45°	40'	30'	45°
4' 0"	36'	20'	30°	60'	40'	30°	4' 0"	22'	15'	30°	36'	25'	30°
4' 6"	30'	15'	25°	50'	35'	25°	4' 6"	18'	15'	20°	30'	20'	20°
5' 0"	24'	15'	20°	40'	25'	20°	5' 0"	14'	10'	20°	24'	16'	20°
5' 6"	20'	10'	20°	30'	20'	20°	5' 6"	10'	10'	20°	20'	10'	20°

X—Height of sash. A—Maximum length of run. B—Maximum distance from power to end of run. C—Standard opening in degrees.



STANDARD DETAIL OF SUPERIOR SASH OPERATOR

THE IDEAL OPERATOR (CHAIN CONTROL) IS NOW WIDELY USED THAN ANY OTHER TYPE OF SASH OPERATING MECHANISM. IT CONSISTS MAINLY OF A WORM & GEAR CONTROL, IS SELF LOCKING AT ALL POINTS - HORIZONTAL SHAPING OF VARYING SIZES FROM $\frac{3}{4}$ " TO $1\frac{1}{2}$ ", ON WHICH ARE CLAMPED DROP FORGED STEEL LEVERS ATTACHED BY CONNECTING RODS AND SASH PLATES TO THE ARM. A LARGE NUMBER OF SIGHTLY VARYING TYPES OF CONTROLS (WORM & GEAR POWER) HAVE BEEN DEVELOPED WHICH ENABLE US TO MEET THE PECULIAR AND VARYING CONDITIONS WHICH ARE CONFRONTED THERE. OFTEN, ON THE SAME JOB, SEVERAL TYPES REQUIRED; THE COMPLEST FORM IS ILLUSTRATED HEREWITH.

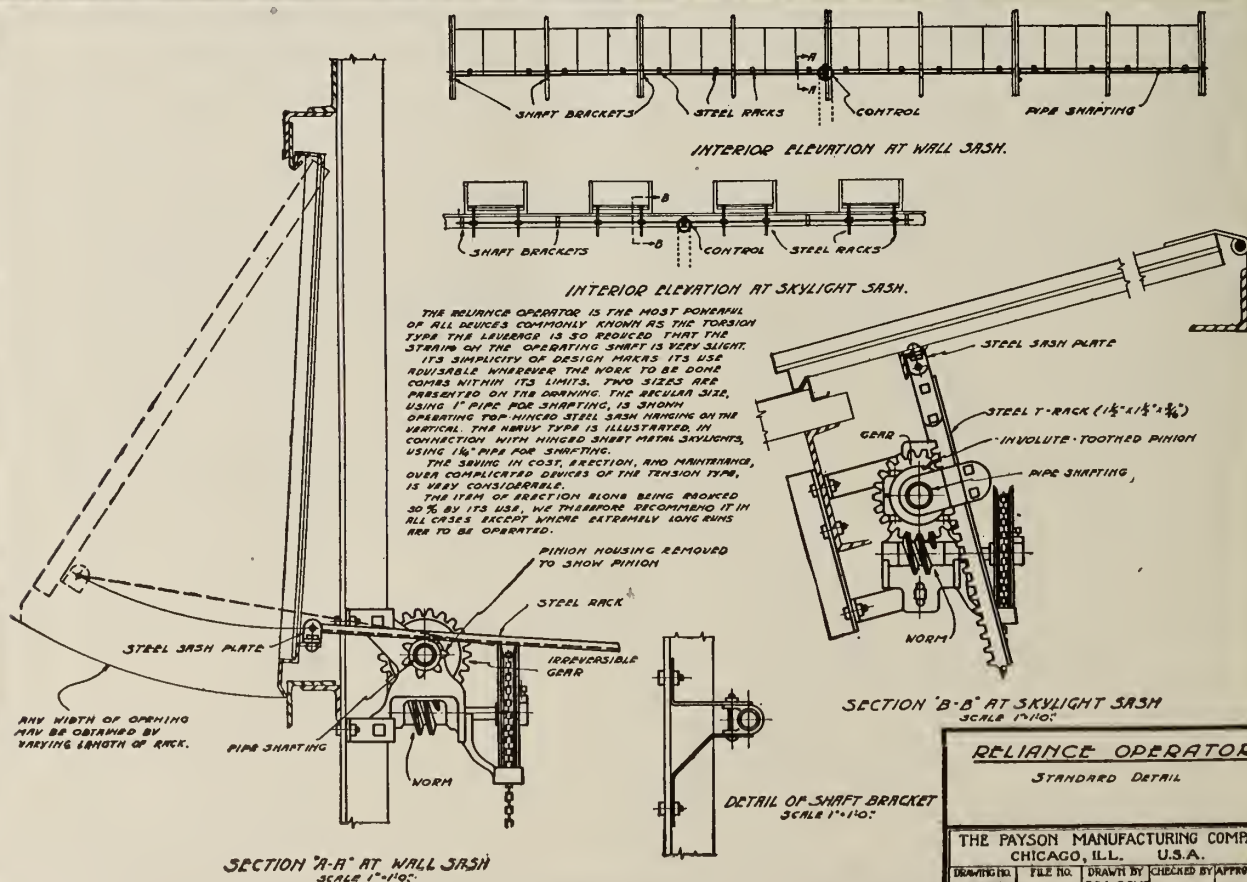


VERTICAL SECTION AT CONTROL.
SCALE 1"=1'-0"



IDEAL OPERATOR STANDARD DETAIL

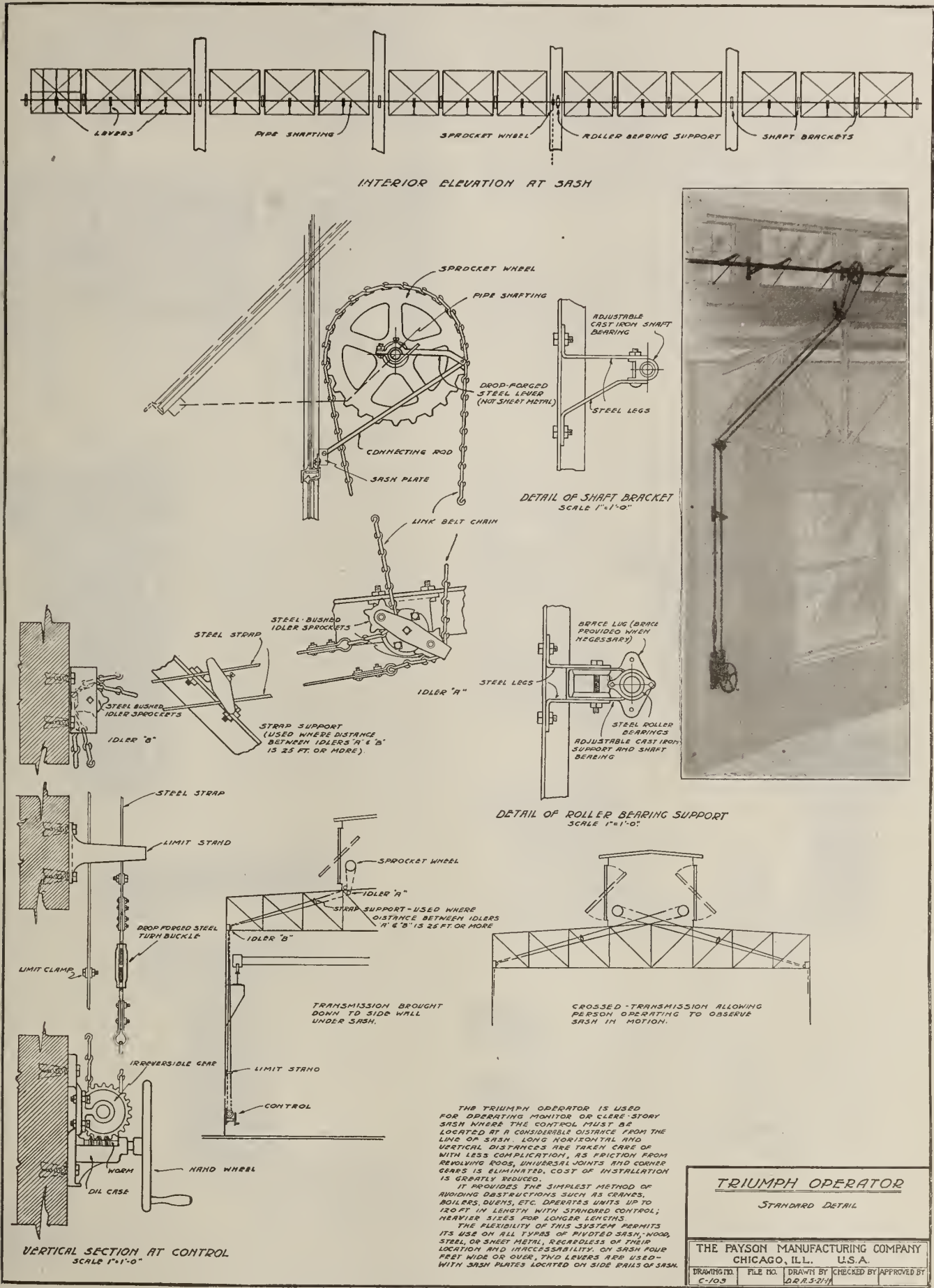
THE PAYSON MANUFACTURING COMPANY
CHICAGO, ILL. U.S.A.
DRAWING NO. C-101 FILE NO. DRAWN BY CHECKED BY APPROVED BY
A.C.L. 5-27-17



RELIANCE OPERATOR STANDARD DETAIL

THE PAYSON MANUFACTURING COMPANY
CHICAGO, ILL. U.S.A.
DRAWING NO. C-102 FILE NO. DRAWN BY CHECKED BY APPROVED BY
A.C.L. 5-27-17

STANDARD DETAILS OF IDEAL AND RELIANCE SASH OPERATORS



STANDARD DETAILS OF TRIUMPH ROLLER BEARING SASH OPERATOR

WAGNER MANUFACTURING CO.

Manufacturers of Door Hangers and Tracks and Overhead Trolley Carrier Systems
CEDAR FALLS, IOWA

Products

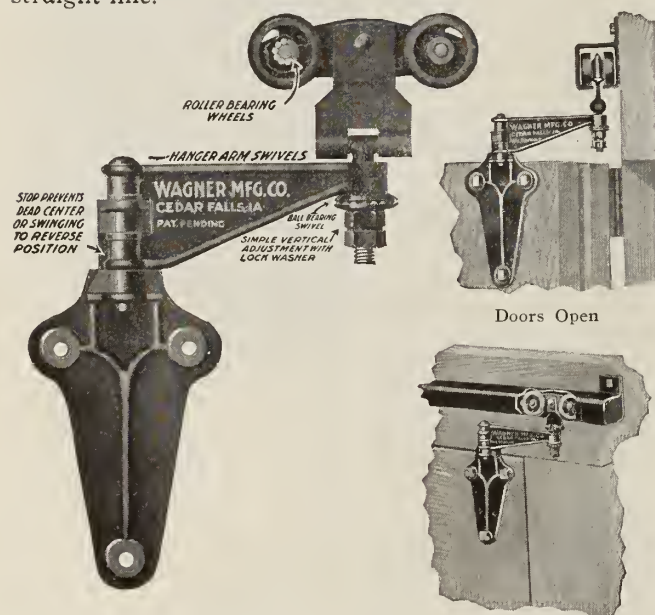
TROLLEY DOOR HANGERS and TRACKS; FOLDING-SLIDING DOOR EQUIPMENT for factories, warehouses, docks, stores, garages and barns; OVERHEAD TROLLEY CARRIER SYSTEMS for factories, warehouses, and other industrial buildings.

WAGNER
TRADE-MARK

Door Hangers

CLOZTITE DOOR HANGERS—For folding-sliding doors. Doors are hinged together and hung to jamb, being supported at opposite side by 1 Wagner Cloztitle hanger.

Adapted for openings with 2, 3, 4, 5 or 6 doors. In 4-, 5- or 6-door openings, 2 hangers are required. Doors fit as snug in jambs as an ordinary hinged door. Can be installed on inside or outside of building. The swinging arm automatically adjusts itself for varying thicknesses of doors and position. Track attached to wall in straight line.



Doors Open

Doors Closed

CLOZTITE DOOR HANGERS NOS. 58, 59 AND 78

No. 58 Hanger—Used in No. 15 track; doors $1\frac{5}{8}$ in. thick; $8\frac{1}{2}$ -in. head-room required.

No. 59 Hanger—Used in No. 15 track; doors $2\frac{1}{2}$ in. thick; $8\frac{1}{2}$ -in. head-room required.

No. 78 Hanger—Used in No. 20 track; doors $2\frac{1}{2}$ in. thick; 12-in. head-room required.

No. 1506 Door Hanger—Doors $1\frac{3}{4}$ to $2\frac{1}{2}$ in. thick.

No. 1507 Door Hanger—Used in No. 15 track; doors $2\frac{1}{2}$ to $2\frac{3}{4}$ in. thick. Front pendant 9 in. long, 4 in. wide and $\frac{3}{16}$ in. thick. Bottom of track to top of door $2\frac{1}{4}$ in.; bottom of track to top of bracket $4\frac{3}{16}$ in.



NOS. 1506 AND 1507 DOOR HANGERS



TYPICAL USE OF CLOZTITE DOOR HANGER ON SHIPPING ROOM OR RECEIVING ROOM DOORS

Nos. 206 and 207 Door Hangers—Used in No. 20 track. Bottom of track to top of door $2\frac{1}{4}$ in.; bottom of track to top of bracket 6 in.

No. 710 Door Hanger—Doors $1\frac{3}{4}$ to $2\frac{1}{4}$ in. thick.

No. 711 Door Hanger—Used in No. 25 track; doors $2\frac{1}{4}$ to 3 in. thick. Front pendant 12 in. long, $4\frac{1}{2}$ in. wide and $\frac{3}{16}$ in. thick. Bottom of track to top of door $1\frac{1}{2}$ in.; bottom of track to top of bracket 6 in.

No. 725 Door Hanger—Used in No. 25 track; doors $2\frac{1}{4}$ to $3\frac{1}{2}$ in. thick. Pendants 12 in. long, $4\frac{1}{2}$ in. wide and $\frac{1}{4}$ in. thick. Bottom of track to top of door 5 in. minimum; bottom of track to top of bracket 6 in.



NOS. 710 and 711 DOOR HANGERS



NO. 725 DOOR HANGER

Wagner Trolley Tracks.

Self-cleaning. When attached to side walls use track bracket No. 5E. Tracks furnished in lengths of 4, 6, 8 and 10 ft. Shipped complete with end caps.



NO. 5E BRACKET



Full Size
Cross Section
of
Wagner
Leader Track
No. 15

Full Size Cross Section of Wagner
Hawkeye Track No. 40.

FULL SIZE CROSS SECTIONS OF WAGNER TROLLEY TRACKS
No. 15 track No. 15-gage steel. No. 20 track No. 13-gage steel. Nos. 25 and 40 tracks No. 12-gage steel.

Wagner Overhead Trolley Carrier Systems.

For factories, warehouses, storerooms, docks and wherever heavy and bulky goods must be handled.

Send sketch with dimensions and proposed arrangement of track showing radius of curves, etc. A special engineering department is at the service of engineers and contractors. Drawings for proposed installations will be furnished without charge. Special work supplied where standard types shown do not meet requirements.

CARRIERS—Rigid and swivel types. Wheels, gray iron. Bearings, hardened steel rollers. Connecting bars, steel and malleable iron. Eyebolts and pendants, drop forged. Capacities specified below allow a wide margin of safety.

CAPACITIES OF CARRIERS

Number	Track	Capacity lbs.	Bottom of track to bottom of eye, in.	Length over all, in.	Wgt., lbs.
1200	40	1800	7	21¾	16½
1200	40	4000	9¾	48	42
300	15	180	3¾	5¾	3
502	15	500	5½	13	6
522	15	1000	9	28	14
1000	40	600	3¾	7½	5
1202	40	1500	7¾	22	16
1222	40	3000	10½	46	41
302	15	200	6	7	3¾
504	15	500	7½	16	8½
524	15	1000	10	34	19
1002	40	700	6	7½	6¼
1204	40	1800	9	21¾	17
1224	40	3000	13½	44½	43

TRACKS—For sizes of tracks required for carriers see table above.

SWITCHES—2-way, 3-way and rotary crossover.

BRACKETS—Any type for attaching to side wall or ceiling; or clamps for attaching to I-beams on special order.



ROTARY CROSSOVER SWITCH

CURVES—Any radius, bent to order when blue prints are furnished.



NO. 1200 CARRIER



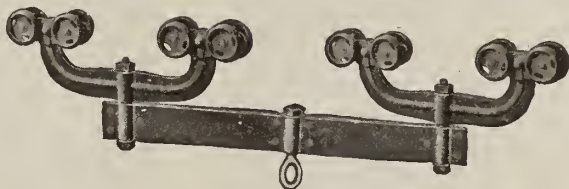
NOS. 300 AND 1000 CARRIERS

NOS. 502 AND 1202 CARRIERS



NOS. 302 AND 1002 CARRIERS

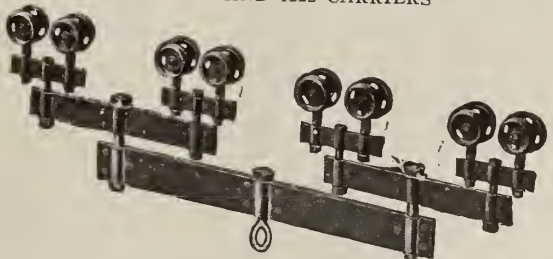
NOS. 504 AND 1204 CARRIERS



NO. 1220 CARRIER



NOS. 522 AND 1222 CARRIERS



NOS. 524 AND 1224 CARRIERS

Catalogue and Reference Book.

Sent free on request. Gives complete details of all Wagner door hangers and tracks, fire door fixtures and overhead trolley carrier systems.

MISSISSIPPI WIRE GLASS COMPANY

220 Fifth Avenue
NEW YORK, N. Y.

TELEPHONE:
MADISON SQUARE 9370

BRANCH OFFICES

CHICAGO, ILL., 7 West Madison Street

ST. LOUIS, MO., 4070 North Main Street

Product.

"WIRE GLASS," for Windows and for Vault Lights.
Also best quality Figured Building Glass and Standard Rough and Ribbed Glass for skylights.

Mississippi "Wire Glass."

The MISSISSIPPI WIRE GLASS COMPANY is the original manufacturer of solid "Wire Glass," and its product is universally recognized as the standard wire glass, being the material upon which the Underwriters' standard was based in 1899.

By our process of manufacture, Standard "Wire Glass" is cast solid, and has an average of less imperfections than any "sub-standard" wire glass on the market.

"Wire Glass" is rolled plate glass having a wire netting embedded equidistant from either surface. This process is automatically effected while the glass is in a molten state and, therefore, insures homogeneous and solid "Wire Glass."

The quality of metal and process of manufacturing Standard "Wire Glass" produce the very highest quality, with a tensile strength second to none.

Adaptability.

The object of "Wire Glass" is to afford perfect and constant fire protection at a minimum cost, at the same time admitting and diffusing the light. It is particularly suitable for use in windows, doors, transoms, monitors, skylights and all places where fire or break-age protection is required.

Light Diffusion.

The light may be increased in a room 30 ft. or more deep to from 3 to 15 times its present effect by using Maze, Syenite, Factrolite, Pentecor or Ribbed "Wire Glass," instead of plain glass in the upper sashes.

Conducting Condensation.

"Pentecor," when installed in skylights set at a proper angle, will conduct condensation and prevent dripping.

Advantages.

When employed as above mentioned, "Wire Glass" may be fractured by severe heat or sudden shock, but the wire mesh will hold the shattered pieces in place, preventing their falling and causing serious injury or loss of life. It will also prevent draught and hold a fire within the bounds of its origin.

Underwriters' Requirements, Extract from Rules (1905)

(2) SIZE OF GLASS—(a) The unsupported surface of the glass allowed shall be governed by the severity of exposure and be determined in each case by the Underwriters having jurisdiction, but in no case shall it be more than 48 in. in either dimension or exceed 720 sq. in. (b) The glass to be of such dimensions, after selvage is removed, that the bearing in the groove or rabbet is not to exceed $\frac{1}{8}$ in. less than the full depth called for in rules 6 and 7. (c) The glass to be retained by the structural part of the frame or sash independently of the material which may be used for weatherproof purposes. Only non-inflammable material to be used in setting glass in the sash.



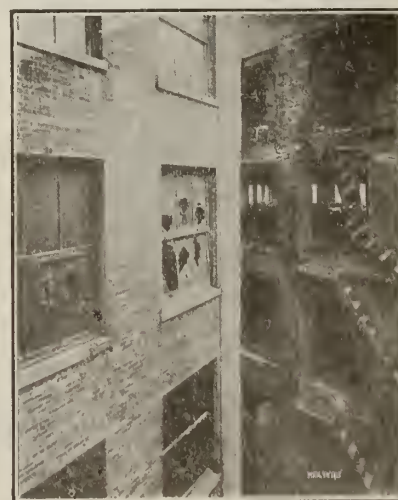
THIS LABEL (PRINTED IN RED) APPEARS ON EVERY PIECE OF THE STANDARD PRODUCT

DATA, MISSISSIPPI "WIRE GLASS"

Style	Thick- ness, in.	Maximum width, in.	Maximum length, in.	Approximate weight per sq. ft., lbs.
Polished.....	$\frac{5}{16}$	48	130	4
Polished.....	$\frac{3}{8}$	30	72	8
Maze.....	$\frac{1}{4}$	48	130	3 $\frac{3}{4}$
Maze.....	$\frac{3}{8}$	48	130	5 $\frac{1}{4}$
Factrolite.....	$\frac{1}{4}$	48	130	3 $\frac{3}{4}$
Factrolite.....	$\frac{3}{8}$	48	130	5 $\frac{1}{4}$
Syenite.....	$\frac{1}{4}$	48	130	3 $\frac{3}{4}$
Syenite.....	$\frac{3}{8}$	48	130	5 $\frac{1}{4}$
Rough.....	$\frac{1}{4}$	48	130	3 $\frac{3}{4}$
Rough.....	$\frac{3}{8}$	48	130	5 $\frac{1}{4}$
Ribbed.....	$\frac{1}{4}$	48	130	3 $\frac{3}{4}$
Ribbed.....	$\frac{3}{8}$	48	130	5 $\frac{1}{4}$
Pentecor.....	$\frac{1}{4}$	48	130	3 $\frac{3}{4}$
Pentecor.....	$\frac{3}{8}$	48	130	5 $\frac{1}{4}$

DATA, VAULT OR FLOOR LIGHTS

Rough "Wire Glass"...	$\frac{3}{8}$	12	12	9 $\frac{3}{4}$
Ribbed "Wire Glass"...	$\frac{3}{8}$	12	12	9 $\frac{3}{4}$
Ground "Wire Glass"...	$\frac{3}{8}$	12	12	9 $\frac{3}{4}$



ASCH BUILDING AND ADJOINING BUILDING, NEW YORK, N. Y.

Typifying efficiency, in modern fireproof construction, of "Wire Glass," as compared to inefficiency of old-style metal shutters with which the Asch Building was equipped.

Note the holes punched in the wire glass windows of the adjoining building by the firemen, to enable them to fight the fire from a point of safety, the wire glass windows forming a fire shield.

Reliability.

Mississippi "Wire Glass," having an indisputable reputation of being a superior product to the sub-standard makes, the company offers no guarantees as an inducement to stimulate sales. Customers know what they are getting when Mississippi "Wire Glass" is specified and installed.

How to Specify.

(Specify outright by name, and be protected.)

"Wire Glass" shall be installed in [specify location] and in all places marked W. G. on plans and elevations.

The "Wire Glass" to have a thickness of at least $\frac{1}{4}$ in. at thinnest point. Wire mesh to be not larger than $\frac{3}{8}$ in., and no wire used for such mesh to be smaller than No. 24 B. and S. gage. Plane of the wire mesh to be practically midway between the two surfaces of the glass.

Selva shall be removed from glass before framing.

[State here type or types of glass to be used and where.]

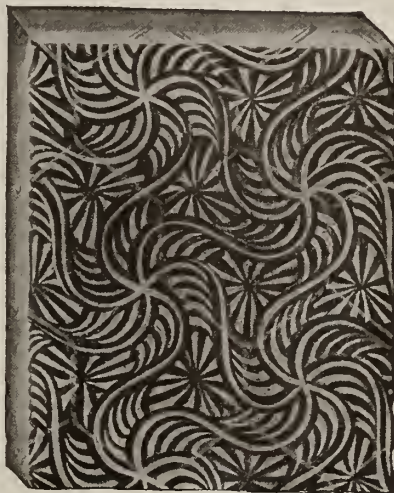
NOTE—Where the recognized standard and perfected product is required, specifications should call for "Wire Glass," the product of MISSISSIPPI WIRE GLASS COMPANY.



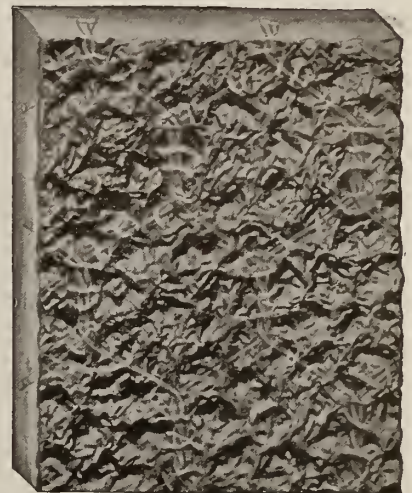
—Width—
POLISHED "WIRE GLASS"
Sizes up to 48 in. wide and 130 in. long
Thicknesses about $\frac{1}{8}$ and $\frac{3}{8}$ in.



—Width—
ROUGH "WIRE GLASS"
Sizes up to 48 in. wide and 130 in. long
Thicknesses $\frac{1}{4}$ and $\frac{3}{8}$ in.



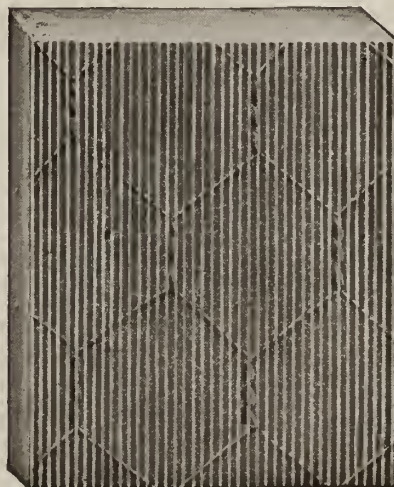
—Width—
MAZE "WIRE GLASS"
Sizes up to 48 in. wide and 130 in. long
Thicknesses $\frac{1}{4}$ and $\frac{3}{8}$ in.



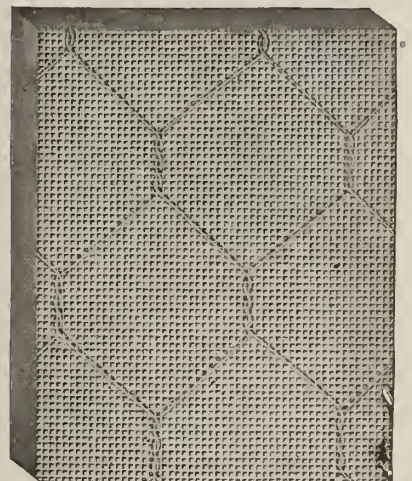
—Width—
SYENITE "WIRE GLASS"
Sizes up to 48 in. wide and 130 in. long
Thickness $\frac{1}{4}$ in.



—Width—
PENTECOR "WIRE GLASS"
Sizes up to 48 in. wide and 130 in. long
Thickness $\frac{1}{4}$ in.



—Width—
RIBBED "WIRE GLASS"
Sizes up to 48 in. wide and 130 in. long
Thicknesses $\frac{1}{4}$ and $\frac{3}{8}$ in.



—Width—
FACTROLITE "WIRE GLASS"
Sizes up to 48 in. wide and 130 in. long
Thicknesses $\frac{1}{4}$ and $\frac{3}{8}$ in.

Factrolite for Industrial Buildings.

EFFICIENCY OF FACTROLITE—The MISSISSIPPI WIRE GLASS COMPANY has had practically every kind of glass tested to determine efficiency in light transmission and finds Factrolite to be far ahead of anything else suitable for installation in industrial buildings.

The accompanying report and plotting speak for themselves.

TEST OF FACTROLITE—The tests were made by measuring the distribution of light in two planes perpendicular with each other, with light from an incandescent lamp 3 ft. distant, falling normally upon and passing through the glasses. The relative light intensities are recorded in per cent of the normal (0°—normal—equals 100%.)

REPORT NO. 24558

DISTRIBUTION OF LIGHT TRANSMITTED THROUGH FACTROLITE—INCIDENT LIGHT ON ROUGH SIDE OF GLASS—RELATIVE LIGHT INTENSITIES

Angles	First Plane		Plane Perpendicular to First Plane	
	Right	Left	Right	Left
0 (Normal)	100%		100%	
2½	60.5	86.5	85.2	75.4
5	41.8	51.8	41.0	28.9
7½	24.0	30.6	15.8	13.8
10	9.88	13.3	1.33	9.14
15	1.43	4.45	.39	1.31
20	.101	.81		

Total light transmitted through Factrolite incident light normal on rough side of glass: 84.5%.

ECONOMY OF FACTROLITE—Today, as never before, owners of industrial buildings are coming to realize that the utilization of daylight to its fullest extent by the use of proper glass means the conservation of energy required for artificial lighting, and the maximum production of the employees.

Whereas more heat is required to maintain a given temperature in a building with 80% of its wall area glass than is required for a wall area of 20% glass,

this additional heat is required for only five months of the year, whereas, with the 20% glass area, it is necessary to artificially light the building a large part of the time.

Factrolite breaks up the rays of the sun, diffusing the light and distributing it equally.

INSPECTION INVITED—Before placing a contract for glass, those interested are urged to get a sample of Factrolite and compare it with every other make of glass recommended for industrial buildings.

Without a doubt, they will become convinced that Factrolite offers the maximum of lighting efficiency with the minimum of cost, thus reducing the overhead and cost of maintenance, and increasing the efficiency of manufacturing the commodities.

Tests Made by the Electrical Testing Laboratories Showing Transmission and Illumination.

Test Report No. 28482 rendered to the MISSISSIPPI WIRE GLASS COMPANY on the distribution of illumination through figured sheet glass windows in a model room made by the Electrical Testing Laboratories of New York City.

OBJECT—An investigation to study the distribution of daylight illumination in a room with various types of ¼-in. figured sheet glass used in the window.

TEST ROOM—Model—Representing a room 50 by 100 by 14 ft.

Scale—1 ft. equals 25 ft. (24 by 48 by 7 in.)

Windows—Continuous on one side of room 3 ft. high, sill 4 ft. from floor.

Ceiling and Walls—White glass finish (commercial factory paint.)

Floor—Brown linoleum (having reflection factor of average factory floor.)

TEST STATIONS—Test stations in five lines, as shown.

SOURCE OF LIGHT—Concentrated filament incandescent lamp, representing the sun at 30° from horizon. The intensity of the sun was approximately proportioned to the size of the room.

Sky uniformly bright within \pm 20%.

Light within the room—direct sunlight, 80% ; sky-light, 20%.

RESULT OF TESTS—Transmission of light through glass samples, in per cent of clear, Clear Glass taken as 100%.

Rough wire.....	98%
Syenite	87%
Maze wire.....	82%
Factrolite wire.....	88%
Pentecor wire horizontal.....	90%
Pentecor wire vertical.....	94%
Ribbed vertical.....	96%
Ribbed horizontal.....	99%

Horizontal illumination of working plane, equivalent to 40 in. above floor.

Samples.

Samples of the MISSISSIPPI WIRE GLASS COMPANY's products are filed with the Architects Samples Corporation, New York City.

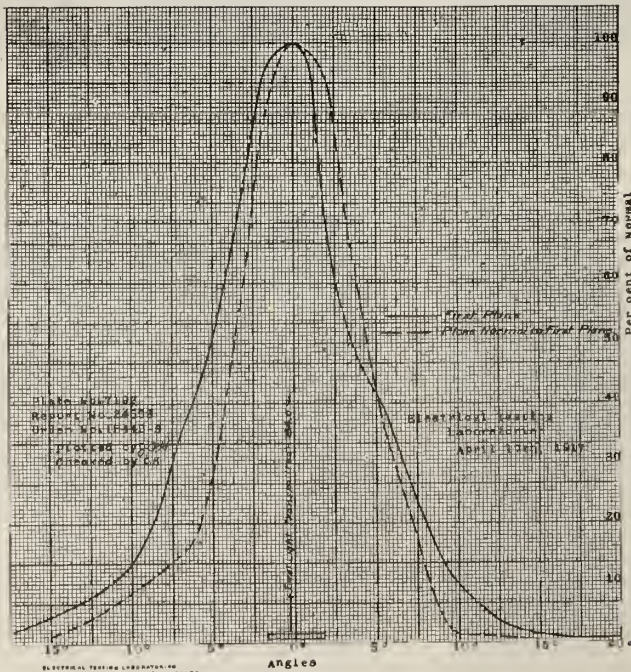


CHART SHOWING EFFICIENCY IN LIGHT TRANSMISSION WITH FACTROLITE

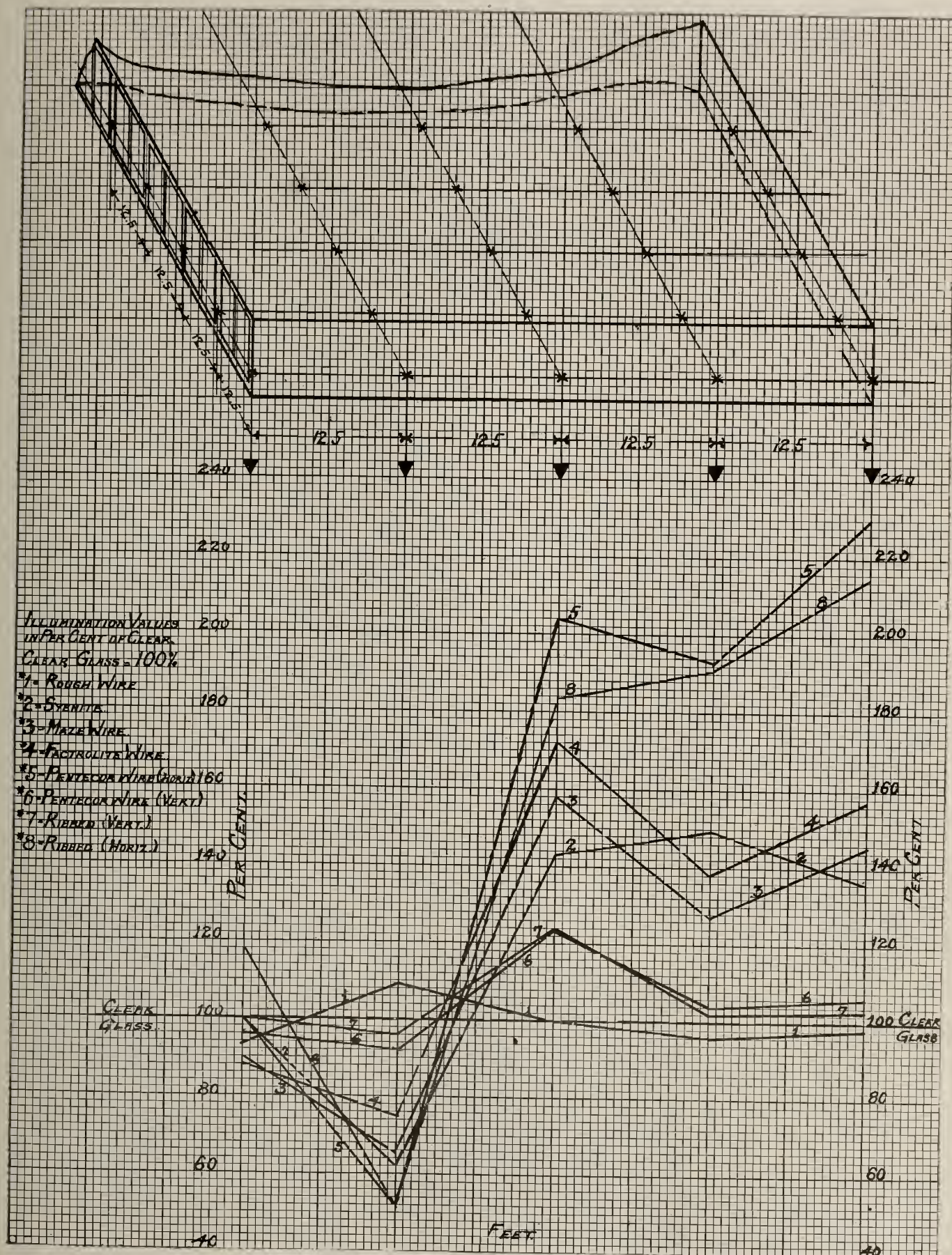


CHART OF ILLUMINATING VALUES OF MISSISSIPPI "WIRE GLASS"
Horizontal illumination on working plane equivalent to 40 in. above floor

WALTER COX, PRESIDENT

PENNSYLVANIA WIRE GLASS COMPANY

EXECUTIVE OFFICES

CABLE ADDRESS:

"WIRE GLASS, PHILA"

Pennsylvania Building

PHILADELPHIA, PA.

WORKS

DUNBAR, PA.

NEW YORK OFFICE, 150 Nassau Street

Products.

WIRE GLASS: Aqueduct, Cobweb, Ribbed, Rough, Florentine, Polished.

CORRUGATED WIRE GLASS.

Glass without Wire: Cobweb, Ribbed, Rough, Florentine.

Wire Glass.

PROCESS—Solid wire glass, made by the Pennsylvania continuous process, is formed complete by one pouring and one rolling. It is the only process that makes possible the manufacture of wire glass as thin as $\frac{1}{8}$ in.

APPROVAL—Wire glass, made by the PENNSYLVANIA WIRE GLASS COMPANY, having the distinctive mark (Cabled Strand) is standard under the rules of the National Board of Fire Underwriters.

FIRE PROTECTION—Wire glass is a valuable fire retardant, and therefore a safeguard to human life, and an important factor in the reduction of insurance rates. It is insisted upon by insurance underwriters in all instances where there is any fire hazard.

QUANTITIES AND SAMPLES—Quantities will be listed from drawings furnished this company and approximate estimates provided. Our engineering department offers gratuitous advice on all glass problems.

Requests for samples should be made to the main office in Philadelphia, Pa., where they will be promptly acknowledged.

SPECIFICATIONS—Engineers should always specify "Solid Wire Glass manufactured by the PENNSYLVANIA WIRE GLASS COMPANY," and "to comply with the rules and regulations of the National Board of Fire Underwriters."

Corrugated Wire Glass.

DESCRIPTION—Corrugated wire glass is the new wire glass making possible the most economical and efficient building construction. It gives great diffusion of light and heat rays, reducing to a minimum shadows and glare.

ADVANTAGES—Corrugated wire glass is the best and cheapest form of construction where maximum amount of light is required. It is weatherproof and dustproof; the latter on account of its smooth surface—dirt and germs will not adhere to it. There is practically no up-keep. Buildings in which corrugated wire glass is installed have a modern, up-to-the-minute appearance. Corrugated wire glass is one of the best fire retardants used in building construction.



TRADE-MARK

DAYLIGHT BUILDING—By using corrugated wire glass in roofs and side walls, a daylight building is obtained, without any shadows, glare or objectionable features.

Corrugated wire glass can be used in roofs and side walls alone, or in combination with corrugated iron or corrugated asbestos of equal pitch.

STANDARD SPECIFICATIONS—Materials—All glass marked or shown "C.W.G." on plan, or specified, is to be corrugated wire glass manufactured by the PENNSYLVANIA WIRE GLASS COMPANY, Pennsylvania Building, Philadelphia, Pa.

Provide all the necessary metal cover strips, inner strips, bolts, lead washers, asphalt strips, asphalt paint and any special iron clips or metal strips, and all labor and materials necessary to make a watertight and workmanlike job, satisfactory to the owner or engineer. All materials shall be furnished and installed in accordance with plans and details, and the following specifications:

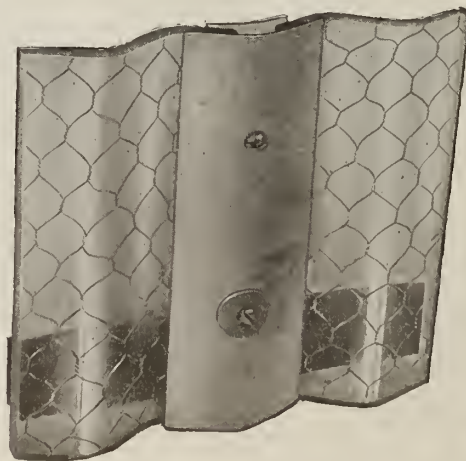
Method of Laying—Lay glass edge to edge, and allow a space between the sheets of glass as shown on plans. Cover joints with a $2\frac{3}{4}$ -in. asphalt strip, painted on the glass side with asphalt paint, the full length of sheet of glass. Then cover outside with $2\frac{3}{4}$ -in. wide, and inside with $1\frac{1}{2}$ -in. wide, No. 24 gage galvanized iron or other suitable metal strips, full length of glass.

The glass to be hooked to purlin with iron clips as shown, with lead washers, and $\frac{1}{4}$ -in. round head stove bolts. Tighten bolts just snugly. Between the purlins or main fasteners, put in intermediate fasteners (consisting of $\frac{1}{4}$ -in. round head stove bolt with lead washer securely screwed down) every 10 or 12 in.

Roofing—Roofing where shown "C.W.G." to be laid on purlins protected by a 2-in. asphalt strip painted with asphalt paint. Care must be taken to pack purlins with asphalt so that glass lies true and straight. Provide asphalt strips, special cover caps, inner strips, bolts, etc. at joint of cornice and glass, or where glass comes in contact with masonry, as shown on scale details.

Side Walls—Side walls to be constructed in accordance with details, with all necessary parts as shown, to make an air and watertight job. All openings to be filled with Minwax, Arco Sealit or equally elastic cement.

All glass which comes in contact with metal or masonry must be protected with asphalt strips between glass and metal. All metal work to receive one coat of asphalt paint as a priming coat.

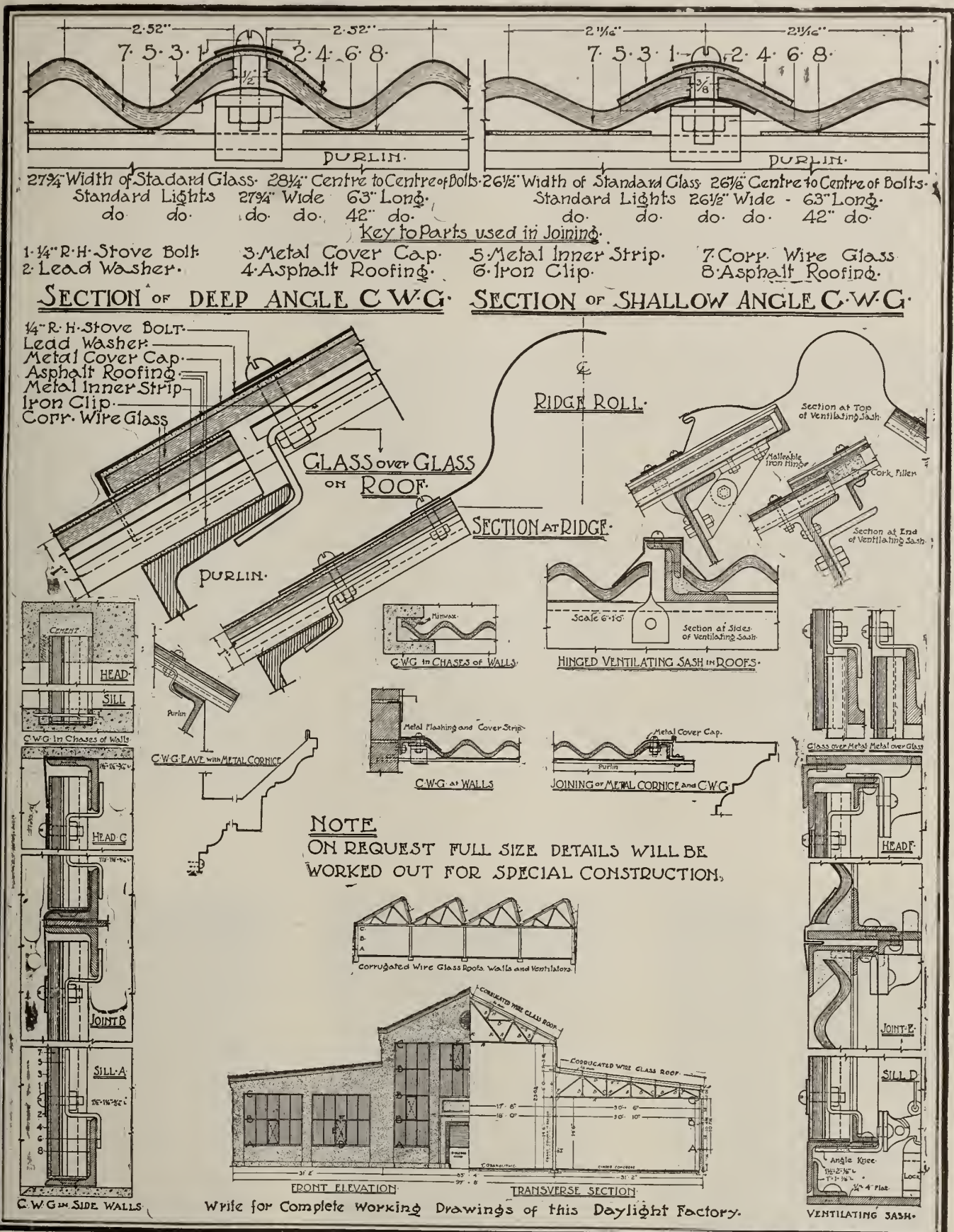


Exterior View—Metal Cover Strip



Interior View—Metal Inner Strip and Iron Clip with Purlin

CORRUGATED WIRE GLASS



DRAWN & DESIGNED BY
 PENNSYLVANIA WIRE GLASS CO.
 C.W.G. SHEET No 175.

- CORRUGATED WIRE GLASS -
FOR DAYLIGHT BUILDINGS.

SHEET NUMBER
SCALE 6" 3 1/2 1/16" = 1'-0"
WRITE FOR SAMPLES.

THE WESTERN GLASS COMPANY

Manufacturers of Figured and Wire Glass

STREATOR, ILL.

Products.

FIGURED GLASS.
WIRE GLASS, Plain and Figured.
ROUGH and RIBBED GLASS.
SHEET PRISM GLASS.
POLISHED WIRE GLASS.

Figured Glass.

This is designed for use in hallways, areas, interior partitions, and similar constructions, where the admission of light without transparency is desired.

Made of the best materials obtainable and moulded in attractive patterns, it adds materially to the decorative effects of such installations.

Its distinctive advantages for this service have given it an established reputation.

DESIGNS—The figured glass is made up in a large number of designs, some of which are illustrated in the accompanying cuts. This glass can be supplied to match any style of architecture and to conform to architect's or builder's requirements.

SIZES AND WEIGHTS—Made in thicknesses of $\frac{1}{8}$, $\frac{3}{16}$ and $\frac{1}{4}$ in., with maximum dimensions of 48 by 120 in., and 48 by 132 in.

Rough and Ribbed Glass.

Made in thicknesses of $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ in., with maximum dimensions of 48 by 120 in. for $\frac{1}{8}$ in. thickness, and 48 by 132 in. for other thicknesses. Especially adapted for heavy service in skylights, partitions and factory windows.

$\frac{3}{4}$ in. thick glass is furnished in rough glass or rough wire glass in cut sizes, not stock sheets.

Solite Glass

Used where the maximum *diffusion* of light, as well as the maximum *amount* of light is required.

Nearly 200,000 sq. ft. of $\frac{1}{4}$ -in. Solite glass was specified and used in the Naval Supply Base Building, Brooklyn, N. Y.

Special samples of Solite glass sent on application.

Wire Glass.

Wire glass can be furnished in any of the regular figured designs or in polished transparent sheets, as desired.

Made in thicknesses of $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ in., in sizes up to and including 48 in. wide by 132 in. long.

It is made by a single-pour process and the reinforcement is a special wire fabric of our own design, with 3 twists and 5 loops at the vertical strand.

By our method of manufacture, this fabric is incorporated in the sheet of molten glass while it is being rolled.

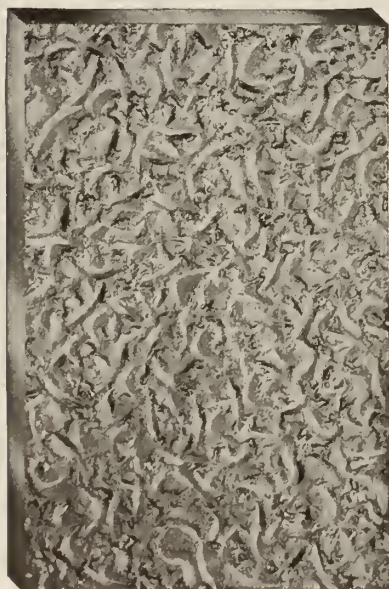
This makes the finished product better able to stand severe strains and sudden temperature changes.

The wire strand used is so thin that it does not obstruct the light and is scarcely noticeable under ordinary conditions.

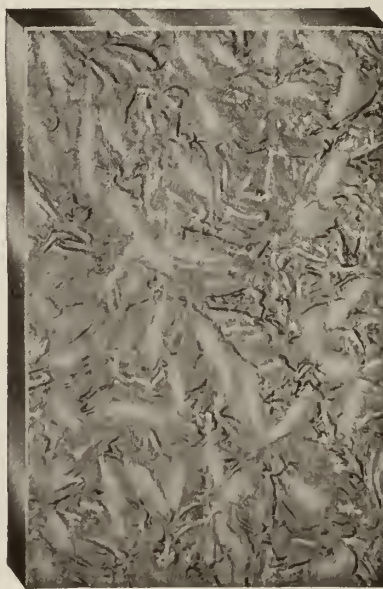
FIRE AND ACCIDENT PREVENTION—The main reason for using wire glass is the reduction of the fire and accident hazards.

Properly installed, wire glass furnishes an effective barrier to the spread of flames through exposed windows and other openings.

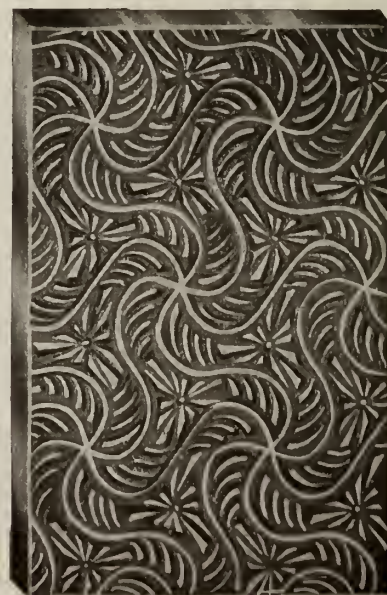
In this connection our product has stood the severe tests imposed by the Underwriters' Laboratories, Inc.,



MOSS FIGURED GLASS



CARNATION FIGURED GLASS



COMET FIGURED GLASS

and has been fully approved by the Fire Underwriters' Association.

Each sheet bears the identification marks of the Underwriters' Laboratories, Inc.

In windows subject to heavy wind pressures or liable to injury from carelessness or from flying bodies, the installation of wire glass insures against injury to pedestrians from falling glass and against the resulting damage suits.

SIZES—Standard wire glass is made as near as possible to $\frac{5}{16}$ in. thick in accordance with the rules of the Underwriters' Laboratories, Inc., covering standard construction of fireproof windows and skylights.

All kinds of wire glass furnished in the standard $\frac{1}{4}$ and $\frac{3}{8}$ in. thicknesses.

Wire glass is furnished in other thickness as called for by engineering requirements.

Sheet Prism Glass.

Where it is desired to project daylight well back into an interior, our sheet prism glass is an effective glazing medium for producing the maximum lighting efficiency.

Furnished in standard thickness and in sizes up to 50 in. wide and 132 in. long.

WEIGHTS OF GLASS PACKED FOR SHIPMENT

Thickness, in.	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$
Weight, lbs. per sq. ft.	2½	3½	4½	6	8	11



RADIANT WIRE GLASS



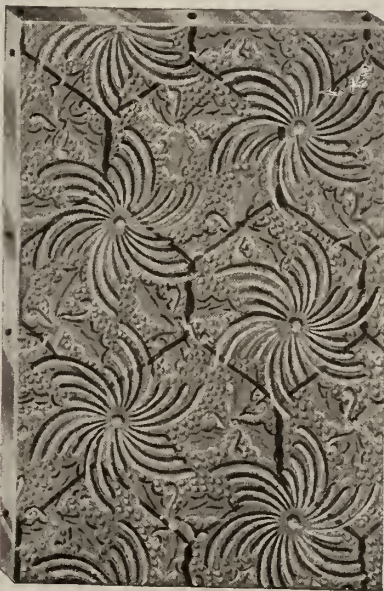
SHEET PRISM GLASS



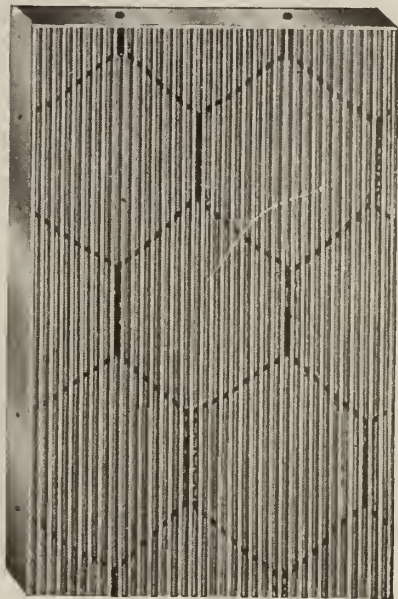
ROUGH WIRE GLASS



POLISHED WIRE GLASS



HOLLY WIRE GLASS



RIBBED WIRE GLASS

KEPPLER GLASS CONSTRUCTIONS, INC.

OFFICES AND FACTORY

1799 First Avenue

NEW YORK, N. Y.

Products.

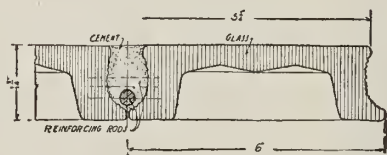
KEPPLER ROOF LIGHTS, GLASS WALLS, GLASS FLOORS, PAVEMENT LIGHTS, VAULT LIGHTS—Glass Unit Formation, Steel Reinforced Cement Ribs, fireproof, low maintenance.

Also, Fireproof Windows and Crystal Ceilings.

Keppler Roof and Vault Lights.

Admit maximum light because of diffusion of all-glass undersurface.

Insured free against maintenance for 5 years.



SECTION THROUGH ROOF LIGHTS

Fireproof and rustproof.

Roof lights support 40 to 70 lbs. per sq. ft., 5 ft. between supports; vault lights support 300 lbs. per sq. ft., 4 ft. between supports. Safety factor, 4.

Weight of roof lights, 12 to 16 lbs. per sq. ft. Weight of vault and floor lights, 20 lbs. per sq. ft.

Keppler Glass Walls.

As strong as outside walls. Admit maximum light. Keep free of snow. Fireproof. Add to appearance of any building.



KEPPLER ROOF LIGHTS, LEHIGH VALLEY R.R., BUFFALO, N. Y.
E. B. ASHBY, Chief Engineer LINCOLN T. BUSH, Consulting Engineer
KENNETH M. MURCHISON, Architect



KEPPLER GLASS WALL INSTALLATION, NEW YORK CENTRAL EXPRESS STATION, BUFFALO, N. Y.

KEPPLER
Glass Constructions N Y

TRADE-MARK.

A Few Keppler Installations.

Lehigh Valley R. R., Bush Trainsheds, Buffalo, N. Y.; Roundhouses, Tifts Farm, Buffalo, N. Y., and East Buffalo, N. Y.; Terminal, Buffalo, N. Y.—Roof Lights.
Pennsylvania R. R. Station, Johnstown, Pa.—Roof Lights;
Union Station, Chicago, Ill.—Vault Lights
Delaware, Lackawanna & Western R. R. Terminal, Buffalo, N. Y.—Roof Lights
Delaware, Lackawanna & Western R. R. Terminal, Hoboken, N. J.—Roof Lights and Concrete Roof
Central R. R. of New Jersey, Trainshed, Newark, N. J.—Roof Lights
New York Central R. R., Express Buildings and Trainsheds, Buffalo, N. Y.—Roof Lights and Glass Walls.
Bethlehem Steel Co., Powerhouse, South Bethlehem, Pa.—Roof Lights
New Departure Mfg. Co., Building, Bristol, Conn.—Roof Lights
Egyptian Lacquer Co., Building, Harrison, N. J.—Roof Lights
Fleischman Building, Cambridge, Mass.—Roof Lights
American Can Co., Factory, Brooklyn, N. Y.—Roof Lights
U. S. Government, Buildings, Dayton, Ohio; Docks, Norfolk, Va.; Army Supply Base, Brooklyn, N. Y.; Naval Torpedo Assembly Plant, Alexandria, Va.—Roof Lights



KEPPLER ROOF LIGHTS—ARMY SUPPLY BASE, BROOKLYN, N. Y.
View from below



KEPPLER ROOF LIGHTS—ARMY SUPPLY BASE, BROOKLYN, N. Y.
View from above

PIERRE DUVINAGE

OWEGO FOUNDRY CO., SUCCESSORS

Manufacturer of Spiral Stairs and Cast Iron Work for Buildings

TELEPHONE CONNECTION

OWEGO, TIOGA CO., N. Y.

Products.

DUVINAGE IRON SPIRAL STAIRS, POST CAPS, WALL PLATES, PIER PLATES and BRACKETS, SILL PLATES, WOOD ROOF TRUSS CASTINGS and RODS.

Cast Iron Work, Trussed Girder Rods and Struts, Cast Iron Columns, Bases and Plates, Wheel Guards, Jamb Guards, Saddles or Sills, Shutter Eyes, Cast Iron Clean-out Doors, Trap Pit Covers, Lintels.

Special Castings; Special Cast Iron and Fittings for sewage disposal plants, water works, and powerhouses; Revolving Domes for astronomical observatories.

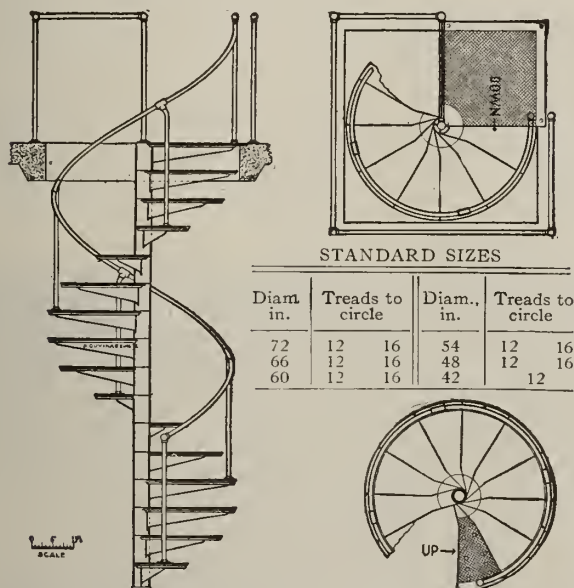
Machinery Castings.

Duvinage Iron Spiral Stairs (Patented Feb. 13, 1917).

Duvinage spiral stairs have been erected and approved for their simple, durable construction as well as their economy in floor space, in offices, stores, mezzanines, boiler rooms, sewage disposal pumping wells, power plants, gas houses, water towers, etc.

They are made of the best grade of iron; have single 1-in. pipe railing on stairs and around well; and center pipe is 3 or 4 in., according to size and height of stairs.

The regular stock treads of these stairs are made so that they can be used either right- or left-hand (illustration shows right-hand) and 12 or 16 treads to the circle, as tabulated. Modifications in riser heights are affected by height between floors.



ELEVATION AND PLANS OF PIERRE DUVINAGE SPIRAL STAIRS

To provide sufficient headroom under top platform, the risers should not be less than $8\frac{1}{4}$ in. high. By calculating the number of risers required, the relative positions of starting and landing points can be determined, so as to decide whether a right- or left-hand stair would be best suited.

Prices, catalogue and further information on application. In ordering, give diameter, distance between

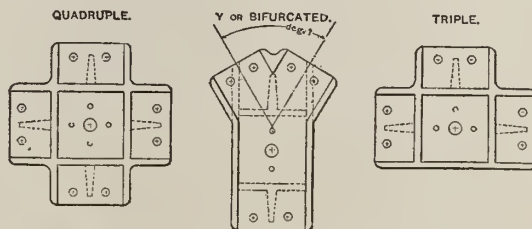
floors, starting point and position of landings desired.

REFERENCES—Among the many purchasers of Duvinage spiral stair may be mentioned:

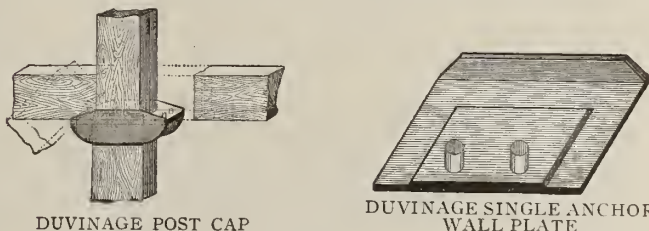
Consolidated Gas Co., Boiler House, Hightbridge, N. Y.
125th Street Theater, New York, N. Y.
J. C. Greenleaf, Architect, Farm Building, Lenox, Mass.
Army Department U. S. Government, Storage Building, Mill Rock, East River, New York, N. Y.
Sterling Piano Co.'s Building, Gust. Ericsson, Contractor, Brooklyn, N. Y.
City of Albany, N. Y., Sewage Disposal Plant
Lehigh Valley R. R., Pier 44, East River, New York, N. Y.
Department of Health, City of New York, Otisville, N. Y.
Lackawanna Railroad, Signal Tower, Buffalo, N. Y.
Wm. Flanagan, Contractor, Store, 430 Pearl Street, New York, N. Y.
Vacuum Oil Co., Powerhouse, Paulsboro, N. J.
Southern Cotton Oil Co., Factory, Bayonne, N. J.
Architectural League of New York, N. Y.
Henry-Wright Manufacturing Co., Hartford, Conn.
Brooklyn Rapid Transit Substation, Ridgewood, Brooklyn, N. Y.
Cosmopolitan Club, 133 East 40th Street, New York, N. Y.
Hotel Woodstock, 127 West 43d Street, New York, N. Y.
Thompson & Binger, Syracuse, N. Y.
Bullard Machine Tool Co., Bridgeport, Conn.
Kings County Courthouse, Frank Quinby, Architect, Brooklyn, N. Y.

Duvinage System of Anchoring.

The Duvinage system for anchoring of buildings consists of post caps, wall plates, pier plates, pier brackets, sill plates and roof truss castings having projecting hubs which fit into holes bored in beams.

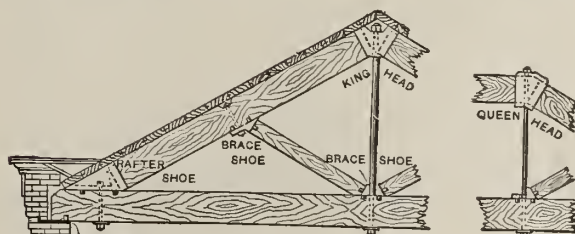


DUVINAGE POST CAPS FOR SELF-RELEASING BEAMS



DUVINAGE POST CAP

DUVINAGE SINGLE ANCHOR WALL PLATE



DUVINAGE ROOF TRUSS

WISCONSIN IRON & WIRE WORKS

Fire Escapes, Stairs and Miscellaneous Iron

TELEPHONE:
LINCOLN 196

1640 Booth Street.
MILWAUKEE, WIS.

Products.

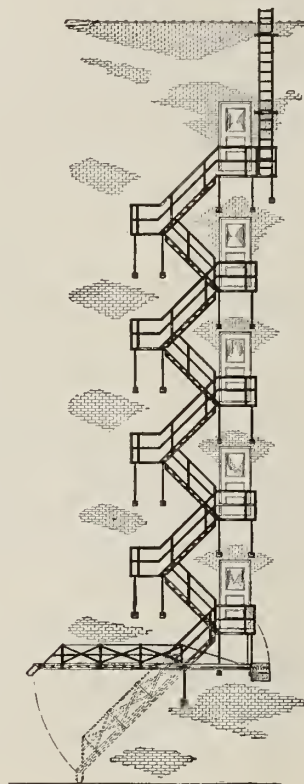
FIRE ESCAPES; STAIRS;
COLLAPSIBLE GATES; WOVEN
WIRE WORK.

Ornamental Bronze and
Iron Work and a large and
miscellaneous list of Iron
and Wire Work, including
Machine Guards.

Fire Escapes.

Manufactured in ac-
cordance with the state laws
and local ordinance require-
ments.

When writing for esti-
mates, etc., give sketch, with
elevation of building to
which fire escape is to be at-
tached; distance from fin-
ished floor to finished floor;
thickness and nature of floor
and wall construction; size
and location of all windows
and door openings.



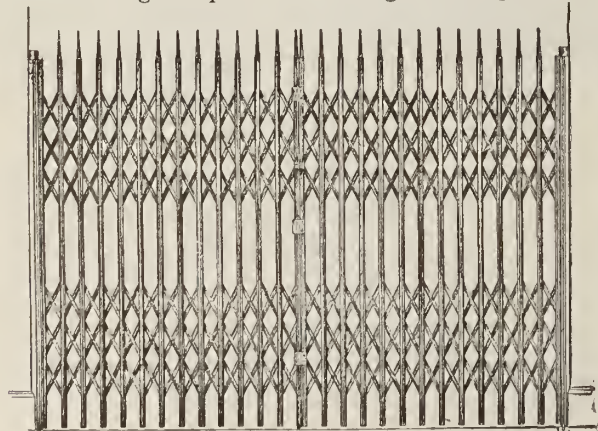
FIRE ESCAPE

Collapsible Gates.

A very valuable protective device manufactured in a variety of designs and sizes to meet any particular purpose and condition. Collapsible gates are being used very widely for the protection of entrances where it is imperative that the passageway and the wall space shall not be obstructed when the gates are open. They are frequently used in connection with the guarding of machines where the collapsible feature permits easy access for repairing and oiling.

Also used to advantage on delivery trucks and wagons.

In writing for prices and designs state purpose in-



COLLAPSIBLE GATE

tended, also size of opening and whether or not an over-
head track can be used and height the track must clear.

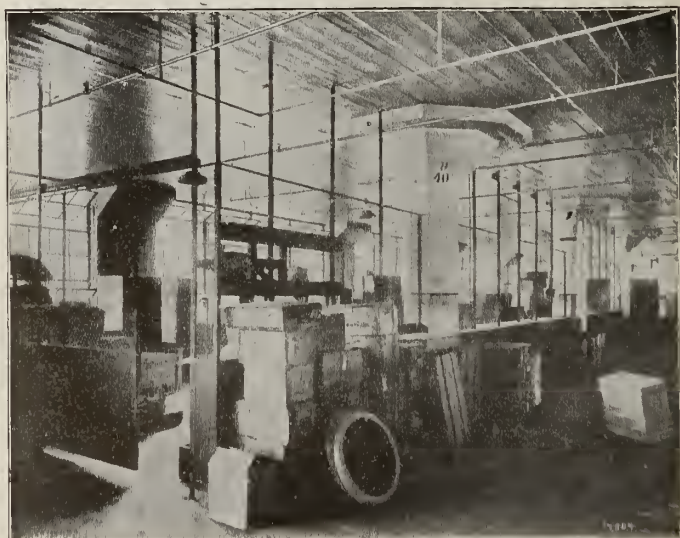
Woven Wire Partitions.

Afford a very economical means of subdividing space in industrial plants. In addition to their low cost they have the advantage of simplifying the lighting, heating and ventilating problems, since they permit the unrestricted passage of light, heat and air. They are easily installed, and any space subdivided can be readily diminished or increased according to the existing requirements, simply by the removal or addition of separate panels. They are neat in appearance, strong, require practically no upkeep, and occupy but very little space in themselves. They afford protection and promote cleanliness and orderliness. Used very extensively for tool rooms, stock-rooms, machine rooms, cashier cages, etc.

These partitions are manufactured in either the square mesh or diamond mesh. The square mesh panel is lower in cost than the diamond, due to the fact that the cloth is machinemade. The diamond mesh is hand woven and is usually preferred where considerations of strength, appearance and durability are important.

Standard panels are 4 by 8 ft., No. 10 wire, 1½-in. mesh, and are interchangeable. These partitions are manufactured to suit requirements. Where desired, the base section can be made of sheet metal with sheet metal countertops. Window and door openings can be arranged to swing or slide in direction desired. The framing likewise can be made of either pipe or structural shapes, depending upon the degree of rigidity required, and the conditions existing.

When writing for prices, send sketch showing the general floor layout, giving approximate sizes; also state height finished floor to ceiling, and the nature of the floor, column and ceiling construction, whether concrete, tile, wood or plaster on metal furring.



WOVEN WIRE PARTITION, STOREROOM, FORD MOTOR
SERVICE STATION, MILWAUKEE, WIS.

AMERICAN FENCE CONSTRUCTION CO.

Woven Wire Fences and Iron Railings

GENERAL OFFICES

96-102 Church Street
NEW YORK, N. Y.

TELEPHONE:

BARCLAY, 6753-4

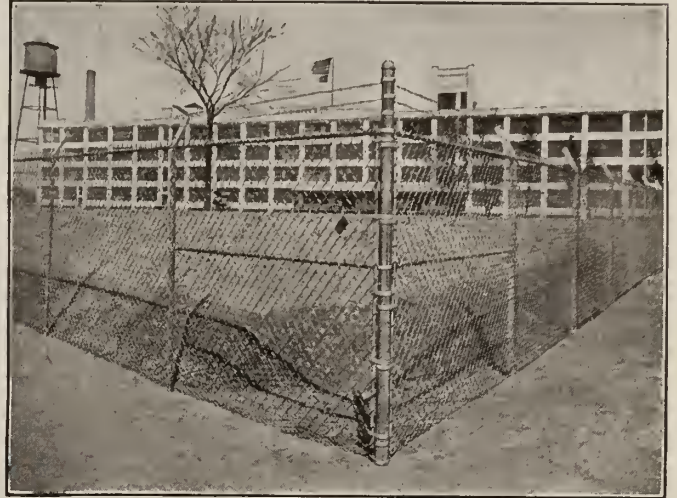
Products.

Manufacturers of and contractors for AFCCO WIRE LINK STEEL FENCING and AFCCO SOLID WROUGHT IRON PICKET and ANGLE IRON PICKET RAILINGS for mills and factories, institutions, public grounds, railway terminals, etc.; IRON GATES and GATE POSTS.

Woven Wire Fencing of Regular or Non-climbable types, Window Guards, Machinery Guards, Tool Room Enclosures, Wire or Iron Lawn Fences and Gateways, Tennis Court Enclosures, etc.



TRADE-MARK



TYPE NO. 1103 AFCCO WIRE LINK FENCE

Fence 7 ft. high over all, enclosing plant of E. R. Durkee & Co. Entire framework galvanized, and all posts set in concrete footings. Fabric is 2-in. mesh of No. 6 wire

Co-operative Service.

Practically every factory or institution fence presents its own peculiar construction problems. The design and estimating department of this organization is composed of men who have been meeting these problems for years, and to supplement their work, the services of this company's district representatives are available without obligation at many points in the Eastern, Central and Southern States.

The prospective user of fencing is urged to avail himself of this service, or to send for the complete Afcco Factory Fence Catalogue.

Erection.

A large percentage of this company's output of fence is erected by them complete. To take care of this important department a well equipped construction force is maintained, but when erection by this company is not desired, shipments of materials are accompanied with instruction drawings and setting plans, showing proper method of erecting, and insuring mechanical workmanship in every detail.

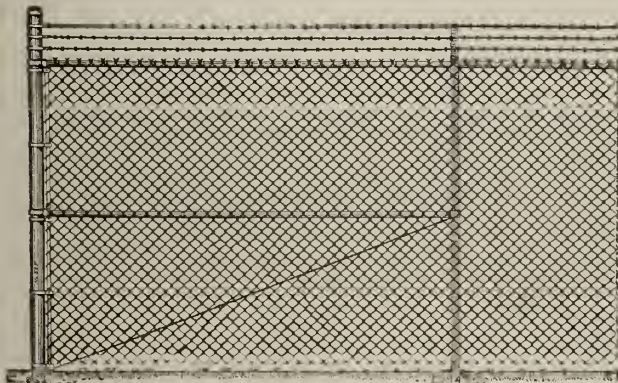


TYPE NO. 1003 AFCCO WIRE LINK FENCE

Fence 8 ft. high over all enclosing Army Supply Base buildings. This type differs from No. 1103 in that no top rail is used. Posts are galvanized and grouted 12 in. into concrete wall. Fabric is 2-in. mesh of No. 9 wire. For this particular piece of government work the barbed wire overhang was flared out instead of in, the inward flare being the usual procedure

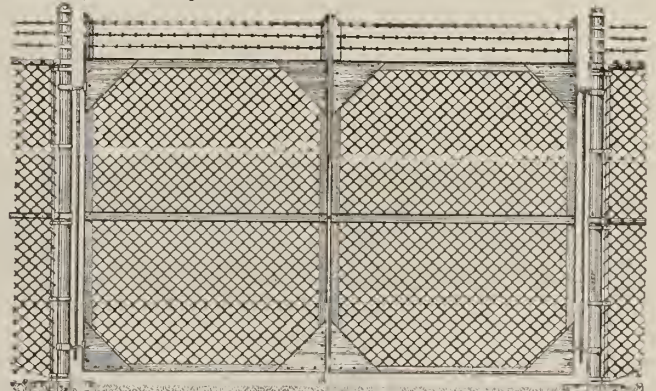
Afcco Factory Fence Features.

END, CORNER AND GATE POSTS—In Afcco fences these posts are made of unusually heavy tubular sections (see Specification data).



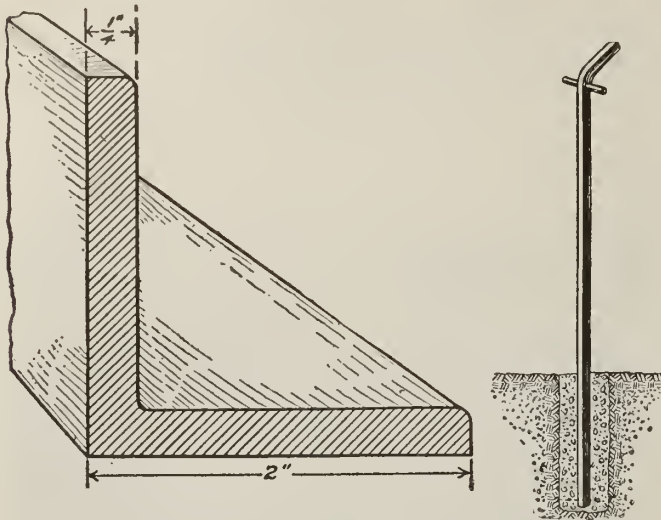
DETAIL OF TYPE NO. 1103 WIRE LINK FENCE

Showing method of bracing at ends. Regular stock heights 7 and 8 ft. Other heights up to 10 ft. can be furnished



DETAIL OF AFCCO DOUBLE SWINGING GATES MADE WITH DOUBLE CORNER GUSSET PLATES

Center latch and drop bolt. Adjustable hinges to allow for full swing. Stock widths single gates 3½ ft.; double gates, 10, 12 and 18 ft.

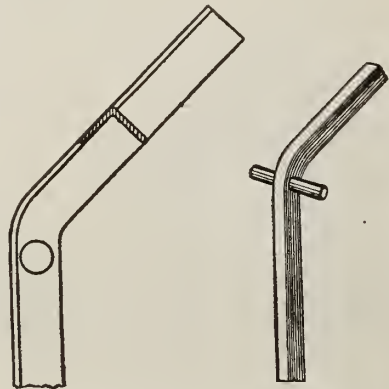


FULL SIZE DETAIL OF ANGLE BAR LINE POST AND ELEVATION SHOWING LINE POST CONSTRUCTION

Note barbed wire arm is integral with post; also hole punched just below bend for pipe rail. This overcomes necessity for using separate parts, such as rail caps and barbed wire arms, assuring greater strength and durability

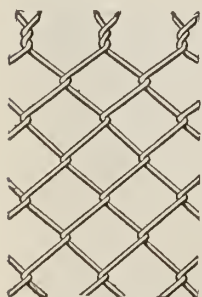
LINE POSTS—The backbone of any fence is its line posts. For that reason the standard spacing for line posts in Afcco fences is 8 ft.

These line posts are 2 by 2 in. high carbon steel angles, having a wall thickness of $\frac{1}{4}$ in., with integral arm for carrying the barbed wire overhang. For fences with top rail such as type 1103, one leg of the angle is punched for the rail to pass through. Thus all bolted parts or slipover fittings are eliminated, and the framework can not be broken down or dismantled after having been assembled.



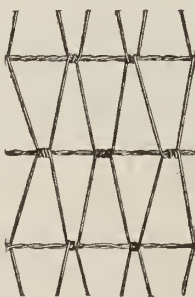
DETAILS OF INTEGRAL BARB WIRE ARM ON ANGLE POSTS
Note simplicity and strength

WIRE LINK FABRIC—Afcco wire link is made of galvanized wire, carrying 70 lbs. of spelter per ton, nearly double the quantity used on ordinary galvanized wire. After weaving, this fabric receives a special oil treatment which further increases its rust resisting qualities.



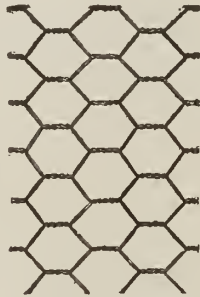
DETAIL "AFCCO" GALVANIZED WIRE LINK STEEL FABRIC, 2-IN. MESH

In widths up to 12 ft. Nos. 9, 6 or 4 gage wire



DETAIL "AFCCO" "VEE" MESH STEEL FABRIC, HORIZONTAL CABLES, 4 IN. APART

In widths up to 8 ft. No. 12½ gage wire



DETAIL "AFCCO" HONEYCOMB FABRIC

In widths up to 6 ft.; 2-in. mesh No. 15 wire, galvanized after making

GALVANIZING—In Afcco fences with galvanized framework the galvanizing is done by the hot dip process *after fabrication*, covering all cut ends, punched holes, etc. No raw metal is left exposed. All bolts used are hot dip galvanized, the threads not being recut, a radical departure from the method in common practice.

POST FOOTINGS—Afcco fences are erected with posts set in concrete. Contrary to common opinion this costs no more than other methods of anchoring posts, insures permanent alignment of the fence, and preserves the steel underground.

Specification Data Afcco Factory Fence.

POSTS—End and corner posts 3-in. outside diameter. Gate posts 4-in. outside diameter wrought pipe with horizontal pipe braces and 2-ply No. 7 galvanized wire truss cables.

Line posts Afcco 1-piece angle, with integral arm, to be spaced 8 ft. apart, set 3 ft. below grade. Galvanized or painted.

TOP RAIL—Tubular $1\frac{3}{8}$ -in. outside diameter wrought pipe. When desired a $1\frac{3}{8}$ -in. rail can be substituted, and line posts spaced 10 ft. instead of 8 ft. apart—8-ft. spacing recommended.

Fences without top rail to have two courses of No. 7 coiled steel supporting wires stretched top and bottom.

GATES—Single or double swinging up to 24 ft., or overhead track sliding types.

Frames of 2-in. T-Section, heavily braced, and corners reinforced with double gusset plates.

FABRIC—Galvanized wire link, triangular mesh, or honeycomb mesh (Afcco wire link 2-in. mesh No. 6 wire recommended for severer services). [Give height and size of mesh.]

Barbed wire overhang 4-point, thick-set galvanized, three or more courses.

GALVANIZING—All posts and their fittings to be hot dip galvanized after fabrication.

Galvanized bolts to be used in assembling. (Threads not recut.)

PAINTING—When galvanizing is not specified for framework, paint 1 shop coat, also 1 field coat before galvanized wire fabric is attached.

ERECTING—Set all posts in concrete footings (ordinarily 3 ft. deep); area for end, corner and gate posts not less than 15 in. in diameter, and for line posts not less than 10 in.

A Few Notable Afcco Factory Fence Installations.

Crucible Steel Co., Harrison, N. J.
North American Chemical Co., Bay City, Mich.
Barrett Co., plants at Youngstown and Toledo, Ohio, Detroit, Mich., Bethlehem, Pa., and Shadyside, N. J.
Consolidated Gas Co., New York, N. Y.
Mexican Petroleum Co., Chelsea, Mass., and Providence, R. I.
International Paper Co., Niagara Falls, N. Y.
Westinghouse, Church, Kerr Co., New York, N. Y.
Department of Correction, Blackwells Island, New York, N. Y.
United Piece Dye Works, Lodi, N. J.
American Car & Foundry Co., Berwick, Pa.
U. S. Government, Department of Yards and Docks, Army Transport Service, Gas Defense Service, Ordnance Department, Department of Military Aeronautics
Bartlett-Hayward Co., Baltimore, Md., 10 installations
The Koppers Co., Pittsburgh, Pa., 5 installations
Singer Mfg. Co., Elizabethport, N. J.
Habirshaw Electric Cable Co., Nepperhan, N. Y.
City of Fall River, Mass., Water Works Department
City of Akron, Ohio, Water Works Department
National Lead Co., New York, N. Y.
Turner Construction Co., New York, N. Y.
Shuford Mills, Hickory, N. C.
Central Hudson Gas & Electric Co., Poughkeepsie, N. Y.
Hart Roller Bearing Co., Orange, N. J.
Arcade Cotton Mills, Rock Hill, S. C.
Cleveland Worsted Mills, Ravenna, Ohio
J. E. Barber Thread Works, Paterson, N. J.
Renfrew Mfg. Co., Renfrew, Mass.
Endicott, Johnson Co., Binghamton, N. Y.
Ludlow Mfg. Associates, Ludlow, Mass.
Crown Mfg. Co., Pawtucket, R. I.
Baer Bros., Stamford, Conn.
Aluminum Co. of America, Massena, N. Y.
Manomet Mills, New Bedford, Mass.
Department of Parks, Brooklyn, N. Y.
State Normal School, Lowell, Mass.

Afco Wrought Iron Fences and Gates.

Illustrations show the 3 leading types of wrought iron fences and gates designed by this company for factory enclosures.

Afco factory fence catalogue showing various other designs, also methods of installation, and containing much valuable information, will be mailed on request.

No. 325 Special Iron Picket Fence.

In connection with simplicity and great strength, this design incorporates low erection cost by virtue of the panels being made in 10-ft., instead of the ordinary 8-ft. lengths. This reduces, by 20%, the number of holes to dig, posts to set and panels to hang.

SPECIFICATIONS—Pickets $\frac{3}{4}$ -, $\frac{7}{8}$ -, or 1-in. square wrought iron. Rails 2 by 2 by $\frac{1}{4}$ -in. angles, or 2 by 1 by $\frac{1}{8}$ -in. channels. Line posts 3-in. I-beam, $5\frac{1}{2}$ -lb. section for heights up to 6 ft.; $7\frac{1}{2}$ -lb. section for greater heights. No back bracing required with these posts. Posts set 18 in. into concrete footings which extend not less than 36 in. below grade. Panels 10 ft. long equipped with heavy center supports.

No. 152 Iron Picket Fence.

Similar in general to design shown on top of page, except that in this fence there are 3 horizontal rails of 2 by $\frac{5}{8}$ -in. solid iron, and the entire work stands on a concrete coping. Line posts enter concrete 12 in.

Angle Picket Railing.

The vertical members in this design are high carbon steel angles instead of solid bars, making a difference of about 25% in weight with a consequent reduction in cost. This reduction in weight makes it practical to rust-proof this type of fence by hot dip galvanizing in panels after fabrication. No painting is then required.

SPECIFICATIONS—Pickets 1 by 1 by $\frac{3}{8}$ -in. angles on 5-in. centers, or $1\frac{1}{4}$ by $1\frac{1}{4}$ by $\frac{3}{8}$ -in. on 6-in. centers. Rails 2 by 2 by $\frac{1}{8}$ -in. angles. Line posts, regular adjustable picket post with back supporting brace and cast iron ground base, or 3-in. standard I-beam section to set in concrete. Panels 8 ft. long equipped with center supports.

Special Gates.

Massive iron gates at the main factory entrance are decidedly attractive. They can be used in connection with wire as well as iron fence without greatly increasing the cost. The view shown herewith is a good example of what can be accomplished.

In this instance massive brick piers were used, ornamented at the top with specially designed lamps. Width of gates 20 ft. Height at center 7 ft. 6 in.

Note ornamental panel effect at center and on each side.

The extreme width of these gates was made necessary owing to the driveway entering at an acute angle.

Many other designs showing factory gate installations can be submitted.

**NO. 325 WROUGHT IRON RAILINGS, 7 FT. HIGH**

Posts are $7\frac{1}{2}$ -lb. I-beam section set in concrete. Pickets $\frac{3}{4}$ in. square, set diagonally. This fence can be furnished in all heights from 4 ft. up to 8 ft.

**NO. 152 IRON PICKET FENCE, 6 FT. HIGH, ENCLOSING PLANT OF THE CROWN MFG. CO., PAWTUCKET, R. I.**

Pickets $\frac{3}{4}$ -in. square, set square. Horizontal rails 2 by $\frac{5}{8}$ -in. solid. Posts are $5\frac{1}{2}$ -lb. I-beam section, ornamented with pineapple heads

**ANGLE PICKET FENCE AND GATES, 6 FT. HIGH, ENCLOSING PECK MEMORIAL HOSPITAL GROUNDS, BROOKLYN, N. Y.**

At a distance of only a few feet this fence has the appearance of an unusually massive solid picket fence

**SPECIALLY DESIGNED WROUGHT IRON FACTORY ENTRANCE GATES, MAIN DRIVEWAY ENTRANCE TO BAER BROTHERS PLANT, STAMFORD, CONN.**

AMERICAN STEEL & WIRE COMPANY

Manufacturers of Woven Wire Fencing

208 So. La Salle Street

CHICAGO, ILL.

SALES OFFICES

NEW YORK, 30 Church Street
WORCESTER, 94 Grove Street
BOSTON, 120 Franklin Street
PHILADELPHIA, Widener Building
PITTSBURGH, Frick Building
BUFFALO, 337 Washington Street
DETROIT, Foot of First Street
CINCINNATI, Union Trust Building

CLEVELAND, Western Reserve Building
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ST. PAUL-MINNEAPOLIS, Pioneer Building, St. Paul
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EXPORT REPRESENTATIVES, UNITED STATES STEEL PRODUCTS Co., 30 Church Street, New York
PACIFIC COAST REPRESENTATIVES, UNITED STATES STEEL PRODUCTS Co., San Francisco, Los Angeles, Portland, Seattle

Products.

WOVEN WIRE FENCING and STEEL GATES for all purposes.

For Wire Rope, see pages 78-84; for Concrete Reinforcement, see pages 158-63; for Electric Wires and Cables, see pages 1092-1108.

Quality of Wire.

The company makes large quantities of both Open Hearth and Bessemer steel, using both kinds extensively in the manufacture of American fence, with equally good results. The wire used is just right for fence purposes, not too hard nor too soft. It is tough and strong, and can be spliced with ordinary fence tools. When galvanized by our superior process, it makes the best woven wire fence that can be produced.

Quality of Galvanizing.

After being properly cleaned, the wire is passed through a bath of molten zinc or spelter, as it is commonly called. The wire is never passed through the zinc bath more than once, because to pass it through the second time would melt off the first coat of zinc. The terms "double galvanized" and "triple galvanized" are, therefore, entirely misleading, because no double or triple galvanized wire is made. A uniform coating of zinc applied so as to avoid bare and thin spots on the wire is far more desirable than a heavy uneven coating with portions of the wire poorly protected.

After many years devoted to scientific investigation, the AMERICAN STEEL & WIRE COMPANY has been able to determine the proper speed, temperature, etc., that should be used in galvanizing the different sizes of wire, to secure the best results.

Fences and Gates for Industrial Plants, etc.

PARK AND PADDOCK FENCE—A clean and distinctly efficient fence for yards surrounding manufacturing plants, as by virtue of the extreme heights and the strength of the large No. 9 wires made of hard steel, property is thoroughly walled in without the expensive and unclean features of the wooden or brick wall.

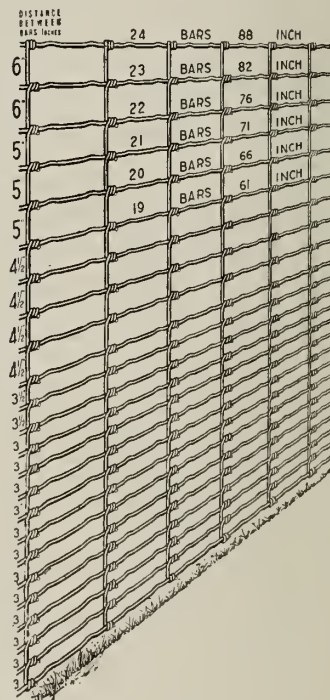
Also especially adapted for parks, fair grounds, racetracks, country clubs, golf clubs, tennis courts, zoological gardens, branding pens and stockades.

With the use of a strand of barbed wire at the extreme top, and in some cases with two or more barbed wires arranged horizontally, upon brackets, the largest protection may be obtained. When erected upon our galvanized steel posts it becomes an enduring investment, requiring no attention for repairs nor to guard against fires.

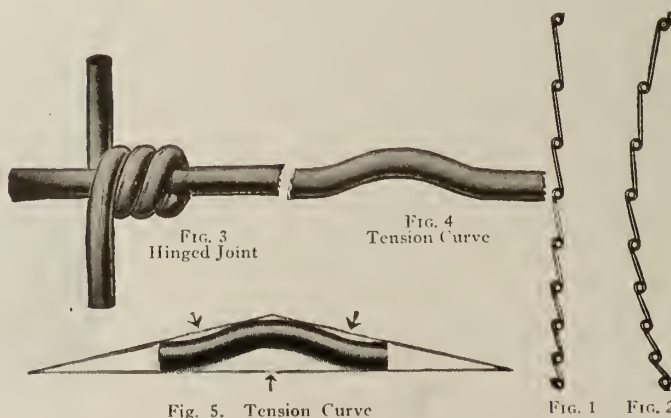
PARK AND PADDOCK

GATES—Especially strong gates with large tubular steel frames and filled with all No. 9-gage Park and Paddock fence fabric. These gates are firmly braced by 2 horizontal and 1 vertical brace. Made in widths of 10, 12 and 14 ft., and in six heights to match Park and Paddock fence.

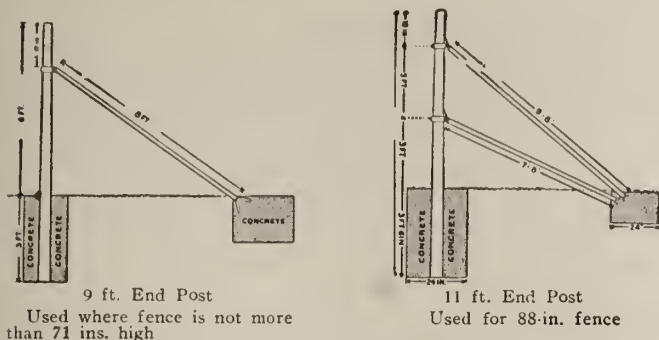
CONSTRUCTION OF PARK AND Paddock FENCE — (See illustration below.) Fig. 1 is side view of upright or stay wires, showing each stay to be a separate and distinct wire. It also shows the stays as they appear in the fence when upright. Fig. 2 shows action of stays when unusual pressure is brought against the fence. Fig. 3—When pressure is removed, the fence will resume its original position. Figs. 4 and 5 show the tension curve, the pull of expansion and contraction.



PARK AND PADDOCK FENCE
All No. 9 gage wire. Stay wires 6 or 12 ins. apart. Put up in rolls of 20 rods each



METHOD OF FASTENING STAY WIRES TO LINE WIRES



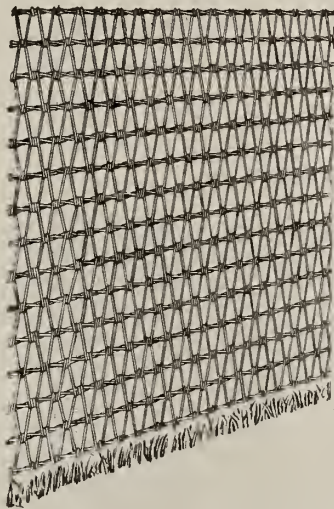
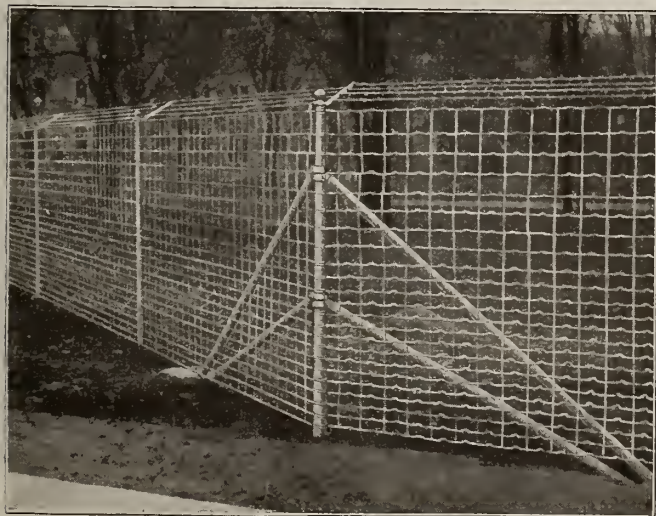
METHOD OF SETTING END OR CORNER POSTS

LIST PRICES AND WEIGHTS, PARK AND PADDOCK FENCE

Design No.	Approx. height, ins.	No. of horizontal bars	Stay wires 12 ins. apart	Stay wires 6 ins. apart
			Approx. wt. per rod, lbs.	Approx. wt. per rod, lbs.
1961	61	19	28.0	37.5
2066	66	20	29.6	39.8
2171	71	21	31.2	42.1
2276	76	22	32.8	44.4
2382	82	23	34.6	46.8
2488	88	24	36.3	49.3

DIAMOND LAWN FENCE—This fence is suitable for use around industrial plants, and for similar purposes to those for which the Park and Paddock fence is employed.

The triangular truss used is the strongest form of construction known. The diagonal or cross wires are so interwoven with the horizontal cables that slipping is impossible. This gives the fence exceptional strength and rigidity. At every second cable the cross wires are wrapped around the cable, thus forming a perfect hinge joint. Under a heavy or sudden pressure the fence will act just like a hinge, and when the pres-

DIAMOND LAWN FENCE
2-in. mesh, non-climbable

82-INCH PARK AND PADDOCK FENCE ERECTED ON AMERICAN GALVANIZED STEEL POSTS

Showing 11-ft. corner post with 4 braces; also extension arms with 4 barbed wires

sure is removed it can be bent back to its original position without injury to the wires.

The cross wires having 2-in. spacing makes this fence non-climbable and affords great strength and durability, enabling it to stand the heaviest usage, while still retaining its shape.

Furnished in 6 heights and 3 specifications as shown in following table, in rolls of 10 and 20 rods.

AMERICAN TUBULAR STEEL GATES—Made in various widths and heights, and filled with a heavy 2-in. diamond mesh, non-climbable fabric, to match Diamond lawn fence. Strong, tubular frames, substantially braced.

LIST PRICES AND WEIGHTS, DIAMOND LAWN FENCE,
2-IN MESH

Approx. height for all styles, ins.	SPECIFICATIONS I 2-strand No. 12½ Horizontal Cables, No. 14 cross wires	SPECIFICATIONS J 2-strand No. 12½ Horizontal Cables, No. 12½ cross wires	SPECIFICATIONS K 3-strand No. 12½ Horizontal Cables No. 12½ cross wires
	Approx. wt. per rod, lbs.	Approx. wt. per rod, lbs.	Approx. wt. per rod, lbs.
58	29.4	38.3	44.6
50	25.3	32.9	38.4
42	21.2	27.6	32.2
34	17.2	22.2	26.0
26	13.1	16.9	19.8
18	9.0	11.5	13.6

American Galvanized Steel Fence Posts.

The American post has 18 years to its credit in actual service in the field throughout the entire country, in all kinds of soil and subject to all sorts of conditions. The following are a few of its advantages:

Sufficient strength; will withstand exposure to atmospheric conditions, fire, lightning, etc. Not lifted by frost; occupies as little space as possible; equal resistance in all directions; readily detached from fence. Easy to set, requiring no special tools; practically indestructible. Can be driven in ordinary soil; easily set in hard earth or pebbly soil by boring 2-in. hole. No staples required; adapted for any style woven wire fence, barbed or smooth wire; light in weight, easily handled; can be moved without injury and reset.

EXTENSION ARMS FOR AMERICAN STEEL POSTS—For use with American galvanized steel fence posts, these arms are made to carry 4 lines of barbed wire. No staples required. The arms are neat, strong and easily attached. They are shipped detached and are fastened to the posts by 2 bolts, thoroughly coated with zinc.



Line Post End Post Corner Post

AMERICAN STEEL POSTS

Line posts 5 to 9 ft., No. 13 or No. 16 gage metal; 10 and 11 ft., No. 13 gage only. End and corner posts, 7 and 8 ft., No. 10 or No. 12 gage metal; 9, 10 and 11 ft., No. 10 gage only



ARMS FOR LINE, END AND CORNER POSTS

ANCHOR POST IRON WORKS

Manufacturers of Wire Fences, Iron Railings and Entrance Gates

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TELEPHONE:
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FACTORIES: GARWOOD, N. J., and CLEVELAND, OHIO

Products.

ANCHOR POST CHAIN LINK WOVEN STEEL and MESH FENCES and GATES; WOVEN WIRE FENCES; ANCHOR POSTS; PICKET RAILINGS; ELECTRICALLY WELDED IRON RAILINGS and GATES for factories, water companies and railroads; WIRE FENCES and ELECTRICALLY WELDED SLIDING and SWINGING GATES for country and suburban homes; WROUGHT IRON and WIRE WINDOW GUARDS; INTERTRACK FENCES.



TRADE-MARK

experience thus acquired is offered for the solution of problems.

At New York, and also at the several branches, is maintained a force of men skilled in putting up our fences and in solving construction problems. When a customer prefers to erect a fence, instructions and necessary tools are furnished.

Information Required for Estimates.

Engineering and Erecting Service.

ANCHOR POST IRON WORKS has been called upon, by many industrial corporations and railroads, to design fences to meet a wide variety of conditions. The

In writing for prices or ordering, draw a simple diagram showing length of fence lines; location of gates, corners and ends; width of gate openings, single and double. State whether ground is level or graded.

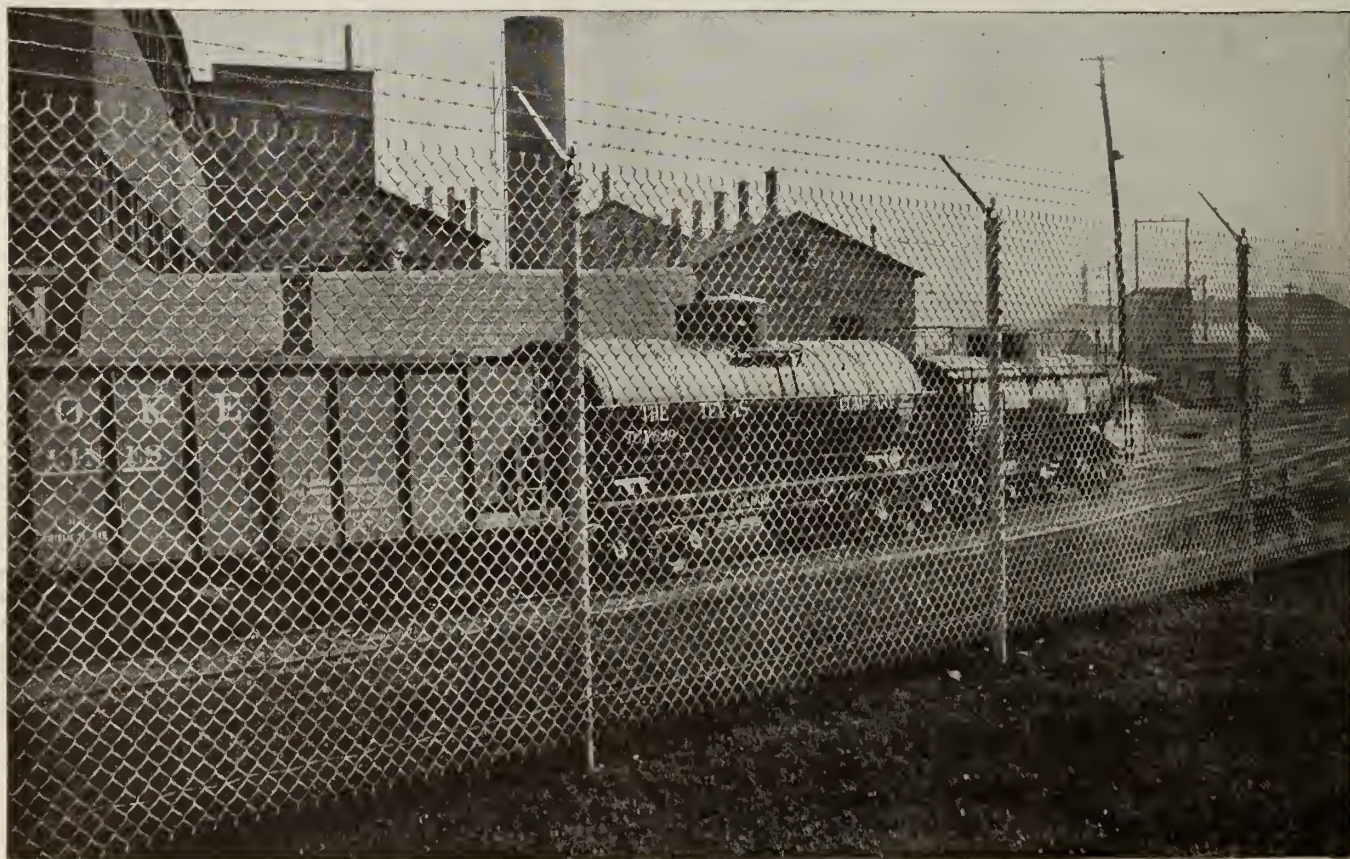


PLATE NO. E3691. 8600 FEET OF STANDARD ANCHOR POST CHAIN LINK FENCE, ERECTED FOR PETROLEUM IRON WORKS, SHARON, PA.

Height	8 ft.
Posts	Galvanized Anchor posts
Fabric	Chain link woven steel—wire No. 6 gage

Anchor Posts.

Anchor posts are U-bars of high carbon steel and, together with all other parts, are heavily galvanized above and below ground, preventing rust and insuring long service. Posts are driven into the ground and held rigidly erect by two anchor stakes driven through slots clamped to opposite sides of the posts.

Chain Link Woven Steel Fences.

Chain link woven steel is of the best quality galvanized steel wire of No. 9 or No. 6 gage, No. 6 being the size most used. Made in any width up to 10 ft. The mesh is so small it affords no foothold for fence climbers; and as an additional protection 3 or more strands of barbed wire are fastened to inwardly inclined arms attached to the tops of posts.

Fence is furnished with or without top rail of galvanized pipe. Posts and all fence parts are galvanized by hot dip spelter process. Under conditions where protection is of utmost importance, these fences are made 10 ft. in height, and diagonal arms and barbed wire are attached to both front and back of posts; the spread across the top is about 2 ft. The gates are as unclimbable as the fence.

Triangular Mesh Fences.

To meet conditions which do not demand the heavier chain link fence, this company builds an unclimbable fence of moderate cost but of great strength and durability.

The posts are regular Anchor posts, size No. 2, set 8 to 10 ft. apart. Fence is made in heights from 4 ft. up to 8 ft. Triangular mesh fabric is of 2-ply cables, 4 in. apart; the upright wires are 2 in. on centers; No. 12½ wires are used for both. Inclined inward from the post tops are steel arms, on which are stretched two or more strands of barbed wire. Posts, fittings and fabric are thickly galvanized.

Chain Link Gates with Electrically Welded Frames.

Rigidity and strength are the most important characteristics of these gates. Their great strength is secured by joining the top and bottom rails of 2½-in. galvanized pipe, to double uprights of 2-in. channel by means of channel corner plates *electrically welded* to the uprights. The corners so formed are fused together into a single absolutely unbreakable and unbendable piece.

The center lift rod holds the gates at both the top and bottom. The padlock can be reached equally well from either the inside or outside of the gate. The hinges are of extra strong malleable iron and so made that the gate can be swung open 180°, or back parallel to the fence line, a feature which is sometimes of the utmost importance, especially on railroad sidings.

Another exclusive feature of this gate is the method by which the chain link panel is fastened between the channel uprights and stretched up taut by means of hook bolts.

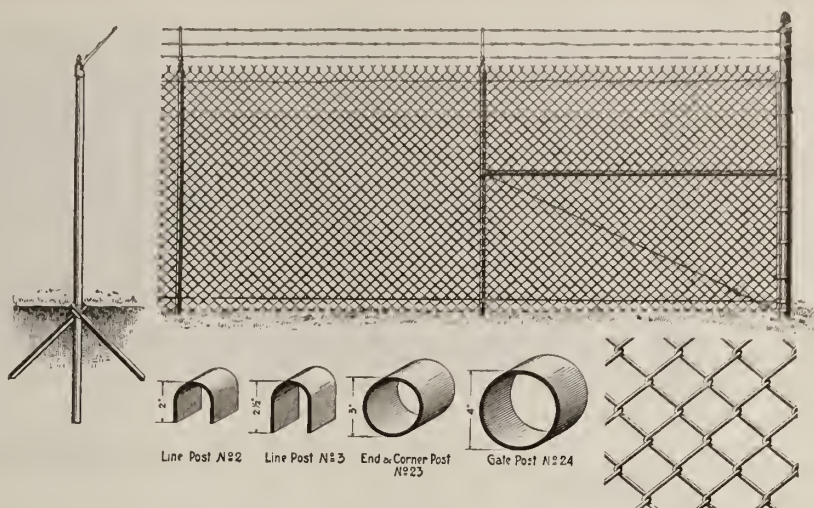


PLATE NO. E3536. CHAIN LINK WOVEN STEEL FENCE

Fabric.....Chain link woven steel—wire No. 6 gage
Line posts.....Galvanized Anchor posts, size No. 3, 2½-in. steel U-bar, set 8 ft. on centers
End and corner posts.....3-in. steel pipe
Gate posts.....4-in. steel pipe

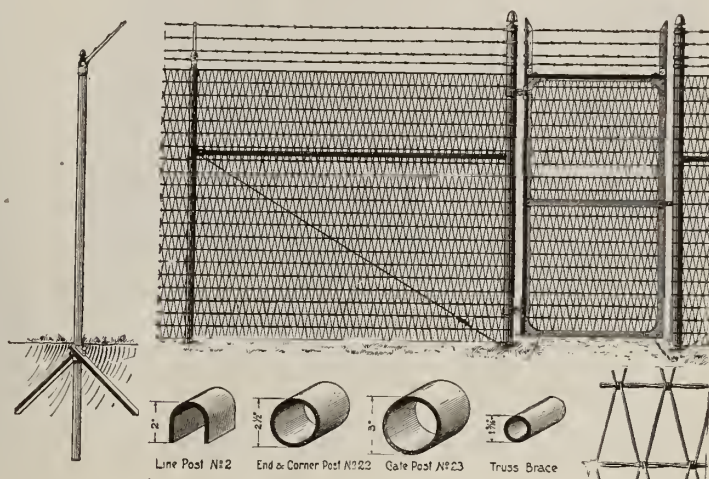


PLATE NO. E3537. TRIANGULAR MESH FENCE

Fabric.....Triangular mesh, No. 12½ wire
Line post.....Galvanized Anchor posts, size No. 2, 2-in. steel U-bar, set 10 ft. on centers
End and corner posts.....2½-in. steel pipe
Gate posts.....3-in. steel pipe

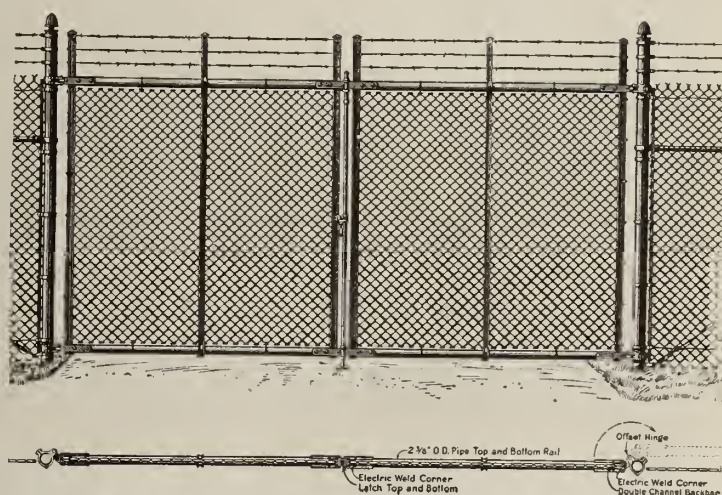


PLATE NO. E3648. ELECTRICALLY WELDED SWINGING GATE

Frames made with electrically welded uprights and corner pieces. Standard gates made in height to match fence. Single gates, 4 to 10 ft. between gate posts; double gates, 8 to 24 ft. and larger

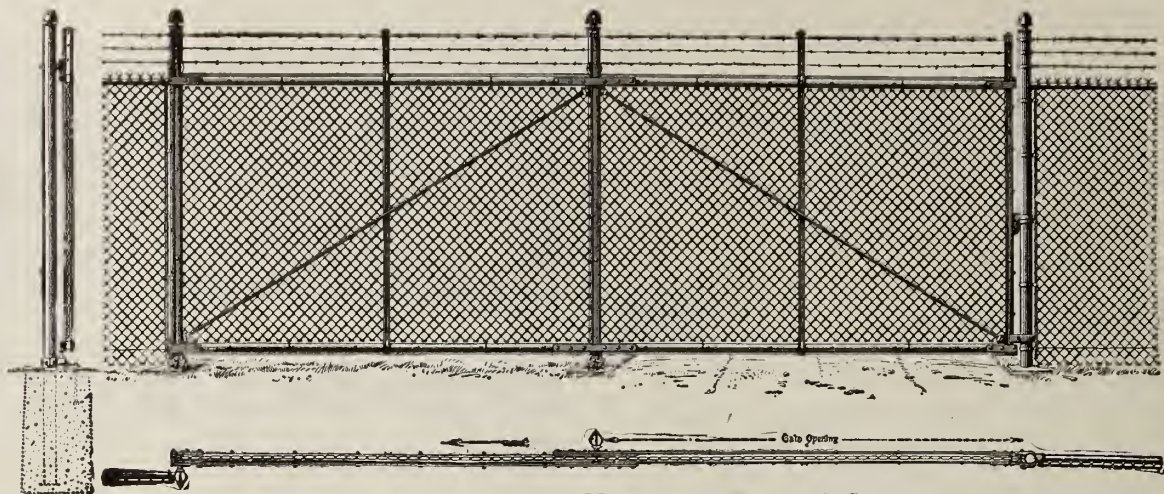


PLATE NO. 3692. ELECTRICALLY WELDED SLIDING GATE
Operates on rollers attached to two supporting posts. Gate opens one-half its length. No overhead structure and track required. Single gates made in widths from 4 to 14 ft., opening from right to left as ordered. Double gates, sliding in both directions, furnished for greater widths than 14 ft.



PLATE NO. E3693. ANCHOR POST CHAIN LINK FENCE WITH ELECTRICALLY WELDED GATES, ERECTED AT THE U. S. FLEET SUPPLY BASE, SOUTH BROOKLYN, N. Y.
Height.....7 ft.
Length.....5100 ft.
Fabric.....Chain link woven steel—wire No. 9 gage, 2 in. mesh

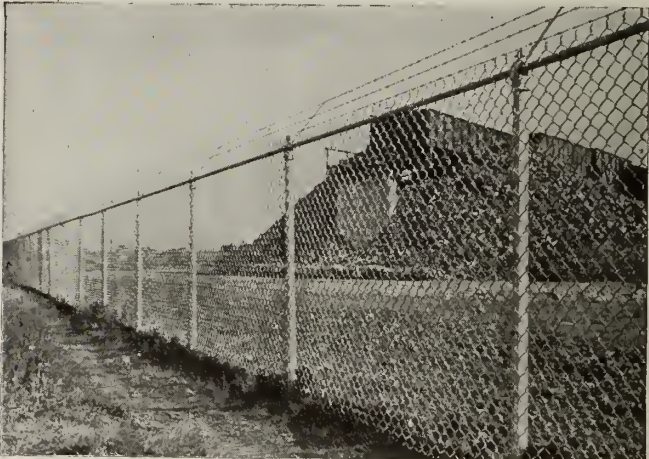


PLATE NO. E3694. ANCHOR POST CHAIN LINK FENCE, ERECTED AT THE PLANT OF H. W. JOHNS-MANVILLE CO., MANVILLE, N. J.
Height.....7 ft.
Length.....6000 ft.
Fabric.....Chain link woven steel—wire No. 6 gage, 2 in. mesh



PLATE NO. E3533. TRIANGULAR MESH FENCE, ERECTED FOR THE AMERICAN AIRCRAFT COMPANY AT COPIAGUE, N. Y.
Height.....8 ft.
Posts.....Galvanized Anchor posts
Fabric.....Triangular mesh 2 x 4 in.
Equipped with arms and 4 strands barbed wire
(Specifications and details on preceding page)



PLATE NO. E3695. SQUARE MESH FENCE, ERECTED FOR MERCK & CO., RAHWAY, N. J.
Height.....8 ft.
Posts.....Galvanized Anchor posts
Fabric.....No. 9 galvanized wire, woven into rectangular mesh
Equipped with arms and 7 strands of barbed wire



PLATE NO. E4617. ELECTRICALLY WELDED IRON RAILING, ERECTED FOR THE HARTFORD HIGH SCHOOL, HARTFORD, CONN.

Height.....6 ft.
Pickets..... $\frac{3}{4}$ -in. grooved square
Rails..... $\frac{3}{4}$ -in. grooved square double rails
Posts.....3 in. I-beam, set with drive anchors
Panels.....Standard length, 10 ft.; height, 6, 7 or 8 ft.



PLATE NO. E4596. RAILING ERECTED FOR NEW YORK, NEW HAVEN & HARTFORD RAILROAD CO., PAWTUCKET, R. I.

Height.....5 ft.
Pickets..... $\frac{3}{4}$ -in. square
Rails.....2x2 in. channels
Posts.....3-in. I-beams, set in concrete
Panels.....Standard length, 10 ft.
Length.....12,000 ft.



PLATE NO. E4606. ELECTRICALLY WELDED DOUBLE GATES AT THE FACTORY OF THE DURATEX COMPANY, NEWARK, N. J.

Electrically Welded Railings and Gates.

A new and quite revolutionary process in the manufacture of railings and gates has recently been perfected.

ANCHOR POST IRON WORKS has secured the rights of manufacture, and has installed the necessary electrical machinery for the manufacture of railings and gates of every size and weight, from those made of light iron bars of $\frac{1}{2}$ -in. square, up to the very heaviest forms required for any service. By this process, the rails, pickets or other members are welded together at all points of intersection under a heavy electrical current, combined with a mechanical pressure of from 1 to 5 tons exerted at the moment the weld is made. This insures an absolute and unbreakable union of the metal of both the pickets and the rails.

Railings and gates made in this way are remarkably strong and rigid. Each unit, that is, each panel of railing, or each gate, being welded into practically one piece of metal, is free from weak joints or rivets.

Bulletin No. 24 describes this type of railing. A copy will be sent on request.

Iron Gates.

These gates are made to match the railing; the rails and pickets being the same as in the railings.

The gates are hung on strong, malleable iron

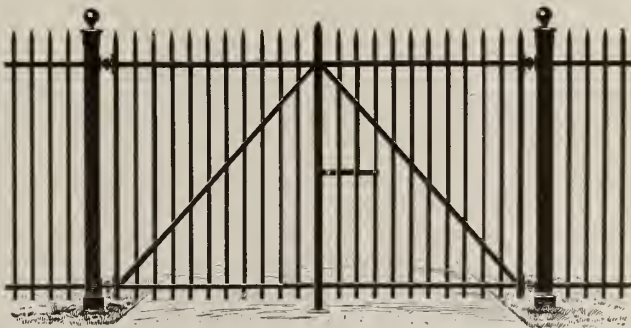


PLATE NO. E4531. IRON DOUBLE GATE

hinges; and are equipped with drop bolt in the center, hasp and padlock.

The gate posts are our standard posts No. 100 or No. 200; 3 in. or 4 in. square, respectively.

These posts are usually set in concrete.



PLATE NO. E4460. WROUGHT IRON WINDOW GUARD

In writing for price, give width and height of window openings and state method of fastening preferred

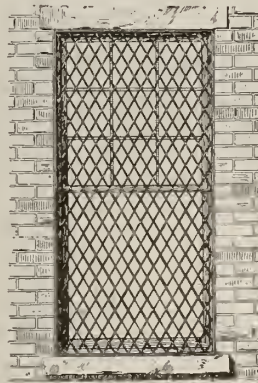


PLATE NO. E3453. WIRE WINDOW GUARD

In ordering, state size of mesh, number of wire, and whether channel or round frame is preferred

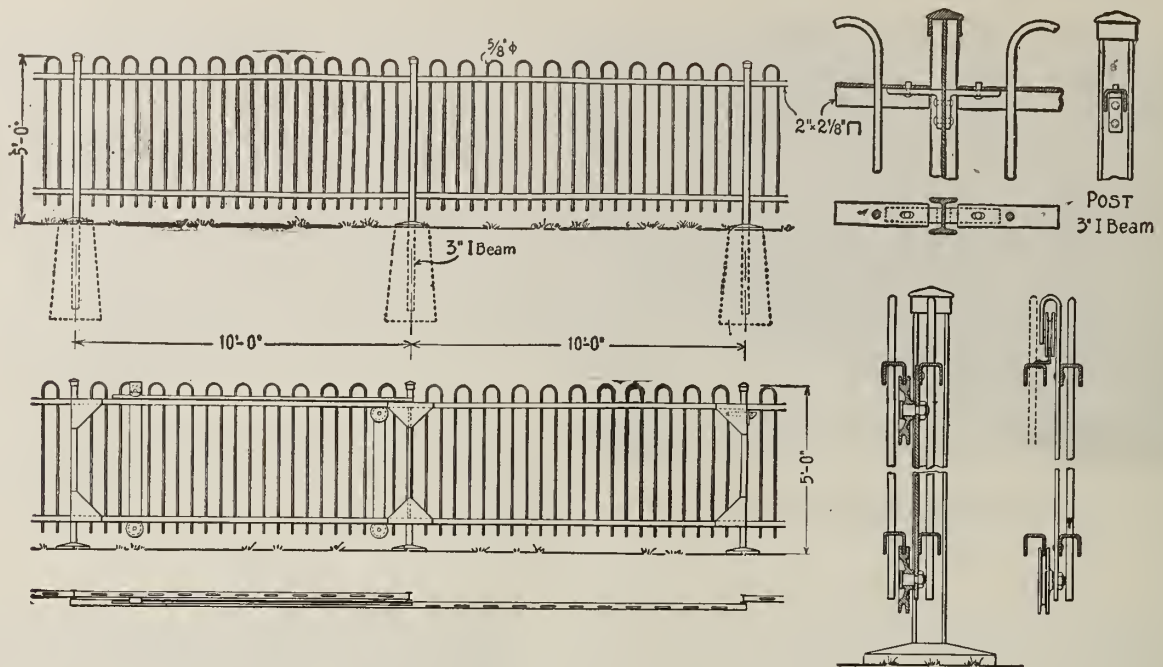


PLATE NO. E4487. INTERTRACK RAILROAD FENCE

Intertrack Railroad Fence.

This type of railing has been adopted by some of the principal railroad systems of the country, for fencing between tracks at stations and other exposed points. The posts are made of 3-in. standard I-beam, set in concrete footings. The panels are 10 ft. in length, supported by two very rigid rails of 2 by 2-in. channel. The pickets are $\frac{5}{8}$ or $\frac{3}{4}$ in. round, spaced 8 in. apart, so as to afford protection and strength, at the same time making the panel as light as possible. These panels are fastened to the posts in such a way that they can be quickly and readily removed, so as to facilitate work between the tracks when necessary. The railing shown in the illustration is 4 ft. 6 in. in height but can be made higher if desired.

The gates are very substantially constructed; give a maximum opening of 10 ft.; and are so arranged that they slide on the railing, and do not require a track across the gate opening at grade. They are easy to operate, and will not get out of order. The framing of the gate is made of the same panels as the railing, reinforced with gusset plates as shown in illustration.



PLATE NO. E4551. INTERTRACK FENCE

Erected for Central Railroad of New Jersey, Jersey City, N. J.

Notable Installations of Anchor Post Iron Railings and Unclimbable Fences.

Alabama & Vicksburg Railway, Vicksburg, Miss.
 American Brass Company, 4 plants
 American Encaustic Tiling Company, Maurer, N. J.
 American Glue Company, Peabody, Mass.
 American Locomotive Works, 3 plants
 American Radiator Company, 2 plants
 American Thread Company, Willimantic, Conn.
 Canadian Car & Foundry Company, Fort William, Ont., Can.
 Central Railroad of New Jersey, Jersey City, N. J.
 Cluett-Peabody Company, Troy, N. Y.
 Colt's Patent Fire Arms Company, Hartford, Conn.
 Crouse-Hinds Co., Syracuse, N. Y.
 Delaware, Lackawanna and Western R. R., New Jersey
 Diamond Match Co., 2 plants
 E. I. Du Pont de Nemours & Co., and Allied Interests, 32 plants
 Edison Electric Illuminating Company, Boston, Mass.
 Erie Railroad Company, New York, N. Y.
 Federal Glass Company, Columbus, Ohio
 Firestone Tire & Rubber Company, Akron, Ohio
 Fisk Rubber Company, Chicopee Falls, Mass.
 Ford Motor Car Company, Detroit, Mich.
 J. H. Frederick Silk Mills, Emaus, Pa.
 General Electric Company, 3 plants
 B. F. Goodrich Company, Akron, Ohio
 Imperial Tobacco Company, Ltd., Durham, N. C.
 Linde Air Products Company, 10 plants
 McKinnon Dash & Chain Company, St. Catherines, Ont., Can.
 Michelin Tire Company, Milltown, N. J.
 Minneapolis Threshing Machine Company, Hopkins, Minn.
 National Lead Company, Port Richmond, S. I., N. Y.
 New England Westinghouse Company, Chicopee Falls, Mass.
 New York Central & Hudson River R. R., New York, N. Y.
 New York Edison Company, Shadyside, N. J.
 New York, New Haven & Hartford R. R., New York, N. Y.
 New York, Westchester & Boston R. R., New York, N. Y.
 Ohio Match Company, Wadsworth, Ohio
 Postum Cereal Company, Battle Creek, Mich.
 Procter & Gamble Company, 3 plants
 Hans Rees' Sons, Asheville, N. C.
 Remington Arms & Ammunition Company, Ilion, N. Y.
 Rome Brass & Copper Company, Rome, N. Y.
 Sayles Bleacheries, Saylesville, R. I.
 Southern Cotton Oil Company, Savannah, Ga.
 Swift & Company, Boston, Mass.
 Taylor & Crat, Buffalo, N. Y.
 Thomaston Cotton Mills, Thomaston, Ga.
 Union Bleaching & Finishing Co., Greenville, S. C.
 Washington Steel & Ordnance Co., Washington, D. C.
 Whitman Barnes Mfg. Company, St. Catherines, Ont., Can.
 Winchester Repeating Arms Company, New Haven, Conn.
 The United States Government

A. T. BROOK IRON WORKS

Wire and Iron Fences and Gates

37 Barclay Street
NEW YORK, N. Y.

Products.

FENCE and ENTRANCE GATES for all purposes; NONCLIMBABLE WIRE or WROUGHT IRON FENCES for factories.

Vine and Fruit Tree Arbors and Trellises; Wire Fabrics of every description furnished for Wood Posts.

Special Iron and Wire Partitions for Storage Room and Tool Room; Ornamental Iron Work; Spiral Stairs; Machinery Guards; Office Railings; Window Guards; Cashier's Cages; Gratings; Pipe Railings; Folding Gates; Vault Covers; Weathervanes; Flag-poles, etc.

Facilities.

Over 30 years' experience, and complete equipment, enable this company to promptly furnish and erect products in any part of the country, or products will be furnished complete with full instructions for setting by customers.

Estimates.

Carefully prepared estimates furnished. Diagrams giving dimensions are of great assistance in quoting prices.

Special Designs.

This company will specially design work to suit property and ideas.

Illustrations.

Catalogues or drawings showing fence, gates and other goods of our manufacture mailed on request.

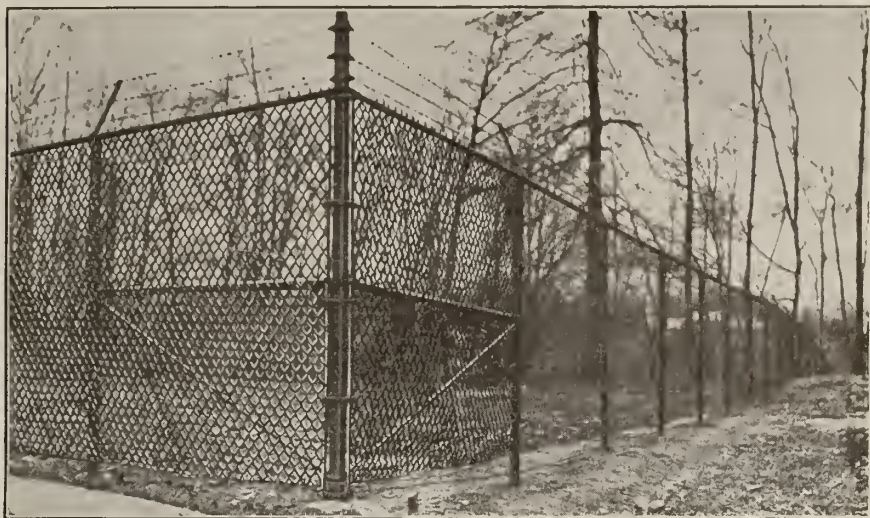


PLATE S.2134. NONCLIMBABLE CHAIN LINK FACTORY FENCE
Also furnished without top rail



PLATE S.2476. ENTRANCE GATE TO A LARGE ESTATE

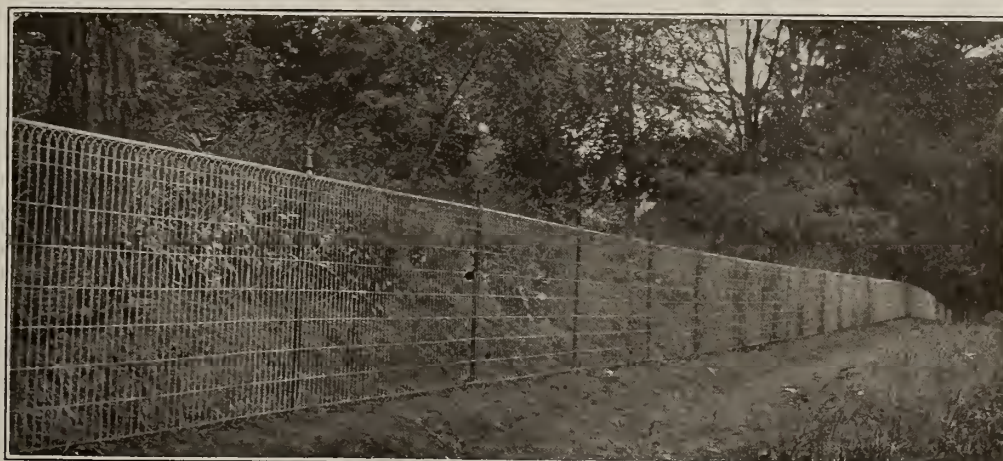


PLATE S.2151. WOVEN WIRE FENCE FOR FRONT LAWN OR DIVISION LINES

Made of heavy galvanized wire with twisted cables. A strong, durable, handsome fence. Mesh $1\frac{1}{2}$ x 6 in. Other meshes of 3 x 6 and $1\frac{1}{2}$ x 6 in. furnished if wanted. Made in heights: 24, 30, 36, 42, 48, 54, 60, 66, 72, and 84 in.

CYCLONE FENCE COMPANY

Manufacturers of Fencing and Gates

WAUKEGAN, ILL.

WAUKEGAN, ILL.

FACTORIES
CLEVELAND, OHIO

FORT WORTH, TEX.

BRANCHES

CHICAGO, ILL., New York Life Building, Cor.

Monroe and La Salle Streets

DETROIT, MICH., 45 Washington Boulevard

ROCHESTER, N. Y., Cutler Building

PHILADELPHIA, PA., 403 Stock Exchange Building

NEW YORK, N. Y., 2787-89 Woolworth Building

OAKLAND, CAL., 310 Twelfth Street

PORTLAND, ORE., 52-54 Union Avenue

SAN FRANCISCO, CAL., 77 O'Farrell Street

Products.

CYCLONE PROPERTY PROTECTION STEEL FENCING AND GATES for Industrial Plants of all kinds, Shipyards, and Water Front Properties, Cotton Mills, Textile Mills, Tank Farms and Oil Refineries, Chemical Plants, City Power and Pumping Stations, Filtration Plants, Reservoirs, etc.

FENCING for City, County, State and National Institutions, Parks, Public and Private Grounds, Country Estates, Country Clubs, Tennis Courts, Cemeteries, Kennels, Animal Cages, Bird Cages, etc.

SPECIAL FENCING and ENTRANCE GATES, WIRE OF IRON, built for any purpose.

SWINGING, SLIDING and FOLDING GATES, IRON RAILINGS, etc.

WIRE WORK of all kinds: Wire Partitions (built-in sections) for Factory Departments, Offices, Stock-rooms, etc., Window and Skylight Guards, Woven Wire Display Signs, Flexible Steel Mats, Wire Conveyor Belting.

Cyclone Service.

Expert engineers will solve all fencing problems



TRADE-MARK

such as rolling land, steep grades, ravines, switch tracks, etc.

Blue prints showing details of Cyclone fence construction, sent free on request.

Special construction salesman will call, measure property, show samples of fence and photographs of completed jobs.

When desired, expert construction superintendent is furnished at nominal cost to superintend erection of fencing anywhere.

Cyclone Standard Construction.

Specifies full standard weight tubular steel for posts and rail. The outside diameter size, also weight per lineal foot of posts and top rail are specified. Figures are taken from full standard weight schedule adopted by manufacturers. It is recommended that all posts be set in concrete and that Cyclone standard specifications be used to insure maximum satisfactory service.

When Cyclone standard fence construction represents a greater investment than conditions would warrant, a lighter weight post construction is provided to suit any requirement.



CYCLONE CHAIN LINK INVINCIBLE FENCING

Chain Link Invincible Fence—Specifications.

FABRIC—Made in all sizes of wire from No. 4- to No. 14-gauge. Woven in various sizes of mesh, in any height desired.

Top and bottom selvages have *twisted* and *barbed* finish.

POSTS—Full standard weight tubular steel. Line posts set 30 in. in ground; end, gate and corner posts, 36 in. in ground. Line posts spaced not over 10 ft. apart.

End, corner and walk gate posts "O," 3 in. outside diameter, weight 5.79 lbs. per lin. ft. Drive and sliding gate posts "J," 3½ in. outside diameter, weight 7.58 lbs. per lin. ft. Line posts "P," 2½ in. outside diameter, weight 3.65 lbs. per lin. ft.

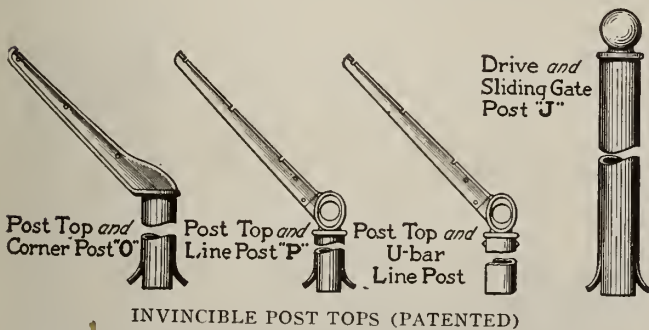
Note—All weights and dimensions are nominal, and are taken from the full standard weight schedule adopted by manufacturers. The permissible variation in specifications is 5% either way.

When desired, U-bar high carbon steel line posts furnished instead of tubular steel line posts. Up to and including 7-ft. fence, U-bar posts are 2½ in., weight 2.73 lbs. per lin. ft. For 8-ft. fence and over, U-bar posts are 2½ in., weight 3.82 lbs. per lin. ft.

TOP RAIL AND BRACES—Tubular steel, 1½ in. outside diameter, weight 2.27 lbs. per lin. ft. Top rail provided with sliding expansion joint (patent applied for) that allows for expansion and contraction of top rail due to atmospheric changes.

GALVANIZED OR PAINTED—Furnished all heavily galvanized, or with galvanized fabric and painted framework.

POST TOPS—Patented; made of pressed steel arms securely riveted to heavy malleable iron base, and carry three 4-point barbed wires, 12 in. in or out from fence line.



INVINCIBLE POST TOPS (PATENTED)

Chain Link Non-climbable Fence—Specifications.

POSTS—Full standard weight tubular steel. Line posts provided to set 30 in. in ground; end, gate and cor-

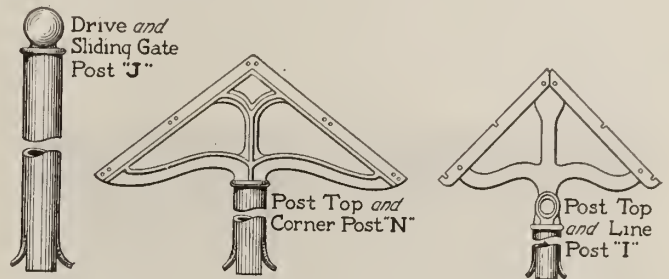


CHAIN LINK NON-CLIMBABLE FENCE

ner posts, 36 in. in ground. Posts to be spaced in line of fence not over 10 ft. apart.

End and corner posts "N," also walk gate posts "J," 3 in. outside diameter, weight 5.79 lbs. per lin. ft. Drive and sliding gate posts "J," 3½ in. outside diameter, weight 7.58 lbs. per lin. ft. Line posts "I," 2½ in. outside diameter, weight 3.65 lbs. per lin. ft.

POST TOPS—Patented; made of pressed steel arms securely riveted to heavy malleable iron base, and carry five 4-point barbed wires 9½ in. in and out from fence line.



NON-CLIMBABLE POST TOPS (PATENTED)

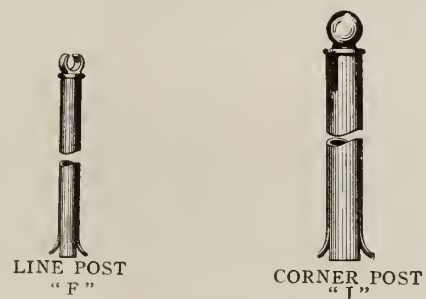
Chain Link Safeguard Fence—Specifications.

Especially recommended for schools, playgrounds, athletic grounds, country estates, parks, etc.; also industrial plants of all kinds.

A row of protecting barbs projects above top rail, or fence is furnished with smooth knuckled selvage in place of barbs.

POSTS—Full standard weight tubular steel. Line posts set 30 in. in ground; end, gate and corner posts, 36 in. in ground. Posts spaced in line of fence not over 10 ft. apart.

End, corner and walk gate posts "J," 3 in. outside diameter, weight 5.79 lbs. per lin. ft. Drive and sliding gate posts "J," 3½ in. outside diameter, weight 7.58 lbs. per lin. ft. Line posts "F," 2 in. outside diameter, weight 2.72 lbs. per lin. ft.



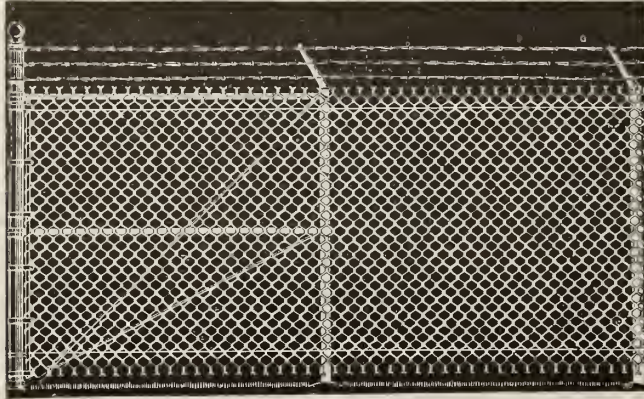
CHAIN LINK SAFEGUARD FENCE

Chain Link Reliance No. 1 Fence—Specifications.

FABRIC—Made 6 ft. high of No. 9-gauge heavily galvanized wire woven into a 2-in. mesh. Top and bottom selvages of fabric have a *twisted* and *barbed* finish.

POSTS—End, corner and walk gate posts full standard weight tubular steel 3 in. outside diameter, weight 5.79 lbs. per lin. ft. Swinging drive gate posts, 3½ in. outside diameter, weight 7.58 lbs. per lin. ft.

Line posts of high carbon steel rolled U-shape 2½ in. wide, weight 2.73 lbs. per lin. ft. and spaced 12 ft. apart. Brace posts of tubular steel, 2 in. outside diameter, weight 2.72 lbs. per lin. ft. Braces, 1⅝ in. outside diameter. Post tops, same as used on Invincible fence.



CHAIN LINK RELIANCE NO. 1 FENCE

Gates.

Gates arranged to swing either way, to lock from either side. Where desired, Cyclone roller bearing sliding gates are furnished running on overhead enclosed steel track.

Gates made single or double drive, or walk gates in any height to fit any opening.

Iron Fences.

Iron fencing and iron front entrance gates built and erected for any purpose. Purchasers' taste can be incorporated in attractive designs that will harmonize with any architecture or landscape.

Prices, Information Required, etc.

Prices on complete fence job, including erection or services of construction superintendent, quoted on application.

When writing, send a diagram or blue print of proposed fence lines, giving measurements of each stretch and total measurements. Make an "O" where corner, end or gate posts are to be used. State whether single or double drive gates are wanted, and give opening size.

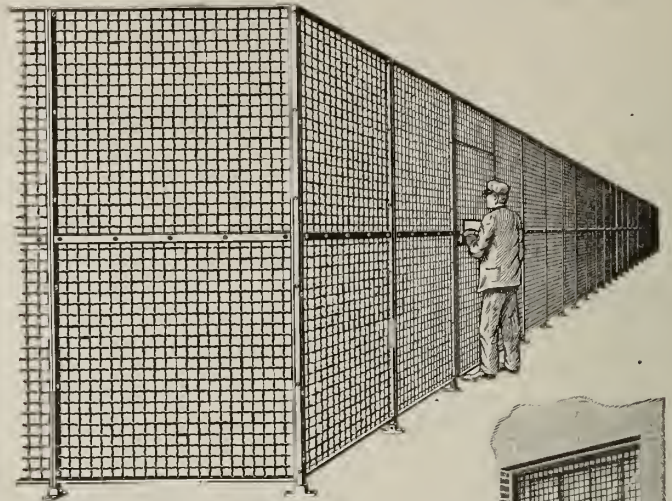
Quotation on complete job will follow by return mail.

Cyclone (Built-in-sections) Woven Wire Partitions.

Built in standard size sections 4 ft. wide by 8 ft. high.

FRAMES—1-in. channel iron. Fabric No. 10-gauge wire, woven in 1½-in. square mesh. Diamond mesh fabric furnished when desired.

Furnished with either swinging or sliding gates. Handholes or wickets provided where needed. Floor



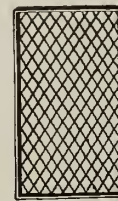
WOVEN WIRE PARTITIONS

flanges furnished for either wood or concrete floors.

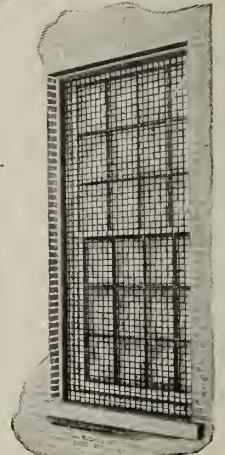
Window Guards.

Frames 1-in. or ¾-in. channel, or ⅜-in. round iron. Fabric No. 10-gauge wire, woven in 1½-in. square mesh. Diamond mesh fabric furnished when desired.

Channel iron frames fit into openings. Round iron frames usually allow ¾ in. on all sides for lap.



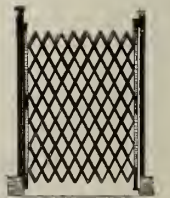
DIAMOND MESH FABRIC



SQUARE MESH WINDOW GUARD

Folding Gates.

Built for any width or height. Take up minimum space.



FOLDING GATE

Woven Wire Signs.

Built in any size with heavy channel iron frames. Letters of heavy galvanized sheet steel.



WOVEN WIRE SIGN

Woven Wire Conveyor Belts.

Cyclone flat wire conveyor belts built of ⅜-in. by No. 18-gauge galvanized flat steel wire, woven in 1- and ½-in. mesh.

Cyclone chain link conveyor belts built using all sizes of galvanized steel wire from No. 4- to No. 16-gauge, woven in any size mesh from ¼ to 1½ in.

Flat wire and chain link belts furnished in any length, in standard widths of 18, 24 and 30 in. Special widths to suit requirements.



WIRE CONVEYOR BELT

ESTABLISHED 1858

J. W. FISKE IRON WORKS

Ornamental Iron, Brass, Bronze, Wire and Zinc Work

65-67 Park Place
NEW YORK, N. Y.**Products.**

FISKE CLIMBPROOF CHAIN LINK FENCING and ENTRANCE GATES; MANHOLE FRAMES AND COVERS; CATCHBASINS.

Window Guards, Tool and Stock Room Enclosures, Folding Gates.

Ornamental Lamp Standards, Wrought Iron Railing, Stable Equipment for horses and cattle, Weather-vanes, etc.

Quality.

The quality of Fiske products is best evidenced by installations for government, states, cities and leading commercial organizations.

Fiske Climbproof Fencing.

Affords protection to all points at all times. The fence is made of heavily galvanized chain link fabric with galvanized set-in-concrete posts assuring a perfect alignment and a further protection from the weather at the ground line.

Fiske gates are strongly constructed of "T" iron galvanized after making; filling of the gate is also chain link fabric.

The height and size mesh can be made to suit all conditions.

Fiske Erecting Service.

For the protection and convenience of customers, a corps of widely experienced erecting men is maintained to set any kind of fencing, railing, gates, and stock room enclosures at reasonable cost. Entire responsibility is assumed when this work is done under their direction.

Catalogue.

A handsomely illustrated catalogue of Fiske products will be mailed on request.

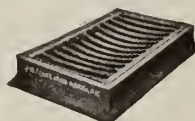


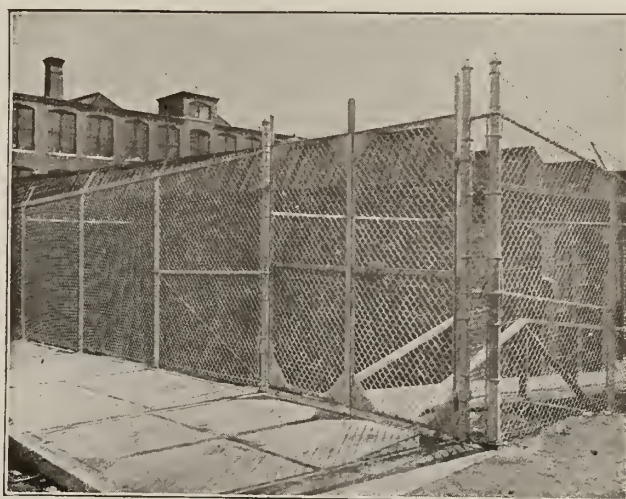
FIG. 161AK. GRATING AND FRAME
Heavy, $3\frac{1}{4}$ in. long, 19 in. wide on top, 6 in. deep



FIG. 163K. MANHOLE FRAME AND COVER
Top, 25 in. diam. Bottom, 36 in. diam., 9 in. deep



FIG. 162AK. CATCH-BASIN INLET
Top 23 in. by 32 in. Bottom flange, 42 in. diam. Grating concave at rear



CHAIN LINK FENCING FURNISHED AND ERECTED FOR THE MILLS WOVEN CARTRIDGE BELT CO., WORCESTER, MASS.



PLATE NO. 3100F. WROUGHT IRON RAILING FURNISHED AND ERECTED FOR THE CLARKE ESTATE, COOPERSTOWN, N. Y.

PAGE STEEL AND WIRE COMPANY

FORMERLY PAGE WOVEN WIRE FENCE COMPANY

(ESTABLISHED 1883)

Galvanized and Special Analysis Wire, Woven Wire Fabrics, Fencing and Ornamental Iron

ADRIAN, MICH. MONESSEN, PA.

NEW YORK, N. Y., 30 Church Street
DETROIT, MICH., Book Building

BRANCHES

CHICAGO, ILL., 29 South La Salle Street
PITTSBURGH, PA., 644 Union Arcade

Products.

PAGE WIRE LINK PROTECTION FABRIC for Outside Fencing, Tennis Courts, Inside Partitions, Window Guards and Conveyor Belting.

WOVEN WIRE FABRICS for Lawn and Garden Fence, Farm Fence, Gates, Reinforced Concrete Construction, General Utility Fabric.

ORNAMENTAL IRON, including Architectural Iron and Fences, Angle Picket Fencing, for factory and institutional enclosures.

Also, Galvanized Wire, Iron and Steel Wire, Rope Wire, Armco Wire, Special Analysis Wire, Barbed Wire, Welding Wire, and all kinds of Wire and Wire Work.

Exclusive Page Features.

All Page wire is produced in Page wire mills. For 30 years Page chemists have been studying the grades of wire suitable for different woven wire fabrics.

By exclusive contract with the American Rolling Mill Company, any wire to be produced from Armco iron must be made by the PAGE STEEL AND WIRE COMPANY. The Page Company is prepared to furnish any of its products in this pure rust resisting material.

Page Wire Link Protection Fences (Standardized).

FABRIC—No. 6 Wire—2-in. meshes, 72 in. high.

No. 9 Wire—2-in. meshes—72 in. high.

Twisted and spiked at top; knuckled at bottom.

When the 2-in. mesh or smaller is used, there is no toe hold obtainable for climbing.

Every foot of this fabric has a twisted barbed top on each link (as illustrated), which is sharpened and affords an effective protection against obtaining a hand hold.

When desired, the fabric can be knuckled over, giving a smooth selvage edge. The bottom edge of the fabric is regularly knuckled unless otherwise specified.

Special construction can be furnished in any heights up to 12 ft., from any sizes of wire from No. 16 to No. 4 and in meshes between $\frac{3}{8}$ in. and 6 in.

Note that nothing but the two above standards will be stocked, and all specials will be subject to delays in delivery and will take advanced costs depending upon the particular order. Standard construction is strongly recommended wherever it can consistently be used.

FINISH—All wires hot galvanized and oil dipped.

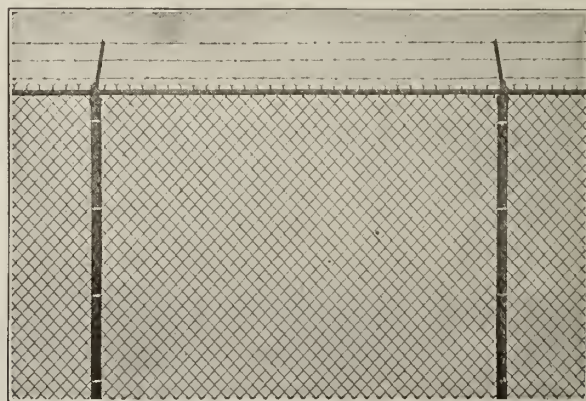
Posts, top rails and all fillings can be furnished galvanized by hot process, or painted, or both as required. See details on following page.

Page Economy Protection Fences.

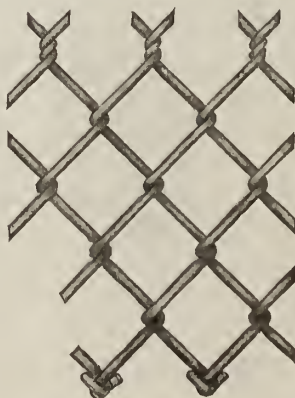
The need for a lighter, but none the less durable, protection fence is met in Page Economy protection fabric. The pickets are of No. 9 wire and the horizontal



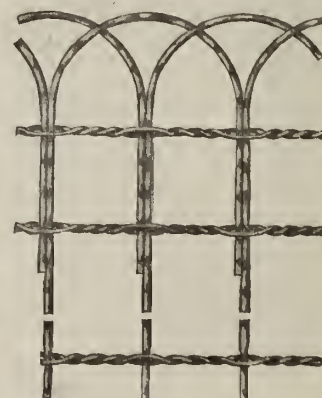
PAGE STANDARD WIRE LINK PROTECTION FENCING,
GROUNDS AND PLANT, OLDS MOTOR WORKS,
LANSING, MICH.



PAGE STANDARD WIRE LINK CONSTRUCTION WITH PIPE
POSTS AND TOP RAIL



PAGE WIRE LINK PROTECTION FABRIC



PAGE ECONOMY PROTECTION FABRIC

cables of No. 12½. All wire is Page standard galvanized by the hot spelter process. Two different meshes are used: 1½ and 2½ in. This fabric can be supplied in any height up to 10 ft.

The pickets are deeply crimped and the cable wires tightly twisted with reverse turn between each two pickets, thus giving a firmly locked joint, but allowing the utmost freedom in conforming to unevenness in ground surfaces.

Posts, Extension Arms and Bracing Construction.

The importance of the post and bracing construction for protection fencing can not be impressed too strongly. On it depend the good appearance, efficiency and durability of the fence.

This company's engineers have given the matter of posts and bracing much careful study and experimentation, and the several types of construction here outlined will meet every need.

Posts and barbed wire arm construction are the same for both fabrics and are furnished in the following styles:

PAGE STANDARD CONSTRUCTION—End and corner posts, braced as shown, 2⅞ in. O. D. Gate posts, braced as shown, 4 in. O. D. Line posts, 2⅜ in. O. D. Top rail, 1½ in. O. D.

Note—Experience has shown that any change from these sizes for end, corner and gate posts is not advisable. Therefore none but these sizes will be furnished for our fabric.

There are two options in line posts as follows:

U-bar posts, 1⅞ by 2⅛ in. Angle iron posts, 2 by 2 by ¼ in.

BARBED WIRE EXTENSION ARMS—Page post tops are made by riveting T-iron steel into a heavy base fitting tightly over the top of the post, thus allowing no moisture to get into the post. Eyelets are provided for 3 barbed wires. This construction prevents breakage from all reasonable blows and can be furnished for any of the line posts mentioned above.

We can also furnish our Government type of two-way arms, carrying 5 barbed wires as per illustration.

PLAIN POST TOPS—Post tops are also provided for use without the barbed wire arms. Our general protection fence catalogue gives various types of construction which make use of these plain tops.

Inside Partitions (Thoroughly Standardized).

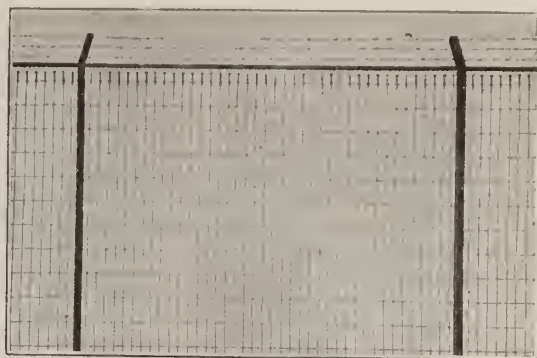
FRAMES—1 by ½ by ⅛-in. channels, crossbraced with ⅜-in. round bars.

FILLER—Page wire link fabric, No. 10 galvanized wire, 1½-in. mesh. This fabric has a marked superiority over other fillers for partition and guard work, for the reason that the strands being interlocking, it is impossible to make an armhole by the spreading of the meshes.

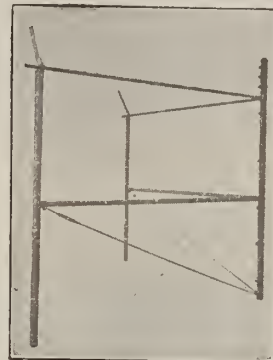
Wire link fabric also lends itself readily to shaping for curved guards and various special forms.

PANELS—4 by 8 ft., entirely uniform. Each panel is provided with legs which furnish a 3-in. floor clearance. They may be placed in horizontal position above a line of 8-ft. sections to supply a 12-ft. partition (see illustration on preceding page), as all drilling for attaching bolts is standardized and will coincide in either position. When used for added height the floor legs are removed.

Doors—Door panels are complete in themselves and are interchangeable with regular panels. Doors, both swing and sliding, can be hung on either side of partition, to swing or slide in either direction, and can be shifted to the position of any regular panel without



PAGE ECONOMY PROTECTION FENCE WITH ANGLE IRON LINE POSTS



PAGE STANDARD END AND CORNER BRACING CONSTRUCTION

Without fabric, but with all fittings in place. Note turnbuckles for tightening braces.

When placed in concrete foundations this construction offers the most rigid support obtainable



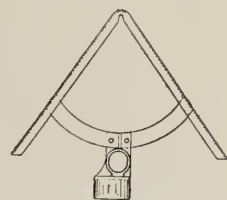
PAGE STANDARD PIPE POST TOP WITH BARBED WIRE ARM

T-iron arm riveted into heavy base which insures against breakage. Top fits over post, not into it, thus allowing no moisture to enter post

PAGE STANDARD TUBULAR POST

Showing concrete base, special non-corrosive bands for fastening fabric, and moisture-proof, non-breakable barbed wire arm with opening for top rail.

Recommended for permanency, durability, strength and neat appearance



GOVERNMENT TYPE EXTENSION ARM
Carries 5 barbed wires

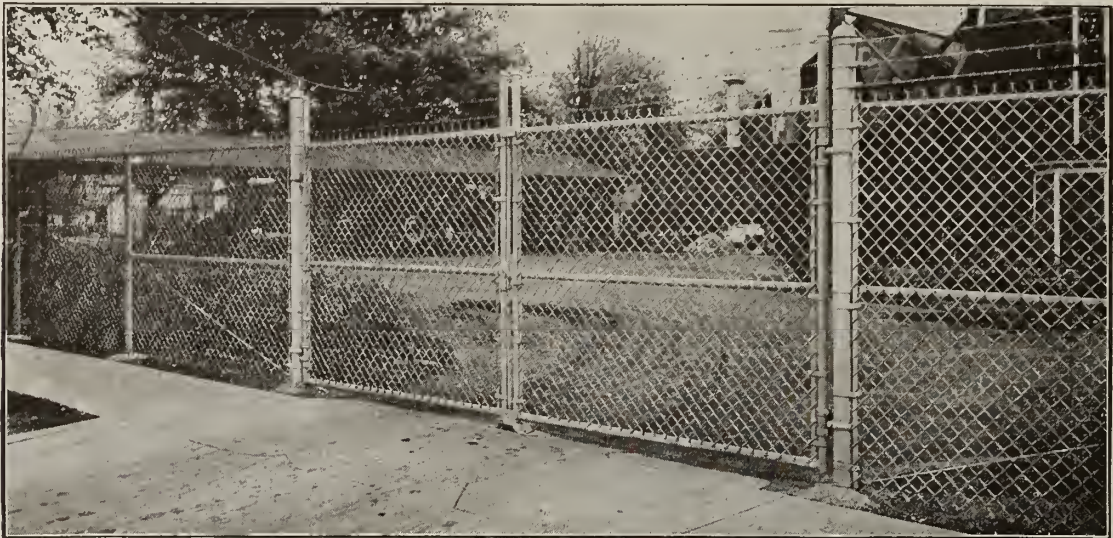


PAGE POSTS AND RAIL

From left to right are shown: gate post, end and corner post, line post, top rail, U-bar post and angle post. Sizes given in detailed explanation at the left



PAGE STANDARD WIRE LINK INSIDE PANEL PARTITION
Note self-supporting construction. No light is lost here



PAGE STANDARD GATE WITH ALL FITTINGS AND BRACINGS

This type can be made for almost any size opening. Either swing or slide and double or single

the drilling of a hole or the alteration of a part, and in only a few minutes of time.

BRACING—Adequate bracing is supplied by a continuous flat bar bolted upon the top and running the entire length of the partition. Additional top bracing when necessary, is obtained by the use of a telescoped bar attaching to the ceiling directly above the partition and extending downward to midway of the panel frame at required intervals.

FINISH—Entire material painted black.

NOTE—Particular attention is called to the fact that this construction is *fully standardized* and can therefore be supplied from stock.

Gates.

The chief advantages of Page standard gates are: Tubular frames, $1\frac{9}{16}$ in. O. D., all braces tubular $1\frac{5}{8}$ in. O. D., and all joints acetylene-welded. This construction makes the gate absolutely non-sagging; and more rigid against all strains than can be secured by any other. Frames and attachments are finished to correspond with other materials on the job. Frames filled with standard Page protection fabrics.

Can be opened, closed and locked from either side. Adjustable offset hinges, allowing gate to swing back against fence, and also use of full width of opening. Lock in three places: top, bottom and middle. Automatic gate stops which hold open each gate. Barbed wire protection as shown.

These features are all-year advantages. There will be no trouble from freezing or snow.

Sliding gates can be furnished of any size or with any clearance. Ball bearing rollers with covered track are standard.

Angle Steel Picket Fences.

Angle steel picket fences provide a maximum of durability and strength, with a minimum of upkeep. The cost is not excessive.

It is recommended that none but concrete foundations be used in erecting this fence.

Pickets are of high carbon steel $1\frac{1}{4}$ by $1\frac{1}{4}$ by $\frac{3}{16}$ in., or may be replaced by solid pickets from $\frac{3}{4}$ to $1\frac{1}{4}$ in. in size. When location is such that atmospheric conditions are harmful to iron and steel, the use of Armco iron will be found to increase the life of this fence.

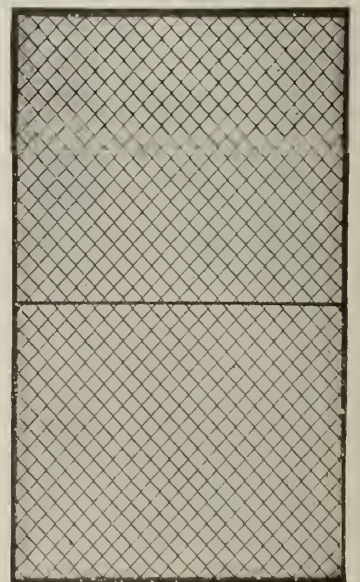


ANGLE IRON PICKET FENCE SHOWING CONCRETE POSTS IN USE

Engineering and Construction Service.

The PAGE STEEL AND WIRE COMPANY maintains a service department which is prepared to design and estimate, and will furnish efficient erecting service at all times. Besides having several groups of service men in various parts of the country, who are highly trained to erect fencing in the most difficult locations, a number of experienced field superintendents are maintained who will go to any part of the country and superintend erection, using labor furnished by the purchaser.

No matter how a job of fencing or inside partitions is erected, a complete set of blue prints is always furnished with the material lists. Proposals are solicited and estimates will be gladly furnished at any time.



WINDOW GUARD MADE FROM CHANNEL IRON AND PAGE WIRE LINK PROTECTION FABRIC

2 in. mesh with No. 9 wire has been used

L. S. GELSER & SON, INC.

Manufacturers of Reinforced Concrete Pipe

FILLMORE, N. Y.

Product.

GELSER REINFORCED CONCRETE SLUICE and BELL END PIPE, for use in sewers, sluices, culverts, etc.

Advantages.

Cost is but one-half that of best cast iron and two-thirds that of best corrugated pipe, while they will withstand all road traffic equally well.

They will not rust like iron pipe or rot like terra cotta, neither will sulphur water, the great enemy of cast iron, have any deleterious effects on them—in fact, they grow stronger with age and are absolutely permanent.

Construction.

Pipe are manufactured by expert concrete workmen, mixing being done thoroughly by machine, the aggregates consisting of the best portland cement procurable, the highest grade of washed sand and gravel and pure spring water, which, altogether, insure a perfect product when properly cured.

Curing is accomplished by keeping pipe under cover protected from all air currents for a period of ten days after moulding, and thoroughly sprinkling three times each day.

Reinforcement.

SLUICE PIPE—Tongue and groove, 2-ft. lengths. Mixture, $2\frac{1}{2}$ parts sand and gravel, 1 part cement. Reinforced with 6 to 9 twisted splice wire hoops to 2-ft. length; gauge, No. 6 to No. 10, according to size.

BELL END PIPE—Mixture, 1 cement, 2 sand, 4 crushed stone, mixed to quaking consistency and thoroughly spaded while being poured into

forms. Made in 4-ft. and 6-ft. lengths. Reinforced with American Steel & Wire Co. triangle mesh.

Guarantee.

This company agrees to furnish pipe, free of charge, in place of any which break during transportation, or for a period of 5 years after being installed.

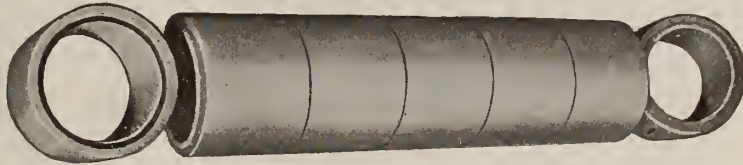
From the nature of concrete, it is safe to assume that if these pipe will stand for 5 years, they will stand for all time.

State Road Work.

This company specializes in pipe for this class of work and guarantees same to meet specifications of state highway departments.

Shipment.

Sufficient stock of well seasoned pipe is carried at all times to fill orders promptly.

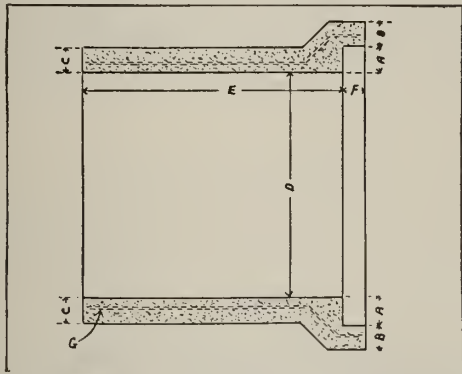


REINFORCED CONCRETE SLUICE PIPE

STANDARD SPECIFICATIONS

Size, in.	Weight, per ft., lbs.	Thickness, in.	Length, ft.
8	45	1 $\frac{1}{2}$	2
10	58	2	2
12	92	2 $\frac{1}{4}$	2
15	109	2 $\frac{1}{2}$	2
18	157	2 $\frac{3}{4}$	2
24	245	3 $\frac{1}{2}$	2
30	369	3 $\frac{3}{4}$	2
36	480	4 $\frac{1}{4}$	2

Price on application.

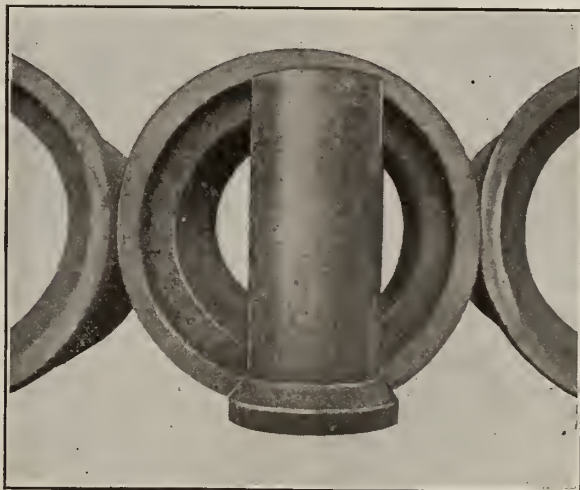


DIMENSIONS DIAGRAM REINFORCED CONCRETE BELL END PIPE

STANDARD SPECIFICATIONS

Dimensions						Weight per lin. ft. lbs.	Reinforcement G—A. S. & W. Triangle Mesh
D in.	A in.	B in.	C in.	E ft.	F in.		
12	2 $\frac{1}{2}$	2	2	4 and 6	2 $\frac{3}{4}$	95	1 layer size .040
15	2 $\frac{3}{4}$	2 $\frac{1}{4}$	2 $\frac{1}{4}$		2 $\frac{3}{4}$	115	1 " " .058
18	3	2 $\frac{1}{2}$	2 $\frac{1}{2}$		2 $\frac{3}{4}$	165	1 " " .080
24	3 $\frac{1}{2}$	3	3		3 $\frac{1}{8}$	255	1 " " .126
30	4	3 $\frac{1}{2}$	3 $\frac{1}{2}$		3 $\frac{1}{2}$	380	2 " " .080
36	4 $\frac{1}{2}$	4	4		3 $\frac{1}{2}$	500	2 " " .107
42	5	4 $\frac{1}{2}$	4 $\frac{1}{2}$		4 $\frac{1}{2}$	850	2 " " .126
48	5 $\frac{1}{2}$	5	5		5 $\frac{1}{2}$	1000	2 " " .180
54	6 $\frac{1}{4}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$		5 $\frac{1}{2}$	1200	2 " " .208
60	6 $\frac{1}{2}$	6	6		6	1500	2 " " .208

Price on application.



REINFORCED CONCRETE BELL END PIPE

Some Users.

Pennsylvania State Highway Department, Harrisburg, Pa.
Tuxedo Park Association, Tuxedo, N. Y.
Harrison County, Clarksburg, W. Va.
Marion County, Fairmont, W. Va.
Edward T. Beck, Warren, Pa.
F. C. Elliott, Trustee, Athens, Ohio
Rose Township, Jefferson Co., Pa.
Armstrong Township, Indiana Co., Pa.

LOCK JOINT PIPE CO.

TELEPHONE:
ORANGE 4771

MAIN OFFICE AND WORKS
AMPERE, N. J.
BRANCH OFFICES
SEATTLE, WASH., PACIFIC LOCK JOINT PIPE Co.

NEW YORK OFFICE
165 Broadway
Telephone, Cortlandt 3095
WINNIPEG, MANITOBA, CAN., CANADA LOCK JOINT PIPE, LTD.

Product.

“LOCK-JOINT” CONTINUOUS REINFORCED CONCRETE PIPE, for Sewers, Water Lines, Intake and Discharge Pipes, etc.

The Lock-Joint System for Sewers.

This system provides a continuous reinforced concrete pipe, laid in sections, in which joints between sections are so made as to insure freedom from leakage or obstacles to flow.

The standard design has a circular section cast with a bell and a spigot end, the bell being flush with the outside circumference of pipe.

Sizes range from 24 to 108 ins. in diameter in 4-ft. lengths, and longer lengths when necessary. This company has a large stock of moulds and a force of expert superintendents, and is in a position to furnish pipe anywhere.

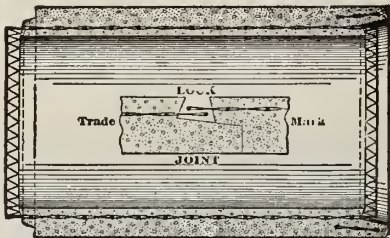


DIAGRAM OF SECTION OF PIPE AND LOCK-JOINT

ADVANTAGES—Pipes are made above ground, in a vertical position, resulting in maximum density of the concrete.

Entire exterior and interior surface can be inspected. Joints are on the interior of the pipe and also can be easily inspected.

The “lock-joint” gives the same strength in the joint as in the body of the pipe—therefore no weak spots.

Minimum of trench necessary to be open. Lay the pipe as fast as bottom is reached, then immediately backfill, as soon as pipe is laid.

Pressure Pipe.

This company manufactures and installs reinforced concrete pipe in sizes 8 to 108 ins. diameter for water supply or any purpose where pipes are subject to hydraulic head up to 150 ft.

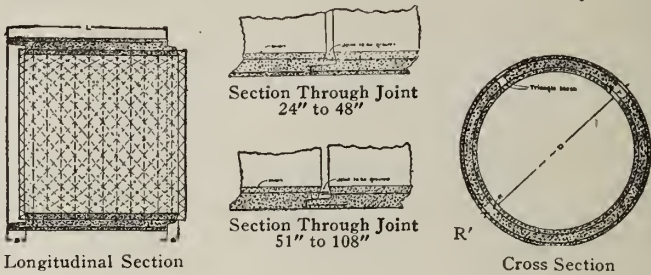
These pipes are manufactured of a richer mix of concrete. Great care is taken in the mixing of the same.

Individual pipe sections are made in lengths of 6, 8, 10 or 12 ft., to meet specific conditions, 8 ft., however, being a standard length for the larger sizes and 12 ft. for the smaller sizes.

The smaller sizes are made with lead expansion joints. The larger sizes are generally made with copper expansion joints. These joints are made to take care of the expansion and contraction in the pipe line due to temperature changes and settlement.

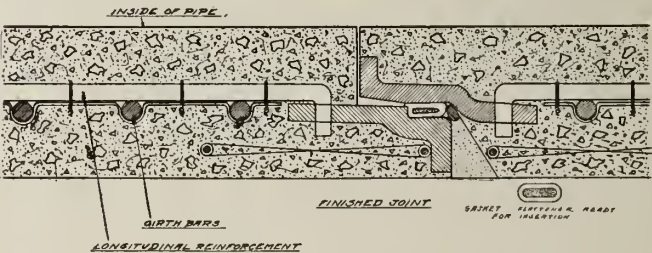
ADVANTAGES—Reinforced concrete pipes manufactured under methods used by this company are smooth and joints offer no hindrance to flow of water.

There are no offsets or projections to encourage growth in the pipes, with the result that the carrying

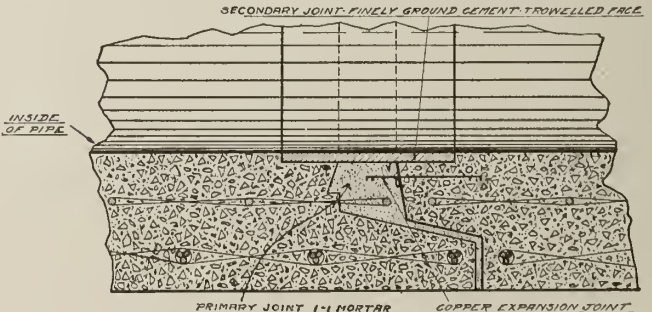


DIMENSION DIAGRAMS STANDARD SEWER PIPE

Dimensions							Reinforcement	A. S. & W. Triangle Mesh
D	T	L	B	S	R	R'		
ins.	ins.	ft.	ins.	ins.	ins.	ins.	Layer	Style number
24	3	4	3	1 1/2	1		1	28
27	3 1/2	4	3	1 1/2	1		1	28
30	3 1/2	4	3	1 1/2	1		1	27
33	4	4	3	1 1/2	1 1/4		1	35
36	4	4	5 1/2	3 1/2	1 1/4		1	34
39	4	4	5 1/2	3 1/2	1 1/4		1	34
42	4 1/2	4	5 1/2	3 1/2	1 1/2		1	34
45	4 1/2	4	5 1/2	3 1/2	1 1/2		1	34
48	5	4	5 1/2	3 1/2	1 3/4		1	23
51	5	4	5 1/2	3 1/2	1 3/4	1	2	26
54	5 1/2	4	5 1/2	3 1/2	1 3/4	1	2	26
57	5 1/2	4	5 1/2	3 1/2	1 3/4	1	2	34
60	6	4	5 1/2	3 1/2	2	1	2	34
63	6	4	5 1/2	3 1/2	2	1	2	34
66	6 1/2	4	5 1/2	3 1/2	2	1	2	34
72	7	4	5 1/2	3 1/2	2	1	2	23
78	8	4	5 1/2	3 1/2	2	1	2	33
84	8	4	5 1/2	3 1/2	2	1	2	33
90	8	4	5 1/2	3 1/2	2	1	2	31
96	8 1/2	4	5 1/2	3 1/2	2	1	2	39
108	9	4	5 1/2	3 1/2	2	1	2	38



LEAD EXPANSION JOINT



COPPER EXPANSION JOINT

capacity of these pipes is as great as, if not greater than, any other type of pipe.

From actual test, “n” in Kutter’s formula has been found to be less than .011. In addition to this, well made reinforced concrete is known to be an extremely permanent material.



54-INCH AND 66-INCH PIPE MANUFACTURED FOR INTERCEPTING SEWER, ALBANY, N. Y.



66-INCH PRESSURE PIPE MADE AT WINNIPEG PLANT FOR GREATER WINNIPEG WATER DISTRICT



A LOCK-JOINT PLANT MAKING 42-INCH PRESSURE PIPE

Subaqueous Pipe.

For powerhouses, water works, sewage plants, etc., made in approximately 20-ft. lengths, with cast iron flanges mounted into each end. Lengths are lowered into place and flanges are bolted together by divers.

Special designs for special cases.



72-INCH SUBAQUEOUS PIPE LAID IN LAKE ERIE

Cost.

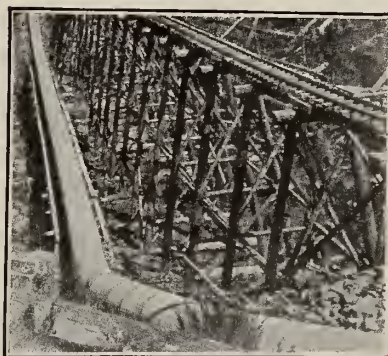
Inasmuch as the pipes are, in almost all cases, manufactured on the ground, local price of materials, such as sand, stone, and cement and steel, naturally influences the cost. However, reinforced concrete pipe is, in almost all cases, considerably less expensive than metal pipe.

Estimates, etc.

Plans, specifications and estimates will be furnished to those desiring same, on receipt of information giving heads to be carried, sizes and quantities of pipe, location of work, and prices of sand, stone and cement, delivered along the line, as the pipes are manufactured on the job.



42-INCH WATER LINE, SEATTLE, WASH.



VIEWS OF 42-INCH "LOCK-JOINT" PIPE FOR SOOKE LAKE WATER SUPPLY, VICTORIA, B. C.

Length of line, 27½ miles; longest tangent on line, 600 ft. Siphon shown under 80-ft. head. 53% of line laid on curves

Immediate Shipments.

Sizes 24- to 48-in. standard sewer pipe, also 12-, 15- and 18-in. bell and culvert pipe carried in stock for immediate shipment from the home plant, Ampere, N. J. Shipping point, Bloomfield, N. J., Delaware, Lackawanna & Western R.R. Write or telephone.

AMERICAN WOOD PIPE CO.

South 32nd and Cedar Streets
TACOMA, WASH.

SALES OFFICES AND MANAGERS

NEW YORK, N. Y., W. D. POTOSKY, Singer Building
SALT LAKE CITY, UTAH, S. A. ROBERTS & Co., 502 Dooley Building
HOUSTON, TEX., DAVID M. DULLER, Houston Land & Trust Co. Building

Products.

WOOD PIPE including Machine Banded and Continuous Stave; WOOD TANKS.

American Wood Pipe.

An ideal water conveying medium for all ordinary and special requirements.

Most economical in first cost, least expensive in installation, lowest maintenance charge, greatest carrying capacity and best returns from investment.

The staves are made from the best grade of yellow fir which is one of the finest known woods for pipe manufacturing purposes, being very strong to resist the crushing strain under the banding, and a wood that lasts indefinitely when saturated with water.

MACHINE BANDED WOOD PIPE—Machine banded wire wound stave pipe is manufactured in sizes from 2 to 30 in. in diameter and for all heads up to 400 ft., and if desired for special requirements, in sizes up to 14 in. for heads up to 600 ft.

The staves for this class of pipe are machined to accurate segments of the circle and to the true inside and outside radius of the pipe. After assembling the staves into pipe, it is placed in a special winding machine and is wound with heavily galvanized steel pipe winding wire applied under tension and spaced according to the pressure for which the pipe is designed. The ends of the pipe are then machined to form the coupling for connecting the sections of the pipe together. The outside of the finished pipe is coated with an asphaltum

mixture applied hot and then rolled in dry sawdust to protect the coating.

CONTINUOUS STAVE WOOD PIPE—This company contracts for material, and assembles into pipe at the site of the work "continuous stave pipe" in sizes from 2 to 14 ft. in diameter.

The staves for this class of pipe are manufactured from the same class of material as the smaller pipe, and the pipe is banded with round steel bands of proper size, with head, thread, washer and nut. The ends of these bands are connected with a malleable iron shoe to allow the bands to be drawn tight around the pipe, and are spaced according to the pressure under which the pipe is to serve.

CARRYING CAPACITY—Wood pipe has a greater carrying capacity than any other class of material on account of the extremely smooth inner surface. The capacity does not decrease with age, as is the case with metal pipe, and is therefore most economical.

Tanks.

This company manufactures all standard sizes of fir tanks, and also tanks for purposes where special designs are necessary.

Information and Service.

The engineering force of this company will be glad to consult in regard to pipe problems.

For information and prices, address the nearest sales manager.



A LINE OF AMERICAN WOOD PIPE CO. CONTINUOUS STAVE PIPE FOR WATER SUPPLY

CONTINENTAL PIPE MANUFACTURING CO.

SUCCESSOR TO

PACIFIC COAST PIPE CO., SEATTLE
WASHINGTON PIPE & FOUNDRY CO.,
TACOMA

PORTLAND WOOD PIPE CO., PORTLAND
NATIONAL TANK & PIPE CO. (PIPE DEPT.),
PORTLAND

GENERAL OFFICE

4515-4519 Fourteenth Avenue, N. W.
SEATTLE, WASH.

EASTERN OFFICE

3904 Woolworth Building
NEW YORK, N. Y.

Products.

MACHINE BANDED WOOD PIPE; CONTINUOUS STAVE WOOD PIPE; CREOSOTED WOOD STAVE PIPE; WOOD STEAM PIPE CASING; WOODEN TANKS.

Machine Banded Wood Pipe.

Machine banded wood pipe is carefully manufactured in sizes from 2 to 30 ins. in diameter—in both types, *inserted joint* or *wood sleeve* as required—to withstand pressure due to any head from 50 to 400 ft. The pipe is in convenient lengths, generally from 8 to 20 ft. The joints are carefully milled, insuring a proper fit. The staves are formed with great precision, giving a completed pipe with uniform internal diameter, thus preserving the fullest efficiency. Heavy galvanized wire is wound around the pipe under tension by a specially designed machine, the size of wire and spacing depending on the pressure to which the pipe is to be subjected. The pipe is dipped in a bath of hot preservative and then rolled in sawdust, giving it a coating which is an added protection to both staves and wire.

Continuous Stave Wood Pipe.

Continuous stave wood pipe is used in diameters from 16 ins. up—the largest pipe yet constructed being 168 ins. (14 ft.) inside diameter. The staves are so milled that when assembled they form the size of pipe desired. In building up the pipe, staves of different lengths are laid side by side so that all joints are broken. Each stave is butted against the one immediately preceding, while saw kerfs or slots at the ends receive a thin metal tongue, thus making the construction continuous and doing away with round-about joints of any type in the pipe. The smooth internal walls and the absence of joints in continuous stave wood pipe combine to make the carrying capacity of this pipe considerably greater than that of any other type. The staves are held firmly in place by steel rods or bands, solidly cinched or tightened until every stave is firmly seated. The pressure under which the pipe is to serve determines the diameter of the rods and spacing of the same. Continuous stave wood pipe is used principally for penstocks, gravity supply lines and irrigation projects.

Creosoted Wood Stave Pipe.

Both *machine banded* and *continuous stave*.

Made from selected lumber, treated with pure coal tar creosote oil by a special process. The wood being thoroughly preserved, the pipe will last indefinitely long, as the staves are immune from decay.

Creosoted wood pipe gives entire satisfaction when laid on the ground, in loose, gravelly soil, or in clay. It may be used for intermittent service or under low pressure, as no damage is done when the pipe is not in use or serving under conditions of only partial saturation. These properties of creosoted wood pipe are recognized as distinct advantages in water supply and irrigation work.

They are equally important when creosoted wood pipe is used for drainage or sewerage purposes. For drainage purposes each length of pipe is bored with a certain number of holes to permit the ground water to flow readily into the pipe and be carried away. For outfall sewers, in either salt or fresh water, creosoted wood pipe has demonstrated its special advantages.

Steam Pipe Casing.

Steam pipe casing is extensively used throughout the United States for the insulation of steam pipes radiating from central heating stations, industrial plants and public institutions. The heat energy thus saved has been shown to repay many times the cost of the original investment.

The casing is made of wood staves bound together with galvanized wire and the ends are headed to make a mortise and tenon joint. The outside is covered, like standard wood pipe, with a preservative coating and rolled in sawdust.

Wooden Tanks.

Wooden tanks are furnished for all purposes and the standard sizes are carried in stock. Tanks of special design can be furnished when required.

Inquiries for Pipe.

When asking for prices or information, please be as explicit as possible to avoid misunderstanding, delays and unnecessary correspondence. In order to give a satisfactory reply the following information, or as much of it as is available, should be given:

- (1) Size of pipe.
- (2) Hydraulic head under which it is to serve, either in feet or pounds to the square inch.
- (3) Length of line.
- (4) Rail or water destination.
- (5) Purpose for which pipe is to be used.
- (6) Whether gravity or pumping system.
- (7) Total maximum discharge.

ESTIMATES—For estimates on continuous stave lines, it is necessary that a profile should be received, as the size and spacing of the bands are governed by the head and are different for every considerable change of the same.

PRICE LISTS—Price lists on pipe are not furnished. Owing to constant fluctuations in the prices of raw materials and the difference in requirements on each and every project, satisfaction can be given only by quoting on requirements as they come up.

Co-operation.

An engineering staff is maintained for the convenience of customers.

ESTABLISHED 1869

THE MICHIGAN PIPE CO.

BAY CITY, MICH.

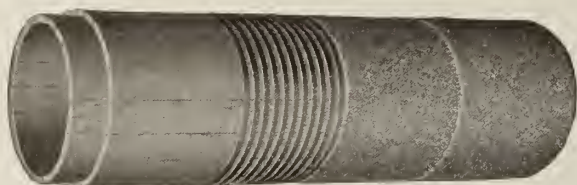
Products.

"MICHIGAN" COMBINATION STEEL and WOOD WATER PIPE; "MICHIGAN" TIN LINED WOOD CASINGS for insulating underground heating pipes.

"Michigan" Combination Steel and Wood Water Pipe.

SCOPE OF USE—Recommended for use in conveying liquids of all kinds in all climates, as follows:

- | | |
|--|---|
| (1) Municipal water supply and distribution systems. | (8) Acids and gases in chemical plants. |
| (2) Mines and railroads. | (9) Pulp in paper mills. |
| (3) Flumes and irrigation systems. | (10) Mineral waters for bottling purposes. |
| (4) Gravity and pressure feed water lines for mills and factories. | (11) Heavy fluids containing grit. |
| (5) Hydro-electric plants. | (12) Ventilating lines and stacks for gas and acid fumes. |
| (6) Liquors in tanneries. | (13) Water and culm in mines. |
| (7) Hot slops from distilleries. | (14) Acidulous and sulphurous water. |



"MICHIGAN" COMBINATION STEEL AND WOOD WATER PIPE
Steel for strength; wood for durability

DESCRIPTION—Made of thoroughly seasoned Canadian white pine and Michigan tamarack staves, machined on the sides forming double tongue and groove for interlocking. Constructed in sections up to 12 ft. in length, spirally banded from end to end under heavy tension with heavy steel banding. Sections, with mortise at one end and tenon at the other, are easily driven together, making an absolutely tight joint. Outside surface covered with thick double coating of special waterproof asphaltum, and rolled in sawdust while hot.

REASONS FOR USING "MICHIGAN" PIPE—

- | | |
|--|---|
| (1) Durability of wood. | (13) Can not burst. |
| (2) Sanitation. | (14) Can be laid in wet trench. |
| (3) 20% more capacity than metal pipe. | (15) Short curved without special fillings. |
| (4) Simplicity in handling. | (16) Low installation and maintenance. |
| (5) Light weight. | (17) 44 years of continued service. |
| (6) Speed in laying. | (18) Easy service connections. |
| (7) Protection against freezing. | (19) Requires no skilled labor. |
| (8) Not affected by electrolysis. | (20) Responsibility of company. |
| (9) Rigid inspection at factory. | |
| (10) Efficient construction. | |
| (11) Great strength. | |
| (12) Asphaltum protection. | |

SIZES—"MICHIGAN" pipe is made in stock sizes up to 48 in. diameter. Larger sizes made to order.

FITTINGS—Special fittings furnished, such as tees, elbows, crosses, branches, etc., also hydrant connections. They are all bored out specially for wood pipe, which insures a safe, tight fit with the wood tenon.

DATA REQUIRED WHEN MAKING INQUIRIES—When requesting quotations, give in detail specifications

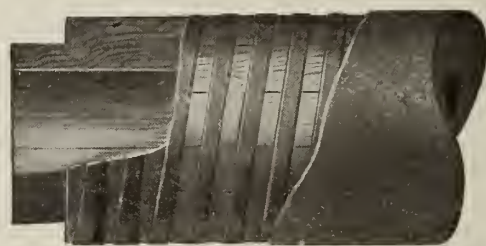
of work, such as whether the line is direct pumping or gravity flow, size of pipe, pressure to be maintained, and for what purpose to be used.

COMPARATIVE COST OF LAYING PIPE PER LINEAL FOOT, NOT INCLUDING TRENCHING AND BACKFILLING

Size pipe, in.	"Michigan"	Cast iron, including lead and hemp	Size pipe, in.	"Michigan"	Cast iron, including lead and hemp
4.....	.01	.09	16.....	.04	.36
5.....	.01	.12	18.....	.04	.40
6.....	.01	.14	20.....	.05	.50
8.....	.02	.17	24.....	.06	.62
10.....	.03	.20	30.....	.07	.75
12.....	.03	.23	36.....	.08	1.05
14.....	.04	.26	48.....	.10	1.29

"Michigan" Tin Lined Wood Casings for Steam Pipes.

SCOPE OF USE—For insulating underground heating pipes, also extensively used with greatest success for covering pipes conveying return water.



"MICHIGAN" TIN LINED WOOD CASINGS

Lengths up to 8 ft. Strengthened with a No. 6 double galvanized wire. Thickness of shell, 2, 3 and 4 in.; 4-inch shell is the standard and gives the most efficient service

DESCRIPTION—Constructed of thoroughly seasoned Michigan white pine and tamarack, of the solid bored log in the smaller sizes, and in built-up form in the larger sizes. Interior of casing lined with bright tin. Dead air space, from 2 to 3½ in., allowed between wrought iron pipe and covering. Outer surface is coated with a heavy waterproof asphaltum coating, and joint is waterproofed.

Co-operative Service.

This company has a field service department of six professional men.

The engineering department offers a free consulting service in connection with the construction of either direct pumping or gravity water works systems, and in solving problems of handling liquids in any form.

Ideas and estimates on complete installations of central heating plants submitted free of charge. The company is in a position to furnish any part of the equipment.

When laying large lines of pipe, or small lines under difficult circumstances, a field superintendent will be furnished at a nominal charge, who is capable of taking over the entire supervision of the installation of the line.

In the construction of large lines of "Michigan" pipe, the company furnishes free of charge one of its field superintendents to instruct the acting superintendent in charge regarding the laying and handling of "Michigan" pipe.

STANDARD WOOD PIPE COMPANY

Manufacturers of Wood Water Pipe and Steam Pipe Covering
WILLIAMSPORT, PA.

Products and Services.

MACHINE BANDED WOOD STAVE PIPE, SOLID BORED WOOD PIPE and STEAM PIPE COVERING for underground exposed steam and hot water pipe.

Continuous Wood Stave Pipe.

We build pipe for water works systems, power plants, municipalities, mill and manufacturing plants, mining and railroad water supplies, irrigation systems, mine culm, salt water mains, heavy fluids, acids, pulp, brine and sewage disposal, also steam pipe covering.

General.

We are endeavoring to describe our product briefly on this page as much as space will permit. The plates in this issue give descriptions of the various kinds of pipe we make. For full details write for our general catalogue, which gives valuable information concerning wood pipe and steam pipe covering.

Machine Banded Stave Pipe.

The staves are made from white pine lumber, Douglas fir, redwood or cypress. They are dressed and finished to a circle corresponding to the radius at both the inner and outer faces. The staves are double tongued and grooved. Each section in pipe is provided with a tenon and chamber 3 to 4 in. deep depending on the size. The pipe is spirally wound with steel bands or galvanized wire. Gauge and spacing of bands are determined by the pressure and size required. The pipe is rolled in a bath of hot asphaltum pitch and then rolled in sawdust. Machine banded pipe is made from 2 up to 48 in. in diameter. The thickness of wall is 1½ to 3 in. and heavier if desired, depending on the size of the pipe. The illustration, plate No. 16, shows in detail the construction of our wood stave pipe. Letter A, thickness of chamber and tenon; B, steel banding; C and D, thickness of shoulder, also shows tongues and grooves; E protective coating.

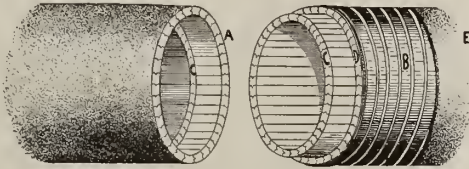


PLATE NO. 16. BANDED STAVE PIPE

Solid Bored Pipe.

Made from solid log up to 8 ft. in length bored 1½ to 8 in., inclusive.

Outside turned off to a perfect diameter and reinforced with banding and coated on the outside the same manner as our stave pipe shown on plate No. 16. The description of the solid pipe is illustrated on plate No. 70. Letter A, banded pipe before it is coated; B, pipe completed with coating on.



PLATE NO. 70. BORED PIPE

Square Wood Pipe.

Especially built for tanneries and chemi-



PLATE NO. 32. SQUARE WOOD PIPE

cal works. Made in lengths up to 8 ft. and bored from 1½-in. hole up to 8 in. in diameter and provided with tenon and socket joints, having a steel banding driven around the chamber end to protect the wood from splitting.

Steam Pipe Casing.

The casing we manufacture for covering steam pipe or hot water pipe is made of two grades as illustrated on plates Nos. 44 and 99. Casing on plate No. 44 is made of selected white pine staves 2, 3 and 4 in. thick. Each stave has a double tongue and groove on the same order as our machine banded wood pipe and joined together. It is wound with heavy galvanized wire and then coated with asphaltum pitch on the outside and rolled in sawdust. Plate No. 44 indicates the construction. A shows thickness of wall; B, galvanized wire; and C, protective coating.

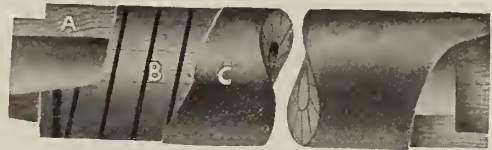


PLATE NO. 44. SINGLE LAYER CASING

The other grade of casing manufactured is called double layer, which consists of two thicknesses of lumber as described on plate No. 99. A, inner shell 2 in. thick; B, asphaltum packing; C, dead air space; D, outer shell 1 in. thick; and E protective coating. Either grade of casing is made tin lined and unlined.

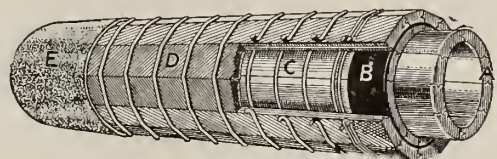


PLATE NO. 99. DOUBLE LAYER CASING

Wooden Specials.

In connection with our cast iron specials we make wood connections of any angle for various pressures. They are used in coal mines and chemical plants where iron fittings can not be used. In plate No. 21, A shows complete section of wood pipe; B, section of wood pipe with tenons on each end used in some instances to connect fittings; C, wood tee; and D, wood ell 45°. Boxes for steam pipe casing of any degree are made on the same order with the exception that they are split in two sections and reinforced with iron bolts, forming an adjustable connection made to correspond to the size of the pipe, so it may be put in its place after the casing and the iron pipe are installed.



PLATE NO. 21. WOODEN FITTINGS

A. WYCKOFF & SON CO.

Machinemade Wood Stave Pipe

ELMIRA, N. Y.

BRANCH OFFICE: ATLANTA, GA., H. H. WHITE, 385 Piedmont Avenue

Products.

Manufacturers of WOOD STAVE PIPE (machinemade), for Water Works Systems, Power Plants, Mill and Manufacturing Plants, Mining and Railroad Water Supplies.

For Waterproof Improved Steam Pipe Casing for underground and exposed steam and hot water pipe, see page 432.

Wyckoff Wood Stave Pipe.

Made from selected Canadian pine. All staves are double tongued and grooved, with faces planed, under close inspection. Winding machine so arranged that staves are banded together or wound with a steel band, at desired uniform tension (see illustration). Pipe is rendered *watertight* by tightly squeezing tongues into grooves. Maximum pipe lengths, 12 ft.; shorter sections permit pipe to be laid on curves, without iron fittings.

Advantages.

The Wyckoff machinemade wood pipe has been and is being successfully used for conveying water to municipalities for domestic and fire purposes. For conveying mine water, both hot and cold; for mine culm, tan liquors, mineral spring waters, brine, heavy fluids and pulps in fertilizer works, paper mills or provision factories, and also for conveying diluted sulphuric, nitric, muriatic, acetic and tartaric acids. Its special advantages may be summed up as follows:

Under proper conditions it is as durable as cast iron.

It is more durable than wrought iron or steel.

It is cheaper than either cast iron, steel or wrought iron.

Its carrying capacity at all times is greater than iron or steel.

By continued use its capacity does not decrease, whereas that of iron or steel does decrease yearly.

No skilled labor is needed in laying.

It can be laid with less width of excavation.

Because it is not as readily affected by frost as is either iron or steel it can be laid at less depth.

Prevents electrolysis.

Saves freight.

Is not corroded by the fumes and acids of many fluids.

Is not destroyed by sulphur or other impurities in minerals.

Does not taint water or contaminate fluids carried.

If frozen the elasticity of the wood retards bursting.

Can be laid in the wettest kind of trench.

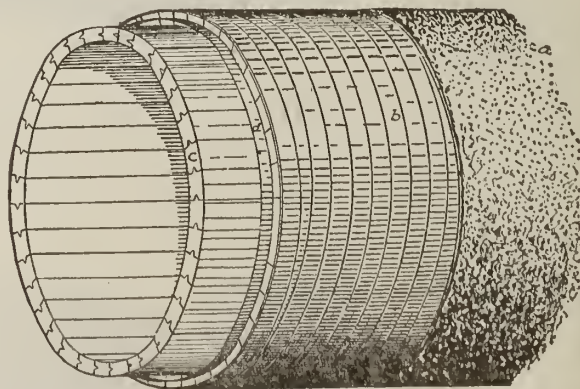
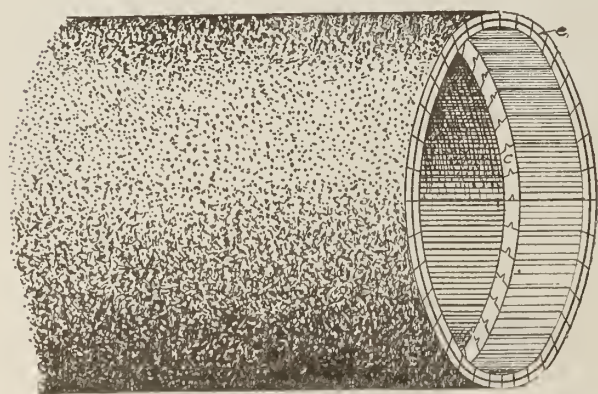
Special Features in Manufacture.

The wood from which Wyckoff wood stave pipe is made is selected Canadian pine. As the staves are run through the finishing machine, which cuts the double groove and tongue and planes the faces to circular and radial lines, a competent inspector of many years' experience handles every stave just at the time when its defects can best be detected. This inspector culls out about 15% of the timber which comes to the factory and these culls are used for other purposes foreign to wood pipe. The winding machine used for banding the wood staves together is so arranged that the band can be wound at any desired tension, according to the set of the machine, which is regulated for each class of pipe according to diameter and pressures specified. The tension can be made great enough to crush the wood in the large size pipe. During the manufacture of one standard a uniform tension and spacing is absolutely assured.

The chambers and tenons are necessarily cut uniformly by a machine, so that every joint between two pipes must fit as the knives and heads are set alike for each size pipe.

Montezuma Asphalt Coating.

As previously stated, when wood pipe is laid under the proper conditions its life depends upon the life of its steel bands, and the life of these depends upon the absence of corrosion. If this can be prevented of course the steel will last a long time. This company has experi-



TWO ENDS OF WOOD PIPE

a—Montezuma asphalt coating; b—Steel bands, wound solid for high pressure; c—Ends of tenon and shoulder

mented for years to ascertain the best mixture for a protective coating. The qualities required are as follows: it must be durable, hard, tough, perfectly waterproof and strongly adhesive to the metal. It must show no tendency to flow under summer temperature and must not become brittle so as to crack or scale, under freezing temperature.

The origin of Montezuma asphalt is an asphaltic base oil found in the Panuco District of Mexico.

This oil is very rich in asphalt; it is very heavy, having a gravity of from 10° to 11.5° Baumé.

The coating is heated in tanks by steam to a temperature of between 250° and 300° Fahr., and applied to the steel bands as it is being wound around the wood, by running the band through the tank which stands upon the winding machine; this method insures a full and complete coating between the steel and the surface of the wood, thus preventing the moisture which may seep through to the outside of the wood from coming into direct contact with the steel bands.

After winding, the chambers and tenons are cut on the pipe, each being 4 ins. in depth by one-half the total thickness of the shell of the pipe, which is usually 1 7/8 ins. thick. After leaving the finishing machine the pipe is placed on the top of two grooved rollers, set parallel and horizontal, with one-half their diameters submerged in a tank of the hot asphalt, as before described. As these rollers revolve the pipe revolves, and the coating which adheres to the rollers is thus applied to the outside surface of the pipe, covering the bands and wood. After all is applied that the surface will hold, the pipe is rolled on to a table filled with sawdust, the sawdust adheres to the hot coating, and protects it from being knocked off or abraded in shipping or laying. When conditions require, the pipe is re-coated by running it a second time over the rollers and through the sawdust, thus getting a protective coating over the whole surface of the pipe from 1/4 to 3/8 in. thick.

Fittings for Wyckoff Wood Pipe.

WOOD FITTINGS—Wooden crosses, tees and ells are made by properly boring heavy blocks cut from square timbers.

Tension bolts as shown prevent the block from splitting—the number and size of the bolts depending upon the pressure to be resisted. The openings are made of the same dimensions as standard chambers, the connections being effected by using, immediately preceding the fitting, a special section of wood pipe having a tenon on each end. This special section is first driven into the fitting and the combination then handled exactly like a regular section of pipe. Or, if especially desired, the fitting may be provided with regular tenon and chamber in the “run.”

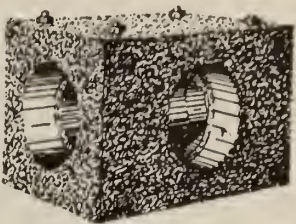
Wood fittings are recommended where the water carries chemicals injurious to iron, or where it is desirable to maintain extreme purity in the liquid conveyed.

They are impractical in large sizes or for highest pressure.

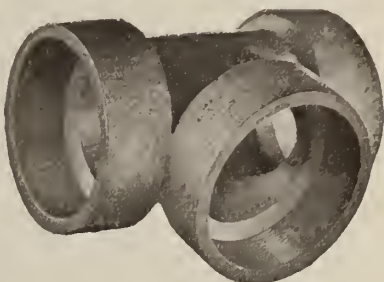
SPECIAL CAST IRON FITTINGS—Special cast iron fittings are most satisfactory for ordinary and general purposes. These are similar to regular cast iron fittings except that the bells are finished to the same dimensions as the chambers of wood pipe of same diameter. This requires a section of wood pipe with tenon on each end as previously described.

On account of the great convenience and universal satisfaction, several manufacturers of valves, fire hydrants, etc., are now furnishing these accessories chambered in the same manner for direct connection to wood pipe.

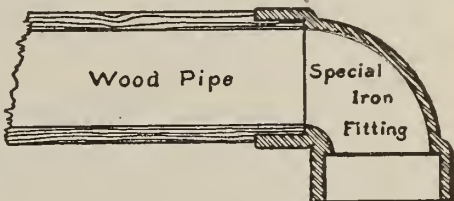
THREADINGS—Threaded fittings and connections to threaded wrought pipe are provided for by supplying special sections of wood pipe in which a reamed end of proper diameter is substituted for regular chamber or tenon as the case may require. The screw on the threaded nipple cuts the screw in the wood pipe as the junction is made, forming a tight and satisfactory connection. Especially in the smaller sizes this style is very efficient and inexpensive.



WOOD FITTING, COATED



SPECIAL CAST IRON TEE

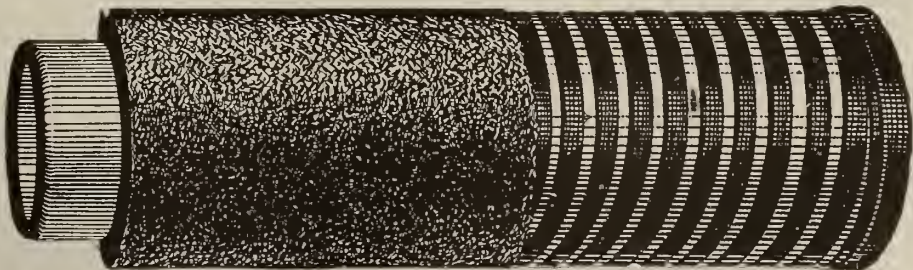


Ball to fit Tenon

SPECIAL CAST IRON ELBOW FOR WOOD PIPE FITTING

DIMENSIONS, DATA, ETC., FOR HANDLING WYCKOFF WOODEN PIPE

Size of pipe, ins.	Outside diameter of pipe, ins.	Weight per lin. ft. in lbs., 80 lbs. pres.	No. ft. in carload 40 ft. car	No. ft. 2-horse truck can haul	No. men used in laying exclusive of foremen	No. ft these men can lay in day of 10 hours
6	10 1/8	15	2700	344	4	2000
8	12 1/8	17	2300	272	4	1900
10	14 1/8	23	1800	216	4	1700
12	16 1/8	25	1500	192	6	1500
14	18 1/8	31	1100	152	6	1400
16	20 1/8	33	900	144	6	1200
18	22 1/8	38	750	128	6	1000
20	24 1/8	42	500	112	6	800
24	28 1/8	50	330	80	8	600
30	36 1/8	80	225	64	8	450
36	42 1/8	95	160	48	8	300
48	54 1/8	120	95	24	8	200



WYCKOFF WOOD STAVE PIPE FOR LOW PRESSURE
Protective coating omitted from one-half of pipe to show steel bands. Note double winding at end of pipe

ESTABLISHED 1864

A. M. BYERS COMPANY

Genuine Wrought Iron Pipe, Couplings and Nipples; Standard Pipe and Oil Country Tubular Goods

PITTSBURGH, PA.

BOSTON, MASS. CLEVELAND, OHIO BRANCH OFFICES CHICAGO, ILL. DALLAS, TEX. NEW YORK, N. Y.

Products.

GENUINE WROUGHT IRON PIPE. Couplings and Nipples; Oil Well Tubing, Casing, Line Pipe, Drill and Drive Pipe.

Guarantee.

(1) All Byers pipe is guaranteed to be made exclusively from Byers pig iron, refined by hand puddling, rolled into muck bar and finally converted into pipe skelp without the use of scrap in any of the processes of manufacture.

(2) Every individual length of Byers pipe is guaranteed to have passed rigid inspection and testing and to be full weight with a variation of not more than 2½% below card weight.

Properties of Byers Pipe.

- (1) High resistance to corrosion gives a useful life 2 to 10 times greater than that of cheaper pipe.
- (2) Easy cutting, threading and bending.
- (3) The fibrous structure makes it extremely resistant to constant vibration and shocks.
- (4) The excellent welding quality of wrought iron makes the weld of the pipe as strong as the wall at any other point.
- (5) Wrought iron has a rough surface to which protective coatings adhere firmly.

The Installation Cost of Pipe.

When a pipe system fails and has to be replaced, the entire original cost usually has to be defrayed again. While the difference in the cost of Byers pipe and cheaper pipe may be 30% to 40%, the use of Byers pipe adds, on an average, only 5% to the total cost of an industrial piping installation over what the cost would be if the cheapest kind of pipe were used. This small premium buys 100% additional life for the whole pipe system.

Specifications.

Copies of complete specifications for genuine wrought iron pipe will be furnished on request. The following condensed specifications are recommended to insure genuine wrought iron pipe:

- "All pipe shall be (Byers) genuine wrought iron, manufactured exclusively from pig iron refined in a puddling furnace, rolled into muck bar, cut, piled and rerolled into skelp without the use of foreign scrap of any kind.
- "A variation of weight of each length, not exceeding 5% above, and 2½% below full standard weight, is permissible.
- "Galvanized pipe, as to base metal, shall conform to above specifications, and be galvanized by the hot metal process, only prime Western spelter being used. Weight of galvanized coating per square foot of surface covered shall not be less than .20 lbs.
- "Couplings and nipples must be made from same quality iron as pipe.
- "Manufacturer's name or trade-mark, as well as year of manufacture, must be rolled in the pipe every few feet."

Literature.

Sent on request.

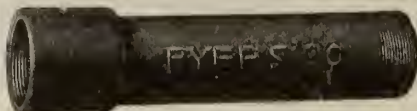
BYERS' GENUINE WROUGHT IRON PIPE, BLACK OR GALVANIZED All weights and dimensions are nominal

	Size	Outside diam., in.	Inside diam., in.	Std. wt. plain ends, lbs. per ft.	Couplings		
					Outside diam., in.	Length, in.	Weight, lbs.
STANDARD							
Buttweld	$\frac{1}{8}$	.405	.264	.244	.640	.937	.053
	$\frac{1}{4}$	.540	.367	.424	.750	1.000	.059
	$\frac{3}{8}$	.675	.489	.567	.968	1.343	.156
	$\frac{1}{2}$	.840	.617	.850	1.078	1.343	.168
	$\frac{3}{4}$	1.050	.819	1.130	1.312	1.531	.243
	1	1.315	1.043	1.678	1.656	1.718	.425
Buttweld and Lapweld	$1\frac{1}{4}$	1.660	1.369	2.272	1.984	2.062	.631
	$1\frac{1}{2}$	1.900	1.604	2.717	2.281	2.312	.884
Lapweld	2	2.375	2.060	3.652	2.750	2.500	1.100
	$2\frac{1}{2}$	2.875	2.460	5.793	3.312	3.125	2.100
	3	3.500	3.059	7.575	4.031	3.125	3.025
	$3\frac{1}{2}$	4.000	3.538	9.109	4.500	3.687	3.900
	4	4.500	4.016	10.790	4.968	3.687	4.200
	$4\frac{1}{2}$	5.000	4.496	12.538	5.531	4.218	6.200
	5	5.563	5.036	14.617	6.281	4.125	8.250
	6	6.625	6.053	18.974	7.375	4.156	10.800
	7	7.625	7.010	23.544	8.375	5.000	14.650
	8	8.625	8.059	24.696	9.406	5.000	16.250
	8	8.625	7.967	28.554	9.406	5.000	16.250
	9	9.625	8.927	33.907	10.687	6.375	33.700
	10	10.750	10.181	31.201	11.937	6.750	42.900
	10	10.750	10.124	34.240	11.937	6.750	42.900
	10	10.750	10.005	40.483	11.937	6.750	42.900
	11	11.750	10.985	45.557	12.937	6.750	45.900
	12	12.750	12.077	43.773	13.875	6.750	49.100
	12	12.750	11.985	49.562	13.875	6.937	49.100

EXTRA HEAVY							
Buttweld	1/8	.405	.207	.314	.640	.937	.053
	1/4	.540	.295	.535	.843	1.250	.125
	3/8	.675	.417	.738	.968	1.343	.156
	1/2	.840	.539	1.087	1.109	1.500	.200
	3/4	1.050	.735	1.473	1.406	2.125	.460
	1	1.315	.949	2.171	1.656	2.375	.625
Buttweld and Lapweld	1 1/4	1.660	1.269	2.996	2.094	2.750	1.150
	1 1/2	1.900	1.491	3.631	2.375	2.750	1.300
Lapweld	2	2.375	1.929	5.022	2.937	3.625	2.400
	2 1/2	2.875	2.311	7.661	3.531	4.125	4.250
	3	3.500	2.887	10.252	4.187	4.250	5.200
	3 1/2	4.000	3.350	12.505	4.750	4.437	6.900
	4	4.500	3.811	14.983	5.250	4.437	7.500
	4 1/2	5.000	4.275	17.611	5.671	4.375	7.700
	5	5.563	4.797	20.778	6.375	5.000	10.850
	6	6.625	5.743	28.573	7.500	5.437	15.500
	7	7.625	6.603	38.048	8.625	6.250	24.300
	8	8.625	7.604	43.388	9.500	6.250	24.000
	9	9.625	8.604	48.728	10.687	6.375	33.700
	10	10.750	9.729	54.735	11.937	6.750	42.200
	11	11.750	10.729	60.075			
	12	12.750	11.729	65.415	13.875	6.937	49.100

DOUBLE EXTRA HEAVY							
Buttweld	1 1/4	.840	.226	1.714	Same as for Extra Heavy		
	3/4	1.050	.413	2.440			
	1	1.315	.576	3.659			
Buttweld and Lapweld	1 1/4	1.660	.874	5.214	Same as for Extra Heavy		
	1 1/2	1.900	1.078	6.408			
Lapweld	2	2.375	1.480	9.029	Same as for Extra Heavy		
	2 1/2	2.875	1.742	13.695			
	3	3.500	2.270	18.583			
	3 1/2	4.000	2.697	22.850			
	4	4.500	3.119	27.541			
	4 1/2	5.000	3.546	32.530			
	5	5.563	4.028	38.552			
	6	6.625	4.857	53.160			

Permissible variation in weight is 2½% below and 5% above. Standard pipe furnished with threads and couplings and in random lengths; extra heavy and double extra heavy with plain ends, and in random lengths unless otherwise ordered. Extra heavy and double extra heavy pipe fitted with threads and couplings at an extra charge above regular.



THE NAME AND YEAR IS ROLLED IN EVERY LENGTH OF BYERS PIPE

PEERLESS IRON PIPE EXCHANGE, INC.

Second-hand and New Pipe, New Mill Seconds and Contractors' Equipment

OFFICE, WAREHOUSE AND YARDS

280-288 Jackson Avenue

LONG ISLAND CITY, N. Y.

NEW YORK OFFICE, 302 Broadway

Products.

SECOND-HAND STEEL and IRON PIPE, CASING and BOILER TUBES; NEW PIPE; NEW MILL SECONDS; CONTRACTORS' EQUIPMENT and SUPPLIES.

Line Pipe, Gas and Oil Well Supplies, Couplings.



TRADE-MARK

Used as rollers and for cores in concrete work; also for conduit purposes.

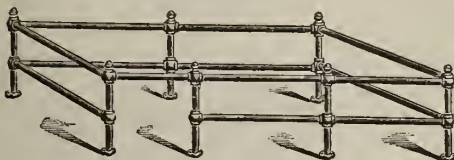
Larger sizes used for culvert purposes, conveying concrete, pile driving, foundation work, etc.

Second-hand Pipe.

Second-hand pipe is extensively used in oil fields and mines, for gas, oil, air and water lines; also for temporary and permanent discharge and exhaust lines, and for culverts. Largely used in all kinds of large and small industrial plants and in all classes of construction work; also in connection with underground and overhead irrigation systems, and for artesian and other well drilling. Suitable for pile driving and foundation work. In fact, can be used for almost any and every practical purpose to which new pipe or mill seconds apply. Sizes carried in stock are from $\frac{3}{8}$ in. to 24 in. in diameter. All second-hand pipe is in "A No. 1" serviceable condition, guaranteed equipped with new thread and couplings. Material saving can be effected by its extensive use.

Casing and Boiler Tubes.

All sizes of casing are carried in stock, suitable for well drilling, etc. Casing, and second-hand boiler tubes, are extensively used in the manufacture of concrete filled columns. Second-hand boiler tubes cleaned and trimmed for re-tubing boilers.



SECOND-HAND PIPE AND NEW MILL SECONDS USED FOR RAILINGS



SECOND-HAND PIPE AND NEW MILL SECONDS USED FOR COLUMNS AND SUPPORTS

New Mill Seconds.

This class of pipe is carried in black and galvanized, in sizes from $\frac{3}{8}$ in. to 12 in. in diameter.

Recommended as most suitable and economical for the following purposes:

All structural and ornamental work, such as area, hand, and bridge railings, fence posts and columns.

Extensively used in the manufacture of racks and stands of all kinds, tool handles, and as integral parts of various kinds of machines, etc.

New Pipe.

All sizes of new pipe are carried in stock—wrought iron and wrought steel, black and galvanized, for water, gas, steam, ammonia, sprinkler systems, etc.

Contractors' Equipment and Supplies.

Second-hand machinery, tools and supplies used in connection with construction work, including boilers, hoisting engines, derricks, concrete mixers, air tanks, etc.

Re-laying rails is a specialty of this company.

List and specification will be gladly mailed on application. Inquiries are solicited. Will gladly quote on, and recommend material most suitable and practical for all requirements.

Buyers of Plants, Equipment, etc.

This Company buys up any quantity of good serviceable used pipe, as well as plants and equipment.

Service.

This Company maintains a large warehouse in Long Island City, N. Y., which is well stocked with all sizes and types of pipe, ready for immediate shipment.



SECOND-HAND PIPE USED FOR DISCHARGE LINE

Modern equipment for cutting and threading of pipe to special specifications.

Shipping Facilities.

In close proximity to the Long Island, Pennsylvania, and all other roads and steamship lines. All orders are immediately filled and shipped.

JOHN SIMMONS CO.

Piping, Mill and Factory Supplies

GENERAL OFFICES

102-110 Centre Street

NEW YORK, N. Y.

Products.

PIPE: Genuine Iron and Steel; Cast Iron Flanged; Cast Iron Water; Cast Iron Soil; Brass and Copper; Lead Lined and Tin Lined; Spiral Riveted.

STEAM TRAPS; AUTOMATIC GRAVITY SCALES.

FITTINGS: Cast Iron, Malleable Iron, Steel and Brass, for steam, water, gas, air and ammonia; Standard, Medium, Extra Heavy and Hydraulic; Simmons Unions.

VALVES: Iron, Steel, Brass, Gate, Globe, Angle and Check; Standard, Medium and Extra Heavy, for steam, water, gas, air and ammonia; Blow-off, Elevator, Radiator, Regulating, Relief, Tank and Vacuum Valves; Foot Valves.

Also, Pressure Tanks; Steam, Hand and Power Pumps; Injectors; Pipe Machines; Vises, Stocks and Dies, Wrenches, Drills, etc.; Expansion, Oil and Storage Tanks; Brass, Lead and Iron Traps; Red Seal Metallic Packing or Gaskets; Pipe Joint Compounds.

Exclusive agency for Wm. Powell Co. line of valves, lubricators, etc., in New York territory.

For Plumbing Supplies, see page 1039.

Pipe.



STEEL AND IRON PIPE, BLACK AND GALVANIZED

"Morehead" Return Steam Trap.

The "Morehead" steam trap removes water of condensation from heating, drying and cooking apparatus and returns the condensation direct to the boiler, regardless of any difference in pressure on the apparatus drained and the boiler, or whether the apparatus is located above or below the water line.

It is admirably adapted for use as a lift pump, and for feeding boilers from open or closed heaters. It handles perfectly water at any temperature. It requires

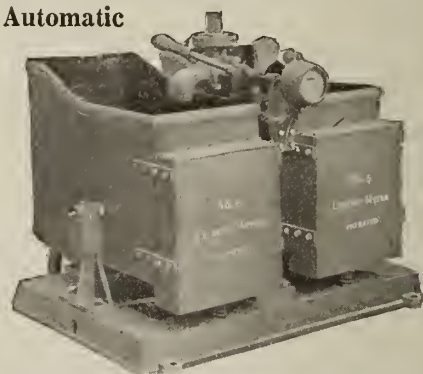


"MOREHEAD" RETURN STEAM TRAP

no special attention, no cylinder lubrication and very little repacking of glands, or repairs of any kind.

Improved Leinert Automatic Gravity Scales.

A simple, positive, automatic balance for recording liquid weight. This apparatus is not affected by temperature or specific gravity changes.



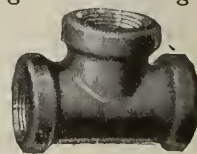
LEINERT AUTOMATIC GRAVITY SCALES

Drop Forged Steel Fittings and Valves.

The "Simmons" line of drop forged steel fittings has been put on the market in answer to the increased demand for fittings free from flaws or airholes liable to be found in all cast fittings, whether gray iron, malleable or cast steel. Fittings are bored out of solid forgings.

Prices quoted on fittings for all pressures up to 10,000 lbs. per sq. in. Drop forged steel valves for the same service are also offered.

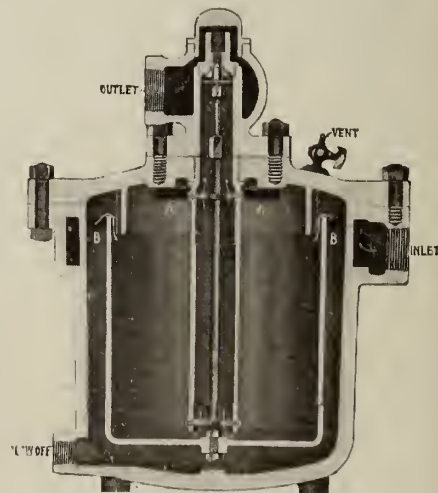
In inquiring for prices please state conditions, and quantity.



DROP FORGED STEEL FITTINGS

Stickie Steam Trap.

The Stickie bucket steam trap is so designed and constructed as to give it the greatest possible efficiency. The construction of the high and low pressure traps are identical except in weight and size of valve openings. No needle point valves. All valves are ball seated and self-grinding.



STICKIE STEAM TRAP

Information.

Circulars containing complete description of JOHN SIMMONS Co. products will be mailed on request. Inquiries will find prompt and welcome attention.

SIMMONS PIPE BENDING WORKS

40 Mechanic Street
NEWARK, N. J.

Products.

PIPE BENDS.
PIPE COILS.
WELDED HEADERS.
VAN STONE JOINTS.
CAST IRON FITTINGS.
VALVES.
STEAM SPECIALTIES.

Pipe Bends.

Made in all shapes and sizes from $\frac{1}{8}$ to 30 in. Full card weight or extra heavy pipe manufactured for the purpose used. Furnished with screwed or Van Stone flanges in cast iron and rolled steel both standard and extra heavy.



16-INCH OUTSIDE DIAMETER PIPE OFFSET

Welded Headers.

Made with any number of welded nozzles in lengths limited only by means of transportation. Light unit construction eliminates leaky joints and lowers shipping and erection costs. Furnished with screwed or Van Stone flanges.



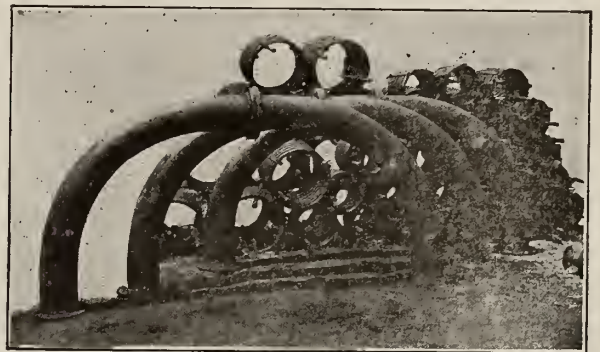
WROUGHT STEEL WELDED HEADERS

Valves and Steam Specialties.

All standard makes furnished ready for installation.

Coils.

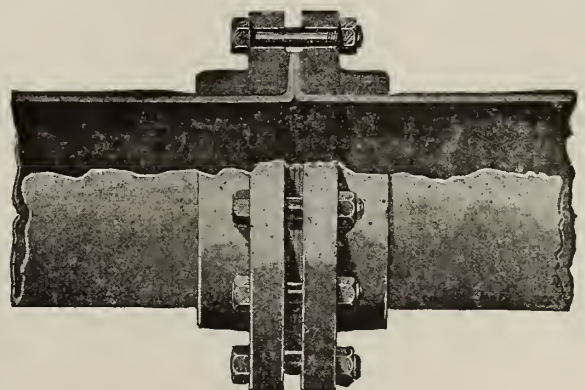
Continuous welded construction spiral, basket, zig zag, taper, miter wall and box return bend coils made to specifications in black or galvanized from iron or steel pipe. Also made from seamless steel tubing, brass or copper pipe.



PIPE BENDS AND COILS

Van Stone Joints.

Produced by improved machinery in sizes from 4 to 30 in. with high hub cast iron or rolled steel flanges in standard or extra heavy.



VAN STONE JOINT

Cast Iron Fittings.

Complete line of standard and extra heavy cast iron flanged or screwed fittings. Special fittings made to specifications.

THE YOUNGSTOWN SHEET & TUBE COMPANY

GENERAL OFFICES AND WORKS
YOUNGSTOWN, OHIO

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CHICAGO, ILL., 1563 McCormick Building
CLEVELAND, OHIO, Leader-News Building

DENVER, COLO., First National Bank Building
SAN FRANCISCO, CAL., 604 Mission Street
DALLAS, TEX., 915 Great Southern Life Building
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ST. LOUIS, MO., Third National Bank Building
DETROIT, MICH., Dime Savings Bank Building

BOSTON, MASS., 120 Franklin Street

EXPORT SALES AGENT: CONSOLIDATED STEEL CORPORATION, 165 Broadway, NEW YORK, N. Y.

Products.

"YOUNGSTOWN" STEAM, GAS and WATER PIPE: "YOUNGSTOWN" STEEL, $\frac{1}{8}$ -in. up to and including 20-in. outside diameter; "YOUNGSTOWN" STAR BRAND IRON (Genuine Wrought Iron), $\frac{3}{8}$ -in. up to and including 12-in. nominal inside diameter, black and galvanized; EXTRA STRONG and DOUBLE EXTRA STRONG "YOUNGSTOWN" STEEL and "YOUNGSTOWN" STAR BRAND IRON PIPE, which includes:

Line Pipe for oil and gas, fitted with recessed extra heavy taper sockets; Tubing and Drive Pipe; Rotary Drill Pipe; Casing; Screw and Socket and Inserted Joint.

Dry-kiln Pipe; Signal Pipe; Ammonia Pipe; and pipe for various other purposes, such as Pipe Water Lines fitted with flanges, etc.; Asphalted Pipe.

ELECTRICAL CONDUITS, "BUCKEYE" RIGID, Galvanized and Enameled; "REALFLEX" FLEXIBLE STEEL ARMORED CABLES.

Also, Pig Iron; Bessemer and Open Hearth Steel Billets, Slabs and Sheet Bar; Puddled Iron Muck Bar; Double Refined Puddled Iron Sheet Bars; Iron and Steel Plates and Skelp.

Bars and Shapes: Rounds and squares, $\frac{1}{4}$ in. to 2 in.; flats up to $4\frac{1}{2}$ in. wide; angles up to 3 in. wide.

"Youngstown" Sheared Plates, $\frac{3}{16}$ in. to 1 in. thick, maximum width 72 in.

"Youngstown" Iron and Steel Sheets, Black and "New Process" galvanized.

"Youngstown" Iron and Steel Roofing, painted and "New Process" galvanized (corrugated, V-crimp, roll and standing seam).

Barbed Wire, painted and galvanized; Wire Rods; Plain Wire, black and galvanized; Wire Nails, Staples and Hoops; "Youngstown" and "Buckeye" Woven Wire Field Fence.

"Youngstown" Pipe.

Like all of our products, "Youngstown" pipe is made by us straight through from the ore in one plant by one organization. With such manufacturing facilities the utmost in quality and service is assured. Works cover an area of 500 acres, entirely devoted to the manufacture of these products.

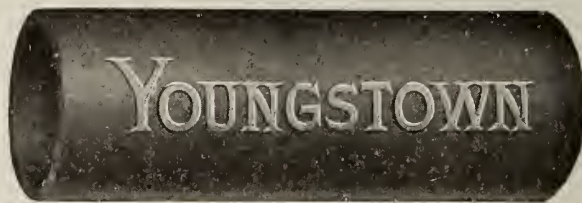
Half a million tons of tubular products are made annually. This includes both "Youngstown" steel and "Youngstown" Star Brand genuine old-fashioned hand puddled iron pipe, both of which meet every demand of architect and engineer for high grade tubular products.

"Youngstown" pipe is made with either standard English or standard American threads, as may be ordered.

All couplings furnished with "Youngstown" steel pipe are forged from genuine wrought iron, which insures easier installation and tighter joints than where steel couplings are used.

Marking of Steel Pipe.

"Youngstown" steel pipe is distinguished by the word "Youngstown" in raised letters on every length of pipe. See illustration.



"YOUNGSTOWN" STEEL PIPE

Specifications for "Youngstown" Steel Pipe.

For the convenience of architects and engineers the following specifications for steel pipe are submitted:

MATERIAL—All "Youngstown" steel pipe shall be made of soft weldable steel of uniformly good quality. This steel to be particularly adaptable to the requirements for wrought pipe, and sufficient crop shall be cut from the top of each ingot to secure solid metal in the skelp.

PROPERTIES—The steel from which the pipe is made shall have approximately the following physical properties:

Tensile strength, not less than 50,000 lbs.
Elastic limit, not less than one-half tensile.
Elongation in 8 in., not less than 20%.
Reduction in area, not less than 50%.

TEST SPECIMENS—Test specimens for determining physical properties shall be cut from skelp or finished pipe.

CRUSHING TEST—When required, cross sections cut from any pipe shall stand crushing down until the inside walls are three times the thickness of the wall from each other without showing cracks on the outside of the bend; except that, in the case of butt-welded pipe, any fracture at the weld must give evidence of having been firmly welded.

BEND TEST—When required, a test specimen cut lengthwise from skelp or finished pipe and filed smooth on the edges shall bend through an angle of 180°, with an inner diameter equal to the thickness of the material, without fracture.

HYDROSTATIC TEST—All sizes shall be tested at mill to an internal pressure, as shown in the following table:

$\frac{1}{8}$ to 2 in., butt-weld, 700 lbs.
 $2\frac{1}{2}$ and 3 in., butt-weld, 800 lbs.
Up to 8 in., lap-weld, 1000 lbs.
9 and 10 in., lap-weld, 900 lbs.
11 and 12 in., lap-weld, 800 lbs.

On the 8-in., 10-in. and 12-in. sizes, which have more than one weight as standard, we have shown the test pressure for the heaviest weight.

LENGTHS—Unless otherwise specified, standard pipe will be furnished in random lengths with threads and couplings; extra strong pipe will be furnished plain ends.

THREADING—Pipe and couplings shall be threaded and tapped according to Briggs' Standard. Thread must be a good commercial thread and must not leak under the specified pressure (paragraph 5). The thread must not vary more than one and one-half turns, either way, when tested with a Pratt and Whitney Briggs' Standard Gauge. All burrs at the ends shall be removed.

COUPLINGS—Chamfered or slightly beveled couplings will be furnished on all steam pipe, and shall be of soft puddled

iron, thoroughly welded and free from all blisters, pits or other defects that would break the continuity of the thread.

TOLERANCE—The pipe shall not vary more than 1% either way from being perfectly round and true to the standard outside diameter, and shall not vary more than 5% either way from weight as listed.

TESTS—All tests shall be made at the mill.

"Youngstown" Star Brand Pipe.

Genuine old-fashioned hand puddled iron pipe, guaranteed full weight. We own and control extensive iron ore properties. From properly selected ore we manufacture pig iron. This pig iron is in turn worked by hand in puddle furnaces into *genuine wrought iron*.

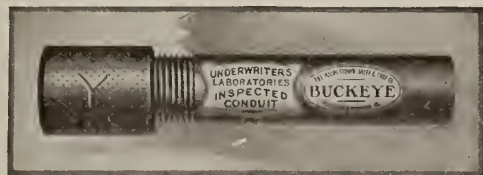
This high grade hand puddled iron is then rolled into skelp. The skelp is made into "Youngstown" Star Brand iron pipe. Those who prefer iron pipe to steel will find in "Youngstown" Star Brand an honestly made, full weight product that will meet their every requirement.

MARKING—All of our "Youngstown" Star Brand iron pipe is marked with the word "Youngstown" in raised letters followed by a star. In butt-weld sizes the star is rolled in the iron; in lap-weld sizes it is stencilled on the pipe.

"Buckeye" Conduit and "Realflex" Armored Conductor.

These two materials, which had acquired an enviable reputation as products of the Western Conduit Company, a subsidiary recently dissolved, are now manufactured by us direct in the same plant and by the same organization.

"BUCKEYE" ELECTRICAL CONDUIT—Is made from mild steel tubing produced for this purpose in our own works. It is furnished in two standard finishes—black enamel and electro-galvanized, and in all sizes up to and including 6 in. in diameter. All couplings are forged from genuine wrought iron.



"BUCKEYE" ELECTRICAL CONDUIT

Special attention is given to the finish and threading of this conduit. It is regularly tested and meets the severest specifications, being used extensively on government work.

"REALFLEX" ARMORED CABLE—Contains the highest grade of copper conductors distinguished by different colors and protected by an armor of galvanized steel wire. This wire, which is manufactured specially in our plant, is flattened on the outside and so wound that it gives genuine protection with a degree of flexibility quite unusual. "Realflex" is ratproof and dustproof, works without waste, is installed with rapidity, fits standard connections, and makes a permanently handsome job. Is flexible, and can be fished with such ease that it is used extensively as a substitute for rigid conduit in difficult locations. Manufactured in a number of sizes and can be furnished with or without lead covering beneath the armor.



"REALFLEX" ARMORED CONDUCTOR

"YOUNGSTOWN" STEEL AND "YOUNGSTOWN" STAR BRAND IRON PIPE

FULL STANDARD WEIGHT—BLACK AND GALVANIZED
All Weights and Dimensions Are Nominal

Size, in.	List price per foot	Diameters, in.		Thickness, in.	Weight per foot, lbs.		
		External	Internal		Plain ends	Threads and couplings	Threads per inch
1/8	\$.05 1/2	.405	.269	.068	.244	.245	27
1/4	.06	.540	.364	.088	.424	.425	18
3/8	.06	.675	.493	.091	.567	.568	18
1/2	.08 1/2	.840	.622	.109	.850	.852	14
3/4	.11 1/2	1.050	.824	.113	1.130	1.134	14
1	.17	1.315	1.049	.133	1.678	1.684	11 1/2
1 1/4	.23	1.660	1.380	.140	2.272	2.281	11 1/2
1 1/2	.27 1/2	1.900	1.610	.145	2.717	2.731	11 1/2
2	.37	2.375	2.067	.154	3.652	3.678	11 1/2
2 1/2	.58 1/2	2.875	2.469	.203	5.793	5.819	8
3	.76 1/2	3.500	3.068	.216	7.575	7.616	8
3 1/2	.92	4.000	3.548	.226	9.109	9.202	8
4	1.09	4.500	4.026	.237	10.790	10.889	8
4 1/2	1.27	5.000	4.506	.247	12.538	12.642	8
5	1.48	5.563	5.047	.258	14.617	14.810	8
6	1.92	6.625	6.065	.280	18.974	19.185	8
7	2.38	7.625	7.023	.301	23.544	23.769	8
8	2.50	8.625	8.071	.307	24.696	25.000	8
8	2.88	8.625	7.981	.322	28.554	28.809	8
9	3.45	9.625	8.941	.342	33.907	34.188	8
10	3.20	10.750	10.192	.279	31.201	32.000	8
10	3.50	10.750	10.136	.307	34.240	35.000	8
10	4.12	10.750	10.020	.365	40.483	41.132	8
11	4.63	11.750	11.000	.375	45.557	46.247	8
12	4.50	12.750	12.090	.330	43.773	45.000	8
12	5.07	12.750	12.000	.375	49.562	50.706	8
13	5.60	14.000	13.250	.375	54.568	55.824	8
14	6.10	15.000	14.250	.375	58.573	60.375	8
15	6.50	16.000	15.250	.375	62.579	64.500	8

The permissible variation in weight is 5% above and 5% below.
Furnished with threads and couplings and in random lengths unless otherwise ordered.

For cut lengths, an extra charge will be made above random lengths.
For pipe smoothed on the inside, known as reamed and drifted, an extra charge will be made above standard pipe.
For galvanized or coated pipe, an extra charge will be made above black.

EXTRA STRONG PIPE—BLACK AND GALVANIZED All Weights and Dimensions Are Nominal

Size, in.	List price per foot	Diameters, in.		Thickness, in.	Weight per foot, lbs. plain ends
		External	Internal		
1/8	\$.12	.405	.215	.095	.314
1/4	.07 1/2	.540	.302	.119	.535
3/8	.07 1/2	.675	.423	.126	.738
1/2	.11	.840	.546	.147	1.087
3/4	.15	1.050	.742	.154	1.473
1	.22	1.315	.957	.179	2.171
1 1/4	.30	1.660	1.278	.191	2.996
1 1/2	.36 1/2	1.900	1.500	.200	3.631
2	.50 1/2	2.375	1.939	.218	5.022
2 1/2	.77	2.875	2.323	.276	7.661
3	1.03	3.500	2.900	.300	10.252
3 1/2	1.25	4.000	3.364	.318	12.505
4	1.50	4.500	3.826	.337	14.983
4 1/2	1.80	5.000	4.290	.355	17.611
5	2.08	5.563	4.813	.375	20.778
6	2.86	6.625	5.761	.432	28.573
7	3.81	7.625	6.625	.500	38.048
8	4.34	8.625	7.625	.500	43.388
9	4.90	9.625	8.625	.500	48.728
10	5.48	10.750	9.750	.500	54.735
11	6.10	11.750	10.750	.500	60.075
12	6.55	12.750	11.750	.500	65.415

The permissible variation in weight is 5% above and 5% below.

DOUBLE EXTRA STRONG PIPE—BLACK AND GALVANIZED All Weights and Dimensions Are Nominal

Size, in.	List price per foot	Diameters, in.		Thickness, in.	Weight per foot, lbs. plain ends
		External	Internal		
1/8	\$.32	.840	.252	.294	1.714
3/8	.35	1.050	.434	.308	2.440
1	.37	1.315	.599	.358	3.659
1 1/4	.52 1/2	1.660	.896	.382	5.214
1 1/2	.65	1.900	1.100	.400	6.408
2	.91	2.375	1.503	.436	9.029
2 1/2	1.37	2.875	1.771	.552	13.695
3	1.86	3.500	2.300	.600	18.583
3 1/2	2.30	4.000	2.728	.636	22.850
4	2.76	4.500	3.152	.674	27.541
4 1/2	3.26	5.000	3.580	.710	32.530
5	3.86	5.563	4.063	.750	38.552
6	5.32	6.625	4.897	.864	53.160
7	6.35	7.625	5.875	.875	63.079
8	7.25	8.625	6.875	.875	72.424

The permissible variation in weight is 10% above and 10% below.

The following notes apply to both tables:

Furnished with plain ends and in random lengths, unless otherwise ordered.
Random length of Extra Strong and Double Extra Strong pipe is considered to be 12 to 22 ft.; we to have the privilege, however, of supplying not exceeding 5% of total order in lengths of from 6 to 12 ft.

For pipe fitted with threads and couplings, an extra charge will be made above plain ends.

For cut lengths, an extra charge will be made above random.

For galvanized or coated pipe, an extra charge will be made above black.

ESTABLISHED 1878

JAMES B. CLOW & SONSManufacturers of Cast Iron Pipe, Plumbing and Heating Supplies;
Cast Iron ColumnsTELEPHONE:
WABASH 2789534-546 South Franklin Street
CHICAGO, ILL.

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Products.

PIPE and FITTINGS.

CLOW GASTEAM RADIATORS.

ULTRA-VIOLET RAY WATER STERILIZERS.

Cast Iron Columns, Bases and Caps.

In Chicago, JAMES B. CLOW & SONS carry a complete line of the following material:

Plumbing Supplies, including Drinking Fountains, Automatic Water Closets, Lavatories, Sinks, etc.

Steam Supplies, including Steel and Wrought Iron Pipe; Cast Iron and Malleable Fittings; Low, Standard and Extra Heavy Valves with Screwed, Flanged, Hub and Spigot Connections—Straightway, Angle, Check, Flap, etc.

Water Works Supplies, including Cast Iron Bell and Spigot-Flanged and Threaded Pipe and Fittings, Lead, Oakum, Tools, etc.

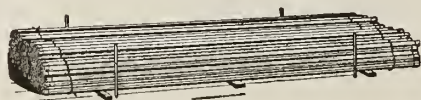
They also manufacture in Chicago Marble Products for all purposes and all brass work for their plumbing business, including Faucets, Bibbs, Traps, Supplies, Showers, etc.

At their Ohio plants, which specialize on making cast iron pipe and fittings, a complete line of Cast Iron Specialties is also produced, including:

Manholes, Lamp Posts, Fountains; Special Castings for Coke Ovens, Filtration Plants, Sugar Refineries, Chemical Companies, Oil Refineries, etc.; Radiators, Boilers; Plumbing Specialties such as Bell Traps, Drum Traps, Gratings, etc.

Steel or Wrought Iron Threaded Pipe.

Can furnish random lengths of steel or wrought iron pipe in all standard sizes, either black or galvanized. Cut lengths to order.



STEEL OR WROUGHT IRON THREADED PIPE

Cast Iron Hub and Spigot Pipe.

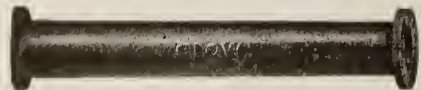
Carried in stock in sizes from 3 to 48 in. 12-ft. lengths are regular; shorter lengths will be cut to order. This pipe is made in all classes for all pressures.



CAST IRON HUB AND SPIGOT PIPE

Cast Iron Flanged Pipe.

Made in all sizes from 1¼ to 48 in. and in all classes

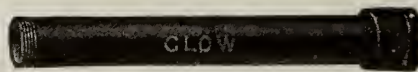


CAST IRON FLANGED PIPE

for all pressures. 12-ft. lengths are regular; shorter lengths will be cut to order.

Cast Iron Threaded Pipe.

This pipe is made in all sizes from 1¼ to 16 in., inclusive. It is threaded at both ends the same as steel or wrought iron pipe. 12-ft. lengths are regular.



CAST IRON THREADED PIPE

Cast Iron or Malleable Screwed Fittings.

A very large stock of screwed fittings in both cast iron and malleable iron, black or galvanized, straight and reducing.



CAST IRON AND MALLEABLE FITTINGS

Cast Iron Hub and Spigot Fittings.

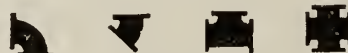
Water and gas fittings are carried in stock in all sizes from 3 to 48 in., in straight and reducing sizes. Also cutting-in specials of all kinds.



CAST IRON HUB AND SPIGOT FITTINGS

Cast Iron Flanged Fittings.

A very large stock of flanged cast iron fittings in all standard sizes for low, standard and extra heavy pressures, both straight and reducing.



CAST IRON FLANGED FITTINGS

Cast Iron Threaded Fittings.

A complete line of cast iron threaded fittings for use with our threaded cast iron pipe. In both straight and reducing sizes.



CAST IRON THREADED FITTINGS

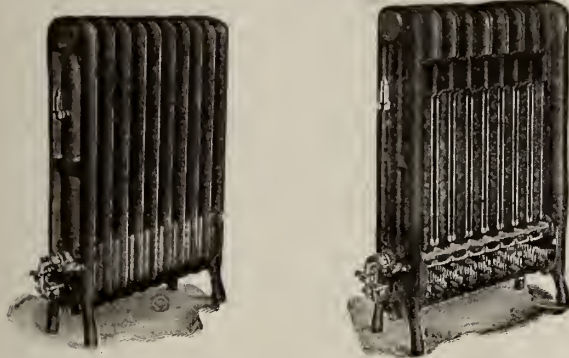
Stock of Pipe and Fittings.

All pipe and fittings carried in stock for all pressures. Castings for special purposes made to order.

Clow Gasteam Radiators.

These radiators provide steam heat without the expense of a boiler, piping and chimney, when and where it is wanted. They also eliminate the disagreeable firing of a coal boiler and do away with the coal bin, dust, dirt, ashes and smoke.

Gasteam heating is adaptable to new or old commercial buildings, factories, stores, churches, schools, theaters and residences. In fact it is a practical and efficient heating system for every purpose.



Ten-section Three-column
GASTEAM RADIATOR Sectional View

Description of Gasteam Heating System.

In appearance Clow Gasteam radiators resemble any other cast iron steam radiator. In place of a boiler, however, each radiator is connected to a gas pipe and a Bunsen burner is placed under the radiator, entirely enclosed in a cast iron combustion box. Directly above the burner is the water chamber (see sectional view). An automatic regulator governs the gas supply, guaranteeing the minimum consumption of gas and the maximum heat.

Operation of Gasteam Heating System.

When heat is required in any room, a match is all that is necessary. By turning the gas cock and applying the match, as to an ordinary gaslight, the burner is lighted, the steam is formed in the water chamber and inside of 30 minutes there is a 5-lb. pressure and a good warm room.

Advantages of Gasteam.

- (1) It gives steam heat when and where it is wanted.
- (2) It eliminates the boiler, the chimney, the coal bin, the piping necessary in a central heating system.
- (3) There is no dirt, no ashes, no dust, no smoke, no firing of the furnace, no janitor when Gasteam radiators are used.
- (4) When heat is required it can be had anywhere in the building by simply lighting a match and turning a gas cock—the Gasteam radiator does the rest.
- (5) Gasteam radiators are furnished in several sizes and heights to meet requirements.

Ultra-Violet Ray Sterilizer.

The advantages of sterilization of water by ultra-violet rays, as compared with other methods of water sterilization, are as follows:

(1) Its action is direct and positive, and results in a complete sterilization of the water. It is a system which has an efficiency of 100%, 100% of the time.

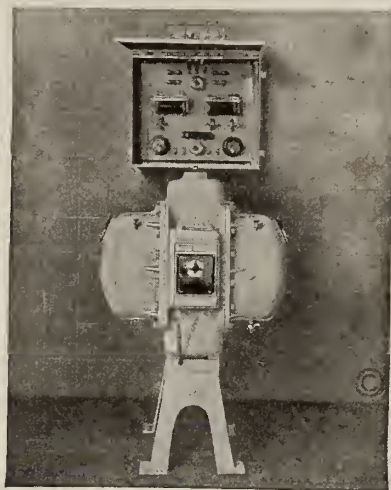
(2) The treatment results in absolutely no chemical change in the water treated. It generates no odor, no taste, no heat, nor any physical change in the water treated.

(3) It does away to the utmost possible extent, with the human element. No attention or care is required, except that of starting the lamps.

(4) The apparatus is so simple in its construction that there is nothing about it that requires adjustment or repairs. With the exception of the lamps, which of course, eventually will have to be renewed, the depreciation on the apparatus is practically nothing.

(5) Its initial cost and the cost of operation are only a fraction of those involved in any other system of water sterilization.

(6) Its cost of operation, in electrical energy consumed, is nominal.



TYPE H-2 R.U.V. WATER STERILIZER

Catalogues.

Complete catalogues gladly sent on request. The following will aid in the selection of the catalogue suited to the requirements:

Plumbing, Catalogue "M."

Drinking Fountains, Fountain Catalogue.

Heating, Special Catalogue.

Cast Iron Pipe, Fittings and Foundry Products—Pipe Economy.

Steam and Water Work Supplies, Catalogue "A."

Water Sterilization, R.U.V. Catalogue.



SHOWROOM, CHICAGO, ILL.

UNITED STATES CAST IRON PIPE AND FOUNDRY CO.

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PHILADELPHIA, PA., 1421 Chestnut Street
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ST. LOUIS, MO., Security Building
SAN FRANCISCO, CAL., Monadnock Building
MINNEAPOLIS, MINN., Plymouth Building
BUFFALO, N. Y., 957 East Ferry Street

Products.

CAST IRON BELL and SPIGOT, FLEXIBLE JOINT and FLANGED PIPE and FITTINGS for Water and Gas.

Flexible Joints for Submerged Lines; High Pressure Pipe and Specials for Fire Service; Plain End and Threaded Cast Iron Pipe; Steam Facings; Cast Iron Culverts; Drains, Sewers, Smoke Flues, Keystone Columns, etc.

Foundry Products: Tanks, Sluice Gates, Screw Piles, Coal Chutes and Bunkers, Suction Strainers, and large Special Castings designed or made to purchaser's design.

Cast Iron Water Pipe.

Cast iron pipe has been used for the carrying of water for generations and is today considered the standard pipe for water. Cast iron water lines laid in 1664 are still in service. A cast iron line laid in this country in 1817 was disconnected after 98 years and then only because the demand for water exceeded its capacity.

Specifications for Cast Iron Water Pipe.

Following is an extract from the specifications of the American Water Works Association, adopted as our manufacturing standard for water pipe.

We are equipped to make standard pipe in all regular sizes from 2 to 84 in.

DESCRIPTION OF PIPE

Section 1—The pipe shall be made with hub and spigot joints and shall accurately conform to the dimensions given in Tables Nos. 1 and 2. They shall be straight and shall be true circles in section, with their inner and outer surfaces concentric, and shall be of the specified dimensions in outside diameter. They shall be at least 12 ft. in length, exclusive of socket.

For pipe 4-in. to 12-in. inclusive, one class of special castings shall be furnished, made from Class D pattern. Those having spigot ends shall have outside diameters of spigot ends midway between the two standards of outside diameter as shown by Table No. 1, and shall be tapered back for a distance of 6 in.

For pipe from 14-in. to 24-in. inclusive, two classes of special castings shall be furnished: Class B special castings with Classes A and B pipe, and Class D special castings with Classes C and D pipe. For pipe 30-in. to 60-in. inclusive, four classes of special castings shall be furnished, one for each class of pipe.

ALLOWABLE VARIATION IN THICKNESS

Section 3—For pipe whose standard thickness is less than 1 in., the thickness of metal in the body of the pipe shall not be more than .08 of an inch less than the standard thickness; and for pipe whose standard thickness is 1 in. or more, the variation shall not exceed .10 of an inch, except that for spaces not exceeding 8 in. in length in any direction, variations from the standard thickness of .02 in. in excess of the allowance above given shall be permitted. For special castings of standard patterns a variation of 50% greater than allowed for straight pipe shall be permitted.

ALLOWABLE PERCENTAGE OF VARIATION IN WEIGHT

Section 7—No pipe shall be accepted the weight of which shall be less than the standard weight by more than 5% for pipe 16 in. or less in diameter, and 4% for pipe more than 16 in. in diameter, and no excess above the standard weight of more than the given percentage for the several sizes shall be paid for. The total weight to be paid for shall not exceed for each size and class of pipe received the sum of the standard weights of the same number of pieces of the given size and class by more than 2%.

No special casting shall be accepted the weight of which shall be less than the standard weight by more than 10% for pipe 12 in. or less in diameter, and 8% for larger sizes, except that curves, Y-pieces and breeches pipe may be 12% below the standard weight, and no excess above the standard weight of more than the above percentages for the several sizes will be paid for. These variations apply only to castings made from the standard patterns.

TESTS OF MATERIAL

Section 9—Specimen bars of the metal used, each being 26 in. long by 2 in. wide and 1 in. thick, shall be made without

TABLE NO. 2. STANDARD THICKNESS AND WEIGHTS OF BELL AND SPIGOT CAST IRON WATER PIPE

Nominal inside diam., in.	CLASS A 100-ft. head 43 lbs. pressure			CLASS B 200-ft. head 86 lbs. pressure			CLASS C 300-ft. head 130 lbs. pressure			CLASS D 400-ft. head 173 lbs. pressure			Nominal inside diam. in.
	Thickness, in.	Weight, lbs.		Thickness, in.	Weight, lbs.		Thickness, in.	Weight, lbs.		Thickness, in.	Weight, lbs.		
		per ft.	per length		per ft.	per length		per ft.	per length		per ft.	per length	
4	.42	20.0	240	.45	21.7	260	.48	23.3	280	.52	25.0	300	4
6	.44	30.8	370	.48	33.3	400	.51	35.8	430	.55	38.3	460	6
8	.46	42.9	515	.51	47.5	570	.56	52.1	625	.60	55.8	670	8
10	.50	57.1	685	.57	63.8	765	.62	70.8	850	.68	76.7	920	10
12	.54	72.5	870	.62	82.1	985	.68	91.7	1100	.75	100.0	1200	12
14	.57	89.6	1075	.66	102.5	1230	.74	116.7	1400	.82	129.2	1550	14
16	.60	108.3	1300	.70	125.0	1500	.80	143.8	1725	.89	158.3	1900	16
18	.64	129.2	1550	.75	150.0	1800	.87	175.0	2100	.96	191.7	2300	18
20	.67	150.0	1800	.80	175.0	2100	.92	208.3	2500	1.03	229.2	2750	20
24	.76	204.2	2450	.89	233.3	2800	1.04	279.2	3350	1.16	306.7	3680	24
30	.88	291.7	3500	1.03	333.3	4000	1.20	400.0	4800	1.37	450.0	5400	30
36	.99	391.7	4700	1.15	454.2	5450	1.36	545.8	6550	1.58	625.0	7500	36
42	1.10	512.5	6150	1.28	591.7	7100	1.54	716.7	8600	1.78	825.0	9900	42
48	1.26	666.7	8000	1.42	750.0	9000	1.71	908.3	10900	1.96	1050.0	12600	48
54	1.35	800.0	9600	1.55	933.3	11200	1.90	1141.7	13700	2.23	1341.7	16100	54
60	1.39	916.7	11000	1.67	1104.2	13250	2.00	1341.7	16100	2.38	1583.3	19000	60
72	1.62	1283.4	15400	1.95	1545.8	18550	2.39	1904.2	22850	....	....	....	72
84	1.72	1633.4	19600	2.22	2104.2	25250	....	....	....	....	....	....	84

The above weights are per length to lay 12 ft., including standard sockets; proportionate allowance to be made for any variation.
NOTE—Table numbers throughout this presentation of pipe and fittings conform to those of general U. S. Catalogue.

charge as often as the engineer may direct; and in default of definite instructions, the contractor shall make and test at least 1 bar from each heat or run of metal. The bars when placed flatwise upon supports 24 in. apart, and loaded in the center, shall support a load of 2,000 lbs. and show a deflection of not less than .30 of an inch before breaking; or if preferred, tensile bars shall be made which will show a breaking point of not less than 20,000 lbs. per sq. in.

COATING
Section 13—Every pipe and special casting shall be coated inside and out with coal tar pitch varnish. The varnish shall be made from coal tar. To this material sufficient oil shall be added to make a smooth coating, tough and tenacious when cold, and not brittle nor with any tendency to scale off.

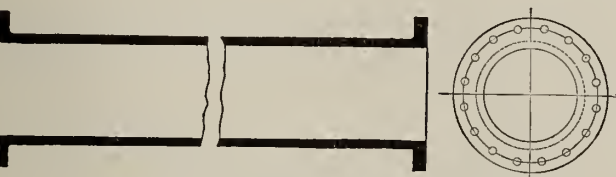
Each casting shall be heated to a temperature of 300° Fahr. immediately before it is dipped, and shall possess not less than this temperature at the time it is put in vat. The ovens in which the pipe are heated shall be so arranged that all portions of the pipe shall be heated to an even temperature. Each casting shall remain in the bath at least 5 minutes.

HYDROSTATIC TEST
Section 14—When the coating has become hard, the straight pipe shall be subjected to a proof by hydrostatic pressure, and, if required by the engineer, they shall also be subjected to a hammer test under this pressure. The pressure to which the different sizes and classes of pipe shall be subjected are as follows:

	20-inch diam. and larger, pounds per square inch	Less than 20-inch diam., pounds per square inch
Class A Pipe.	150	300
Class B Pipe.	200	300
Class C Pipe.	250	300
Class D Pipe.	300	300

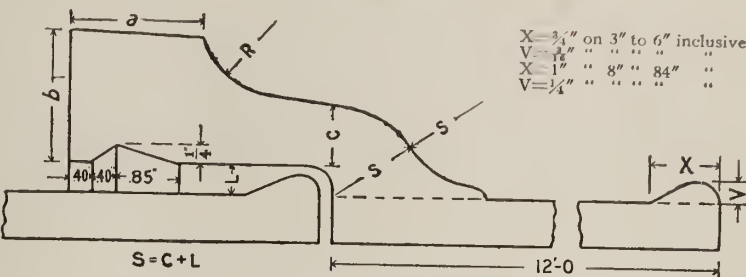
Flanged Pipe.

In recent years, the tightness and strength of the flanged joint have become of value for many special purposes. Flanged pipe is very generally used in power stations and similar buildings, where pipe lines are well supported. The dimensions of flanges, drilling, etc., adopted as standard for all flanged pipe except that for gas, are those recently adopted by the Committee of Manufacturers and the American Society of Mechanical Engineers, and known as the "American 1914 Standard."



STANDARD FLANGED PIPE FOR WATER

TABLE NO. 1. STANDARD DIMENSIONS OF BELL AND SPIGOT WATER PIPE



Nom- inal inside diam., in.	Classes	Actual outside diam., in.	Diam. of Sockets		Depth of Sockets		A	B	C
			Pipe, in.	Special cast- ings, in.	Pipe, in.	Special cast- ings, in.			
4	A	4.80	5.60	5.70	3.50	4.00	1.5	1.30	.65
4	B-C-D	5.00	5.80	5.70	3.50	4.00	1.5	1.30	.65
6	A	6.90	7.70	7.80	3.50	4.00	1.5	1.40	.70
6	B-C-D	7.10	7.90	7.80	3.50	4.00	1.5	1.40	.70
8	A-B	9.05	9.85	10.00	4.00	4.00	1.5	1.50	.75
8	C-D	9.30	10.10	10.00	4.00	4.00	1.5	1.50	.75
10	A-B	11.10	11.90	12.10	4.00	4.00	1.5	1.50	.75
10	C-D	11.40	12.20	12.10	4.00	4.00	1.5	1.60	.80
12	A-B	13.20	14.00	14.20	4.00	4.00	1.5	1.60	.80
12	C-D	13.50	14.30	14.20	4.00	4.00	1.5	1.70	.85
14	A-B	15.30	16.10	16.10	4.00	4.00	1.5	1.70	.85
14	C-D	15.65	16.45	16.45	4.00	4.00	1.5	1.80	.90
16	A-B	17.40	18.40	18.40	4.00	4.00	1.75	1.80	.90
16	C-D	17.80	18.80	18.80	4.00	4.00	1.75	1.90	1.00
18	A-B	19.50	20.50	20.50	4.00	4.00	1.75	1.90	.95
18	C-D	19.92	20.92	20.92	4.00	4.00	1.75	2.10	1.05
20	A-B	21.60	22.60	22.60	4.00	4.00	1.75	2.00	1.00
20	C-D	22.06	23.06	23.06	4.00	4.00	1.75	2.30	1.15
24	A-B	25.80	26.80	26.80	4.00	4.00	2.00	2.10	1.05
24	C-D	26.32	27.32	27.32	4.00	4.00	2.00	2.50	1.25
30	A	31.74	32.74	32.74	4.50	4.50	2.00	2.30	1.15
30	B	32.00	33.00	33.00	4.50	4.50	2.00	2.30	1.15
30	C	32.40	33.40	33.40	4.50	4.50	2.00	2.60	1.32
30	D	32.74	33.74	33.74	4.50	4.50	2.00	3.00	1.50
36	A	37.96	38.96	38.96	4.50	4.50	2.00	2.50	1.25
36	B	38.30	39.30	39.30	4.50	4.50	2.00	2.80	1.40
36	C	38.70	39.70	39.70	4.50	4.50	2.00	3.10	1.60
36	D	39.16	40.16	40.16	4.50	4.50	2.00	3.40	1.80
42	A	44.20	45.20	45.20	5.00	5.00	2.00	2.80	1.40
42	B	44.50	45.50	45.50	5.00	5.00	2.00	3.00	1.50
42	C	45.10	46.10	46.10	5.00	5.00	2.00	3.40	1.75
42	D	45.58	46.58	46.58	5.00	5.00	2.00	3.80	1.95
48	A	50.50	51.50	51.50	5.00	5.00	2.00	3.00	1.50
48	B	50.80	51.80	51.80	5.00	5.00	2.00	3.30	1.65
48	C	51.40	52.40	52.40	5.00	5.00	2.00	3.80	1.95
48	D	51.98	52.98	52.98	5.00	5.00	2.00	4.20	2.20
54	A	56.66	57.66	57.66	5.50	5.50	2.25	3.20	1.60
54	B	57.10	58.10	58.10	5.50	5.50	2.25	3.60	1.80
54	C	57.80	58.80	58.80	5.50	5.50	2.25	4.00	2.15
54	D	58.40	59.40	59.40	5.50	5.50	2.25	4.40	2.45
60	A	62.80	63.80	63.80	5.50	5.50	2.25	3.40	1.70
60	B	63.40	64.40	64.40	5.50	5.50	2.25	3.70	1.90
60	C	64.20	65.20	65.20	5.50	5.50	2.25	4.20	2.25
60	D	64.82	65.82	65.82	5.50	5.50	2.25	4.70	2.60

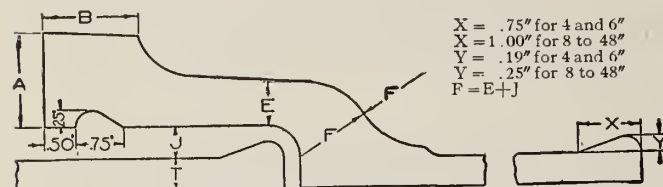
TABLE NO. 33. STANDARD FLANGED WATER PIPE

Nominal diam., in.	Diam. flange, in.	Thick- ness of flange, in.	Diam. bolt circle, in.	Number of bolts	Diam. bolts, in.	CLASS A 100-ft. head 43 lbs. pressure				CLASS B 200-ft. head 86 lbs. pressure				CLASS C 300-ft. head 130 lbs. pressure				CLASS D 400-ft. head 173 lbs. pressure			
						Weight, lbs.				Weight, lbs.				Weight, lbs.				Weight, lbs.			
						Thick- ness, in.	per ft.	per length	Single flange	Thick- ness, in.	per ft.	per length	Single flange	Thick- ness, in.	per ft.	per length	Single flange	Thick- ness, in.	per ft.	per length	Single flange
3	7.50	3/4	6.00	4	5/8	.39	13.0	168	6.4	.42	14.6	188	6.4	.45	15.5	199	6.3	.48	16.4	209	6.2
4	9.00	1	7.50	8	5/8	.42	18.0	238	11.0	.45	20.1	263	10.9	.48	21.3	277	10.8	.52	22.8	295	10.6
6	11.00	1 1/8	9.50	8	3/4	.44	27.9	365	15.0	.48	31.1	403	14.8	.51	32.9	424	14.6	.55	35.3	452	14.4
8	13.50	1 1/2	11.75	8	3/4	.46	38.7	512	23.6	.51	42.7	559	23.2	.56	48.0	622	22.8	.60	51.2	659	22.4
10	16.00	1 3/4	14.25	12	7/8	.50	51.9	688	32.7	.57	58.8	770	32.0	.62	65.5	849	31.4	.68	71.4	918	30.8
12	19.00	1 3/4	17.00	12	7/8	.54	67.0	901	48.5	.62	76.4	1012	47.4	.68	85.4	1118	46.6	.75	93.7	1216	45.6
14	21.00	1 3/4	18.75	12	1	.57	82.3	1107	59.5	.66	94.7	1252	57.9	.74	108.1	1410	56.5	.82	119.2	1541	55.2
16	23.50	1 3/4	21.25	16	1	.60	98.8	1336	75.3	.70	114.6	1522	73.2	.80	133.3	1742	71.2	.89	147.5	1909	69.3
18	25.00	1 3/4	22.75	16	1 1/8	.64	118.3	1581	80.8	.75	137.8	1810	78.1	.87	162.4	2099	75.1	.96	178.4	2286	72.8
20	27.50	1 3/4	25.00	20	1 1/8	.67	137.4	1856	103.7	.80	163.1	2157	99.8	.92	190.6	2480	96.2	1.03	212.3	2733	92.9
24	32.00	1 3/4	29.50	20	1 1/2	.76	186.5	2523	142.7	.89	217.3	2883	137.6	1.04	257.6	3354	131.6	1.16	286.0	3686	126.8
30	38.75	2	36.00	28	1 3/8	.88	266.1	3621	213.9	1.03	312.6	4162	205.6	1.20	366.9	4795	196.1	1.37	421.2	5427	186.4
36	46.00	2 1/4	42.75	32	1 1/2	.99	358.7	4958	326.7	1.15	418.7	5654	314.8	1.36	497.7	6571	299.1	1.58	581.9	7548	282.5
40	50.75	2 3/8	47.25	36	1 3/8	1.06	427.2	5945	409.1	1.23	497.0	6753	394.4	1.48	601.6	7964	372.6	1.72	703.4	9144	351.5
42	53.00	2 3/8	49.50	36	1 3/8	1.10	464.6	6492	458.6	1.28	542.2	7389	441.4	1.54	657.4	8722	416.4	1.78	764.1	9955	393.1
48	59.50	2 3/4	56.00	44	1 3/8	1.26	608.0	8406	554.8	1.42	687.2	9320	536.8	1.71	832.7	10999	503.3	1.96	960.8	12478	474.3

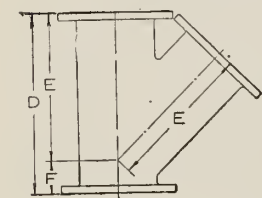
NOTE—Flanges drilled to "American 1914 Standard" templates; send template if other drilling is required. Both holes drilled 1/8 in. larger than bolts. All dimensions in inches. Pipe made in 12-ft. lengths and faced 1/4 in. short for gaskets; special short lengths made to order. Above are neat finished weights. Allowance must be made for variation and finish. All weights are approximate

Cast Iron Gas Pipe.

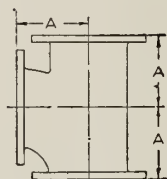
Cast iron gas pipe possesses a power of resistance against corrosion or other factors causing deterioration inherent in the material itself and not dependent solely upon addition of coatings or other artificial aids. The specifications and tables adopted as standard by the American Gas Institute at their eighth annual meeting, held in Richmond, Va., in 1913 have been accepted as standard for gas pipe and specials.



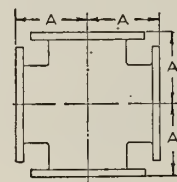
DIMENSION DIAGRAM CAST IRON GAS PIPE



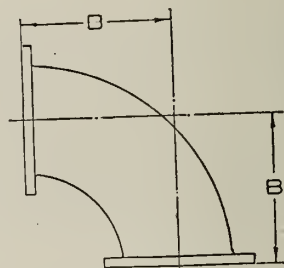
LATERAL



DOUBLE SWEEP TEE



CROSS



LONG RADIUS ELL

TABLE NO. 80. STANDARD FLANGED FITTINGS, 125 LBS. WORKING PRESSURE

Size.....	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
A-A, f. to f., in.....	11	13	16	18	22	24	28	30	33	36	44	50	56	62	68
A, c. to f., in.....	5½	6½	8	9	11	12	14	15	16½	18	22	25	28	31	34
B, c. to f., long rad. ells, in.....	7¾	9	11½	14	16½	19	21½	24	26½	29	34	41½	49	56½	64
C, c. to f., 45° ells, in.....	3	4	5	5½	6½	7½	8	8½	9½	11	15	18	21	24	28
D, f. to f., laterals, in.....	13	15	18	22	25½	30	33	36½	39	43	49½	59	68	78	88
E, c. to f., laterals, in.....	10	12	14½	17½	20½	24½	27	30	32	35	40½	49	56	64	72
F, c. to f., laterals, in.....	3	3	3½	4½	5	5½	6	6½	7	8	9	10	11	12	13
G, f. to f., reducers, in.....	6	7	9	11	12	14	16	18	19	20	24	30	36	42	48
Diam. flanges, in.....	7½	9	11	13½	16	19	21	23½	25	27½	32	38½	46	53	59½
Thickness, flanges, in.....	¾	1	1¼	1½	1¾	2	2¼	2½	2¾	3	3½	4	4½	5	5½
Min. metal thick., body, in.....	¾	1	1¼	1½	1¾	2	2¼	2½	2¾	3	3½	4	4½	5	5½
Bolt circle, in.....	6	7½	9½	11¾	14¼	17	18¾	21¼	22¾	25	29½	36	42¾	49½	56
Number of bolts.....	4	8	8	8	12	12	16	16	16	20	20	28	32	36	44
Size of bolts, in.....	¾	¾	¾	¾	¾	¾	1	1	1½	1½	1½	1½	1½	1½	1½

TABLE NO. 83. "EXTRA HEAVY" FLANGED FITTINGS, 250 LBS. WORKING PRESSURE

Size.....	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
A-A, f. to f., in.....	12	14	17	20	23	26	30	33	36	39	45	55	65	74	84
A, c. to f., in.....	6	7	8½	10	11½	13	15	16½	18	19½	22½	27½	32½	37	42
B, c. to f., long rad. ells, in.....	7¾	9	11½	14	16½	19	21½	24	26½	29	34	41½	49	56½	64
C, c. to f., 45° ells, in.....	3½	4½	5½	6	7	8	8½	9½	10	10½	12	15	18	21	24
D, f. to f., laterals, in.....	14	16½	21½	25½	29½	33½	37½	42	45½	49	57½	68	78	88	98
E, c. to f., laterals, in.....	11	13½	17½	20½	24	27½	31	34½	37½	40½	47½	56	64	72	80
F, c. to f., laterals, in.....	3	3	4	5	5½	6	6½	7	7½	8	8½	10	11	12	13
G, f. to f., reducers, in.....	6	7	9	11	12	14	16	18	19	20	24	30	36	42	48
Diam. flanges, in.....	8½	10	12½	15	17½	20½	23	25½	28	30½	36	43	50	57	65
Thickness, flanges, in.....	1½	1¾	2	2¼	2½	2¾	3	3½	3¾	4	4½	5	5½	6	6½
Min. metal thick., body, in.....	1½	1¾	2	2¼	2½	2¾	3	3½	3¾	4	4½	5	5½	6	6½
Bolt circle, in.....	6	7½	9½	11¾	14¼	17	18¾	21¼	22¾	25	29½	36	42¾	49½	56
Number of bolts.....	8	8	12	12	16	16	20	20	24	24	28	32	36	40	44
Size of bolts, in.....	¾	¾	¾	¾	¾	¾	1	1	1½	1½	1½	1½	1½	1½	1½

NOTE—All extra heavy fittings and flanges to have a raised surface of ⅛ in. high inside of bolt holes for gaskets. Standard weight fittings and flanges to be plain faced. Bolt holes to be ⅛ in. larger in diameter than bolts. Bolt holes to straddle center line.

Tees and crosses 9 in. and down, reducing on the outlet, use the same dimensions as straight sizes of the larger port. Sizes 10 in. and up, reducing on the outlet, are made in two lengths, depending on the size of the outlet as given in the table of dimensions.

Laterals 3½ in. and down, reducing on the branch, use the same dimensions as straight sizes of the larger port. Sizes 4 in. and up, reducing on the branch, are made in two lengths, depending on the size of the branch as given in the table of dimensions.

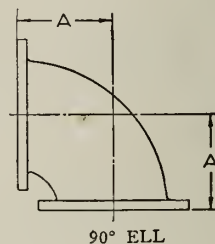
The dimensions of reducing flanged fittings are always regulated by the reductions of the outlet or branch. Fittings reducing on the run only, the long body pattern will always be used.

TABLE NO. 82. "STANDARD" AND "EXTRA HEAVY" REDUCING LATERALS, 125 LBS. WORKING PRESSURE

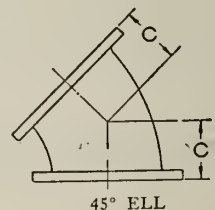
Size.....	4	6	8	10	12	14	16	18	20	24	30
Size of branch and smaller, in.....	2½	3	4	5	6	7	8	9	10	12	15
C, f. to f., run, in.....	13	15	16	18	20	22	24	26	28	32	39
D, c. to f., run, in.....	11	13½	14½	17	19	21	23	25	27	31½	39
E, c. to f., run, in.....	2	1½	1½	1	1	1	1	1	1	1½	2
F, c. to f., branch, in.....	11	13½	15½	18	20½	23	25½	27½	29½	34½	42

TABLE NO. 85. SHORT BODY PATTERNS REDUCING LATERALS, 250 LBS. WORKING PRESSURE

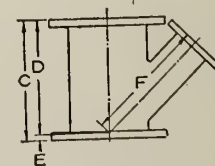
Size.....	4	6	8	10	12	14	16	18	20	24
Size of branch and smaller, in.....	2½	3	4	5	6	7	8	9	10	12
C, f. to f., run, in.....	14	17	20	23	26	29	32	34	37	44
D, c. to f., run, in.....	12	14½	17½	20½	23½	26½	29	31	34	41
E, c. to f., run, in.....	2	1½	1½	1	1	1	1	1	1	1½
F, c. to f., branch, in.....	13	15½	18½	21½	24½	27½	30½	33½	36½	43



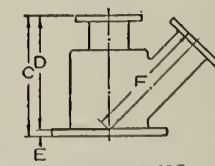
90° ELL



45° ELL



REDUCING LATERAL



REDUCING STRAIGHT AND LATERAL

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LOCK-BAR STEEL PIPE.

Riveted Steel Pipe; Dredge Pipe; Pontoon Pipe; Shore Pipe; Tanks; Standpipes; Steel Linings; Plate Work; Tube Mills.

Advantages of Lock-bar Steel Pipe.

The relative advantages of different forms of pipe are determined by comparing their carrying capacities, strength, durability, and cost.

Lock-bar pipe has a carrying capacity 10% to 15% greater than riveted steel, and slightly greater than cast iron, because of its smooth interior unobstructed by rivets. It has a strength at the joint of 100%, or equal to the plate itself, as hereinafter shown.

Its durability and relatively small cost have been amply demonstrated by actual use for many years, as is evident by the installations given under "References."

Description of Lock-bar Steel Pipe.

"Lock-bar steel pipe is made by upsetting the edges of the plates and connecting them by a lock-bar in the shape of an H, going over the opposite edges and being forced down over them by hydraulic pressure. This takes the place of the riveting in the longitudinal joints. The circular joints may be made by riveting or otherwise, as for riveted pipe. While double riveting



Before Closing

After Closing

FIG. 1. LOCK-BAR JOINT

develops only about 72% of the strength of the steel plate, the lock-bar actually develops 100%."—*American Civil Engineers Pocket Book*, p. 959.

Strength of Joint.

The lock-bar joint is 100% efficient or equal to

the strength of the plate itself. It is therefore possible to use in many instances lock-bar pipe of a thickness of plate $\frac{1}{16}$ in. less than the thickness required in riveted or welded pipe where the joint efficiency is less than the strength of the plate.

Hydraulic Test on 42-inch Pipe.

On Jan. 2, 1909, official tests were conducted by the Robert W. Hunt Co. for the City of Springfield, Mass., on a 42-in. diameter, $\frac{7}{8}$ -in. plate lock-bar pipe under pressure of 1050 lbs. per sq. in. (Fig. 4). The metal of the plate was stretched over 4 in. in circumference without injury or leakage along the lock-bar joints. Higher pressure was not possible because of blowing out riveted pads at gage and inlet, as shown below. At this pressure, the pipe was actually exceeding by 765 lbs. per sq. in. its normal working pressure.



FIG. 2. HYDRAULIC TEST ON 42-INCH PIPE
Showing riveted pads blown out at gage and inlet; lock-bar joint remaining tight

Carrying Capacity.

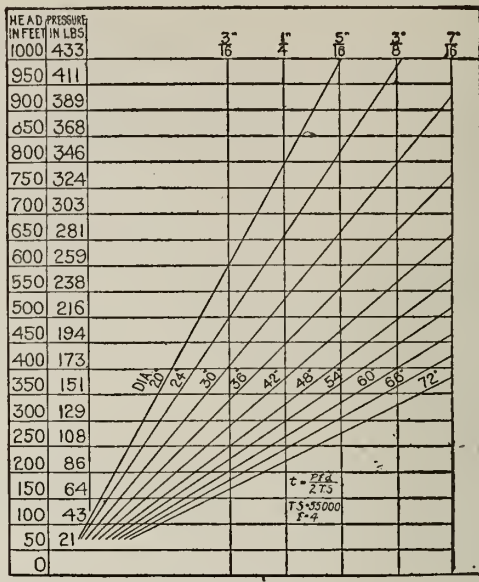
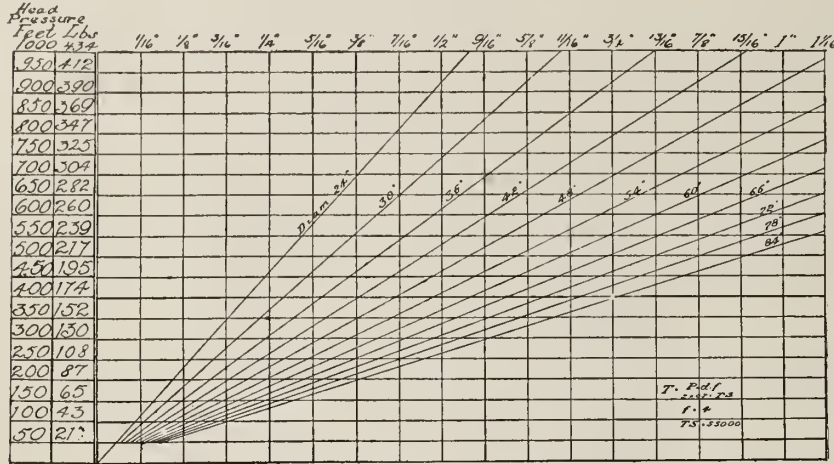
By reason of its exceptionally smooth interior, lock-bar pipe has a slightly greater carrying capacity than cast iron pipe, and from 10% to 15% greater carrying capacity than riveted steel pipe, the interior of which is necessarily obstructed at frequent intervals by the projection of rings of rivets.—*See American Civil Engineers Pocket Book*, p. 959; *Fry's Civil Engineers Pocket Book*, pp. 1162-1163.



FIG. 3. NEW WORKS OF EAST JERSEY PIPE COMPANY, PATERSON, N. J.

Sizes.

Lock-bar pipe is made in diameters from 20 to 72 in., inclusive, and thicknesses of plate from 1/16 to 1/2 in., inclusive.



COMPARATIVE CHARTS SHOWING SAFE WORKING PRESSURES FOR RIVETED AND LOCK-BAR PIPES BASED UPON FORMULA $T = \frac{PFD}{2TS}$; T.S.= 55,000 LBS.; F= FACTOR OF SAFETY 4

Lengths.

Standard lengths, except where necessary to fit pipe to plan or profile of line, or where sizes of plates obtainable impose other limitations, are 30-ft. laying lengths, the most economical for handling and transporting.

Joints.

In all sizes above 24 in., where diameter is sufficient to permit inside rivet insertion and calking, patented riveted taper joints (Fig. 5) are employed. For this joint the pipe is made sufficiently tapered to permit insertion of one pipe in the slightly enlarged end of the contiguous pipe, the two pipes being connected in ordinary practice by one row of rivets, after which the joint is calked both inside and outside in a manner similar to the seams of a boiler.

In some instances buttstrap joints (Fig. 6) are employed.

Special attention is called to the new patented high pressure coupling (Fig. 7) and also the modification of this coupling for submarine work (Fig. 8). Lock-bar pipe with plain ends is furnished for use with these couplings, which can be furnished in all sizes 20 to 48 in. in diameter. The lock-bar on the outside of the pipe is cut down and the pipe welded and smoothed a sufficient distance from the end to permit the pipe to fit into the coupling.

Specifications for Lock-bar Pipe.

PLANING AND UP-SETTING—The longitudinal edges of plates shall be planed to proper dimension and edges up-set to a sufficient degree to

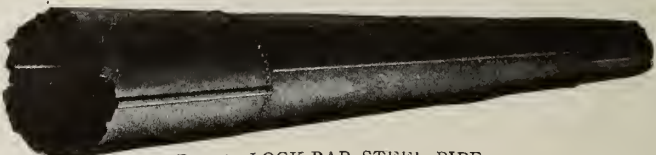


FIG. 4 LOCK-BAR STEEL PIPE

form necessary shoulder for engaging lock-bar. The ends of the plates shall be bevel sheared.

CRIMPING AND ROLLING—The longitudinal edges of plates shall be crimped to proper radius, so that when plates are rolled edges entering lock-bar shall not be damaged by rolling. After crimping, plates shall be cold rolled to diameter of cylinder of pipe.

LOCK-BARS—The lock-bars shall be made from a grade of steel and in accordance with certain specifications which experience has shown best designed for this usage.

PRESSING—Plates and lock-bars shall be assembled and clamped together and lock-bars pressed down over up-set edges of the plates by a hydraulic press exerting a pressure of at least 350 tons per lin. ft. of pipe.

FINISHING—After the bars have been pressed, ends of bars shall be trimmed to edge of plate to conform to bevel of edge of plate.

TESTING—Each section of pipe shall be tested in a hydraulic testing machine to at least one and one-half times the working pressure, which pressure shall be maintained until inspection has been made of entire length of lock-bar joint, and any pipe showing any signs of leakage or weakness at any point shall be returned and repressed.



FIG. 5. RIVETED TAPER JOINT



FIG. 6. BUTTSTRAP JOINT

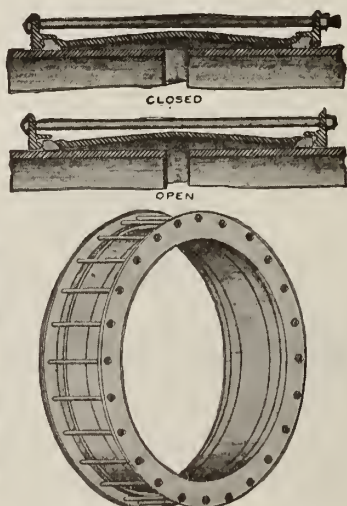


FIG. 7. HIGH PRESSURE FLEXIBLE PIPE COUPLING

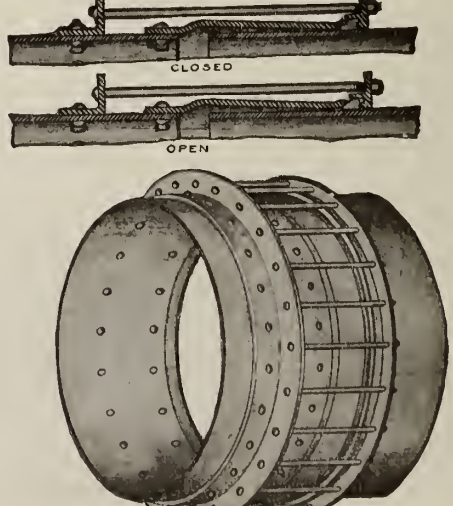


FIG. 8. SUBMARINE PIPE JOINT

General Specifications for All Pipe.

Material used and method of manufacture shall conform to the following detailed specifications, although slight variations from exact specifications may be permitted where, in the judgment of purchaser's inspector, such variations do not affect strength, durability or efficiency.

INSPECTION—All materials entering into manufacture of said pipe and manufacture of pipe itself shall be subject to inspection by purchaser or his duly authorized representative. All steel shall be inspected by purchaser's inspector at mill. Steel plates shall be lifted to a sufficient height or angle to permit proper inspection of both sides, and all plates showing scales, blisters, laminations, burns, or imperfection of any description shall be rejected.

QUALITY OF METAL—Pipe, unless otherwise specified, shall be made of steel plates manufactured by open hearth process which conform to the following requirements:

Tensile Strength—Ultimate tensile strength of steel plates shall be between 55,000 and 65,000 lbs. per sq. in. Form of all test specimens, unless otherwise specified, shall be in accordance with "Standard Specifications for Structural Steel for Bridges" as adopted on August 16, 1909, by American Society for Testing Materials.

Elastic Limit—The elastic limit shall not be less than one-half ultimate tensile strength. The elongation shall not be less than 25% in 8 in. with a reduction in area of not less than 50%.

Rolling—Material shall be rolled true, and billets from which said material is rolled shall be free from seams and cracks. For the purpose of excluding inferior material, there shall be sheared from top of ingot sufficient discard to obtain sound steel.

Punching Test—Specimens for punching test shall be $1\frac{3}{4}$ in. wide, and not less than 10 in. long; a row of not less than 8 holes $\frac{3}{4}$ in. in diameter, spaced $1\frac{1}{4}$ in. between centers, shall be punched while plate is cold, without causing any cracks.

Drifting Test—Specimens for drifting tests shall be 3 in. wide and not less than 5 in. long; not less than 2 holes $\frac{3}{4}$ in. in diameter, spaced 2 in. between centers, and $1\frac{1}{2}$ in. from edges, shall be punched and then enlarged cold by blows from a sledge hammer upon a drifting pin until said holes are at least $1\frac{1}{4}$ in. in diameter, without causing any cracks.

Bending Test—The bending test specimen shall be cut lengthwise and crosswise from sheets, and shall not be less than 6 in. long and 1 in. wide. When cold they shall be bent 180° flat upon themselves without showing any signs of fracture on convex side of bent portion.

Additional Tests—Plates while cold must admit of hammering or scarfing to a fine edge without fracture. Test pieces must stand quenching, forging and other tests to prove fully their temper, soundness, and fitness for use in manufacture of pipe.

Perfect Plates—Plates shall be free from laminations, cinders and any other surface defects. They shall be fully up to required thickness at edges, and any plates which shall be found to be more than 5% short of the required thickness at any point shall be rejected. Not over 5% of plates shall be short of full required thickness at any point. Plates must be rolled flat and sheared as accurately as possible (in no case shall any plates be short of specified dimensions), and must in all respects be in good merchantable condition.

Specimens and Rejections—General qualifications shall be determined from one set of tests from each heat or melt; but any plate which shows defect during the process of punching, bending or riveting shall be rejected notwithstanding previous satisfactory tests of test pieces. Failure of test pieces to conform to specifications shall cause rejection of entire heat or melt from which samples were obtained.

Before proceeding with manufacture of pipe, contractor will prepare and submit to purchaser for his approval shop drawings showing proposed layout.

Punching—Rivet holes shall be punched with sharp clean punches and dies so as to cut holes clean and leave no burr on underside of plates.

SPECIFICATIONS FOR COATING—Material used for coating pipe shall be a specially prepared mineral rubber asphalt mixture.

Pipe section shall be heated in suitable oven to a temperature of not less than hereinafter specified for the bath. Pipe section shall then be dipped vertically in the bath of mineral rubber coating maintained at a temperature of 350° Fahr. or more and of sufficient depth to allow pipe to be entirely submerged, and it shall receive a coating of not less than $\frac{1}{32}$ in. in thickness. Coating must be free from blisters and bubbles; it must strongly adhere to pipe under all circumstances, and must not become soft enough to flow at a temperature of 150° Fahr., nor brittle enough to crack or scale off in freezing temperature. After pipe sections have been removed from bath, they shall be set in a vertical position while cooling.

LOADING—After coating has become sufficiently hard, pipe shall be loaded on suitable cars provided with wood saddles, cut to proper radius for pipe to rest on. All saddles or bolsters, as well as all side stakes on cars which come in contact with pipe, shall be protected with pads of burlap or other suitable material of sufficient thickness to prevent rubbing or chafing of coating. Entire load to be blocked and wired on cars in best possible manner, to prevent, as far as possible, shifting in transit, and injury to coating.

BURLAP WRAPPING—After pipe has been dipped in mineral rubber coating and coating has sufficiently set to prevent flow in subsequent operations, it may, at the purchaser's option, be wrapped with 10-oz. Calcutta burlap or equal, which shall be cut into strips 18 in. wide and applied in accordance with the particular specifications of the EAST JERSEY PIPE COMPANY.

A Few Notable Pipe Lines Made by the East Jersey Pipe Company.

Year	Location	Kind	Size, In.	Length, Ft.
1891	Newark, N. J.	Riveted.	48 and 36.	142,900
1896	Newark, N. J.	Riveted.	48 and 42.	126,000
1897	Paterson, N. J.	Riveted.	42.	40,000
1899	Seattle, Wash.	Riveted.	42.	32,000
1899	Newark, N. J.	Riveted.	51.	47,500
1902	Jersey City, N. J.	Riveted.	52.	93,000
1903	Newark, N. J.	Riveted.	60.	39,300
1903	Troy, N. Y.	Riveted.	33.	35,300
1903	Schenectady, N. Y.	Riveted.	36.	24,000
1904	Astoria, Long Island.	Riveted.	60.	15,000
1905	Lynchburg, Va.	Lock-bar.	30.	15,000
1905	Wilmington, Del.	Lock-bar.	48 and 43.	20,000
1906	Brooklyn, N. Y.	Riveted.	72.	42,300
1906	Honolulu, T. H.	Lock-bar.	30.	8,000
1906	Philadelphia, Pa.	Lock-bar.	48 and 36.	55,300
1907	Gary, Ind.	Lock-bar.	36.	4,000
1907	Trenton, N. J.	Lock-bar.	48.	7,000
1907	Montreal, P. Q.	Lock-bar.	36.	11,000
1907	Lockport, N. Y.	Lock-bar.	30.	68,500
1907	Vancouver, B. C.	Lock-bar.	22.	5,000
1908	Michigan City, Ind.	Lock-bar.	30.	4,000
1908	Philadelphia, Pa.	Riveted.	132.	3,180
1908	Montreal, P. Q.	Lock-bar.	36.	25,000
1908	Springfield, Mass.	Lock-bar.	54 and 42.	63,500
1909	Brooklyn, N. Y.	Lock-bar.	72.	83,000
1909	Portland, Ore.	Lock-bar.	48 to 24.	9,600
1910	Brooklyn, N. Y.	Lock-bar.	48.	16,200
1910	Seattle, Wash.	Lock-bar.	32.	4,050
1910	Seattle, Wash.	Lock-bar.	42 to 24.	12,300
1910	Portland, Ore.	Lock-bar.	52 and 44.	128,000
1910	Catskill Aqueduct.	Riveted.	135, 117 and 114.	33,000
1911	Catskill Aqueduct.	Lock-bar and Riv.	66.	17,020
1911	Seattle, Wash.	Lock-bar.	42, 40, 36 and 24.	16,945
1911	Montreal, P. Q.	Lock-bar.	48, 36 and 30.	7,300
1911	Denver, Col.	Lock-bar.	60.	1,200
1911	Marquette, Mich.	Lock-bar.	66.	8,000
1912	Union Bay, B. C.	Lock-bar.	50.	1,320
1912	Rochester, N. Y.	Lock-bar.	66.	9,254
1912	Ottawa, Ont.	Lock-bar.	42.	2,400
1912	Omaha, Neb.	Lock-bar.	48.	10,550
1912	Akron, Ohio.	Lock-bar.	36.	55,870
1912	Winnipeg, Man.	Lock-bar.	36.	42,500
1913	Minneapolis, Minn.	Lock-bar.	54 and 50.	39,725
1913	Montclair, N. J.	Lock-bar.	24.	8,000
1913	Utica, N. Y.	Lock-bar.	36.	1,000
1913	Wilkes-Barre, Pa.	Lock-bar.	36.	1,350
1913	Schenectady, N. Y.	Lock-bar.	24.	2,420
1914	Schenectady, N. Y.	Lock-bar.	36.	10,500
1914	Essex Junction, Vt.	Lock-bar and Riv.	108 and 36.	2,440
1914	Rutland, Vt.	Lock-bar and Riv.	54.	2,750
1914	Winnipeg, Man.	Lock-bar.	36.	24,000
1914	Brooklyn, N. Y.	Lock-bar.	66.	12,200
1914	Rochester, N. Y.	Lock-bar.	66 and 48.	1,120
1915	Ottawa, Ont.	Lock-bar.	51.	15,000
1916	Minneapolis, Minn.	Lock-bar and Riv.	42 to 48.	7,350
1916	Rochester, N. Y.	Lock-bar.	37.	50,763
1916	St Louis, Mo.	Lock-bar.	36.	26,700
1916	Gary, Ind.	Lock-bar.	36.	1,865
1917	Eastman Kodak Co.	Lock-bar.	42.	7,910
1917	Rochester N. Y.	Lock-bar.	37.	42,140
1917	Carnegie Nat. Gas Co.	Lock-bar.	54, 40, 36 and 30.	48,537
1918	Carnegie Nat. Gas Co.	Lock-bar.	40.	12,000
1918	Jersey City.	Riveted.	72.	3,200
1919	Akron, Ohio.	Lock-bar.	48.	12,000
1919	Jersey City, N. J.	Lock-bar.	72.	88,000
1920	Elyria, Ohio.	Lock-bar.	36.	24,500
1920	Paterson, N. J.	Lock-bar.	30.	12,300
1920	Akron, Ohio.	Lock-bar.	48.	21,250
1920	Bayonne, N. J.	Lock-bar.	48.	44,000

AMERICAN SPIRAL PIPE WORKS

Manufacturers of Lap-welded Steel Pipe, Spiral Riveted Pipe, Steel Pipe Flanges and Hydraulic Supplies

GENERAL OFFICE AND WORKS

CHICAGO, ILL.

EASTERN OFFICE: 50 Church Street, NEW YORK

Products.

LAP-WELDED STEEL PIPE; TAYLOR'S SPIRAL RIVETED PRESSURE PIPE, Galvanized or Asphalted; FORGED STEEL FLANGES; FLANGED FITTINGS; SPECIAL PLATE STEEL FITTINGS; SEAMLESS BOILER NOZZLES; CORRUGATED FURNACES.

Also, Gate, Straightway and Foot Valves; Exhaust Heads; Hydraulic Mining Giants, etc.

Scope of Use.

The products of this company are extensively used for the following purposes:

SPIRAL RIVETED PIPE—For high pressure hydro-electric lines; exhaust steam and condenser piping for various plants; water supply lines, water works systems, pumping mains, distribution work; producer-gas lines, etc.

LAP-WELDED PIPE—For hydro-electric power plants; water supply and intake mains; gas work; shore pipe; dredging pipe; dredging spuds; welded pontoons; large diameter welded drums; tanks; cylinders and shells.

FORGED STEEL FLANGES—For high pressure steam mains, superheated steam, and hydraulic work. Boiler and tank flanges bent to required circle.

Taylor's Spiral Riveted Pipe.

In manufacturing this pipe, a strip of sheet steel is wound into helical shape with one edge overlapping the other for riveting the seam; metal to metal contact at the spiral seam; steel stretched on outer lap slightly offset to insure smoothness on the inside; and riveting is done cold by compression or squeezing under enormous pressure (not by percussion or hammering), thus completely filling rivet holes with slight counter-sink. Hydraulic tests (for bursting pressure) have frequently shown the seam to be strongest part of the pipe.

Pipe comes from machines in a continuous piece and is cut to any desired length. Maximum lengths, galvanized, 20 ft.; asphalted, 40 ft.



FIG. 1. SPIRAL RIVETED PRESSURE PIPE

Forged Steel Flanges.

Being strictly forged steel permits them to be attached securely and rigidly to the pipe by use of power riveters, making an absolutely tight joint, and eliminating the possibility of a leak (Fig. 2).

They are forged from the best grade of steel and can not be cracked or broken in transit or installation. Furnished in either spiral pipe or the A. S. M. E. standard.

Forged Steel Bolted Joints.

For hydraulic purposes. Unbreakable in handling, transportation, or use. Joints allow slight deflection without leakage and take care of all expansion and contraction of pipe. Suitable for highest pressure. By using shorter lengths of pipe, long radius bends are possible (Fig. 3).



FIG. 2. FORGED STEEL FLANGES FOR RIVETED PIPE



FIG. 3. FORGED STEEL BOLTED JOINT

Estimates, or Prices Quoted.

Send us a field or shop sketch, showing layout of line or list of material required, and we will quote special net price and furnish the material cut to exact length with all necessary fittings and specials so immediate installation may be made upon the arrival of the material. Forged steel flanges used throughout. We carry a large stock on hand at all times and are in position to make prompt shipment on all orders. Every length subjected to a hydraulic test of 50% in excess of specified working pressure.



FIG. 4. ASPHALTED PRESSURE PIPE DISCHARGING SAND AND GRAVEL 1¼ MILES FROM SUPPLY
Raising the level of the ground. Using 6,600 ft. of 12-in. No. 12 pipe

Flexible Ball Joints.

Used extensively on submerged pipe lines and on intake mains where pipe follows contour of surface. Deflection of 20° may be had in any direction. Note packing ring which may be tightened, or entire joint re-packed, without affecting clamping ring that prevents joint from pulling apart. Forged steel follower ring, for holding packing and clamping ring (Fig. 5).

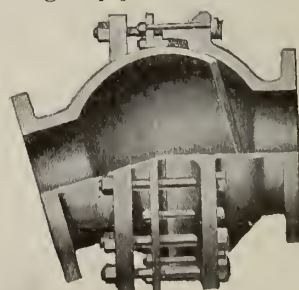


FIG. 5. FLEXIBLE BALL JOINT

Pipe Connections and Fittings.

Several styles of connections (flange, welded flange, field riveted, bell and spigot, bolted socket, bolted joint, etc.) are all of forged steel. Particulars of pipe connections and fittings sent on request (Fig. 8).

Lap-welded Steel Pipe.

Made from best quality of open hearth flange steel, having a tensile strength of 55,000 to 65,000 lbs. per sq. in. Welding accomplished by gas fire, giving most reliable and uniform weld.

SIZES OF PIPE—Diameter, 12 to 72 ins.—see tables.

INSTALLATIONS—From complete piping for the largest hydro-electric plant to the shortest nipples required for special work.



FIG. 6. LAP-WELDED STEEL PIPE

12-in. to 72-in. diameters
For water mains, dredging work, etc. Used as high pressure hydro-electric and vacuum exhaust pipe, etc.

SPIRAL RIVETED PIPE			
Inside diameter, ins.	Thickness, standard gauge	Weight per foot, lbs.	Approx. bursting strength in lbs. per sq. in.
3	20	1.9	1500
4	18	3.0	1500
5	18	3.7	1200
6	16	5.3	1250
7	16	6.2	1070
8	16	7.1	935
9	16	8.0	835
10	16	8.8	750
11	16	9.7	680
12	16	10.6	625
13	16	11.4	575
14	14	15.9	670
15	14	17.0	625
16	14	18.1	585
18	14	19.9	520
20	14	22.1	470
22	12	33.7	595
24	12	36.5	540
26	12	39.5	505
28	10	42.1	606
30	10	56.8	560
32	10	61.6	525
34	10	65.4	490
36	10	69.1	470
40	10	76.7	420
42	10	80.5	399

LAP-WELDED PIPE				
Inside diameter, ins.	Minimum thickness, ins.	Bursting strength in lbs. per sq. in.	Maximum thickness, ins.	Bursting strength in lbs. per sq. in.
12	10 gauge	1.172	1 1/2	4.166
14	10 gauge	1.005	1 1/2	3.568
16	10 gauge	.879	1 1/2	4.686
18	10 gauge	1.041	1 1/2	4.164
20	10 gauge	.937	1 1/2	3.736
22	10 gauge	.852	1 1/2	4.555
24	10 gauge	.781	1 1/2	5.208
26	10 gauge	.721	1 1/2	4.809
28	10 gauge	.669	1 1/2	4.462
30	10 gauge	.833	1 1/2	4.160
32	10 gauge	.781	1 1/2	3.906
34	10 gauge	.735	1 1/2	3.678
36	10 gauge	.694	1 1/2	3.472
38	10 gauge	.658	1 1/2	3.288
40	10 gauge	.625	1 1/2	3.124
42	10 gauge	.595	1 1/2	2.976
44	10 gauge	.568	1 1/2	2.840
48	10 gauge	.520	1 1/2	2.604
50	10 gauge	.500	1 1/2	2.500
54	10 gauge	.463	1 1/2	2.315
60	10 gauge	.416	1 1/2	2.080
66	10 gauge	.379	1 1/2	1.892
72	10 gauge	.347	1 1/2	1.736

We manufacture all intermediate sizes and thicknesses in addition to the above list.

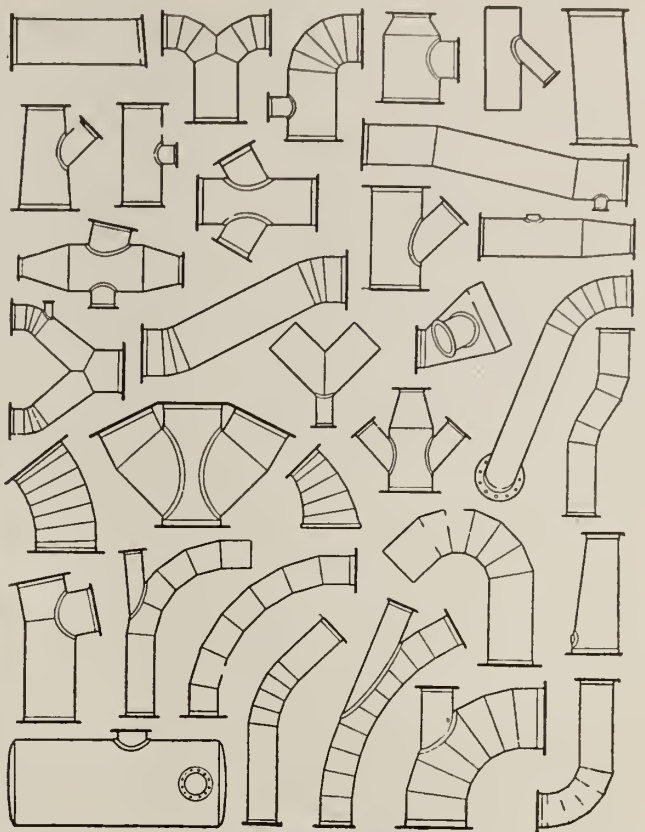


FIG. 8. SPECIAL STEEL PLATE FITTINGS

Corrugated Furnaces.

For internally fired boilers, land and marine types. Every furnace made of highest quality firebox steel in accordance with specifications of U. S. Board of Supervising Inspectors, or U. S. Navy Department or Lloyds. Send for particulars (Fig. 9).

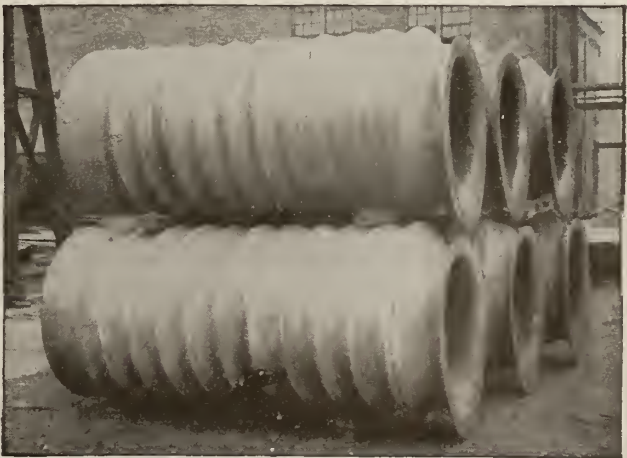


FIG. 9. CORRUGATED FURNACES

Taylor Seamless Forged Steel Boiler Nozzle.

Forged from a single piece of open hearth steel, without a weld. It can not be affected by any possible strain which may arise through the piping system. This seamless nozzle has been proved to be the most reliable and safest connection between boiler drum and a high pressure piping system, and it eliminates all castings, making the boiler wrought steel throughout. Power riveters can be used for attaching the nozzle (Fig. 7).

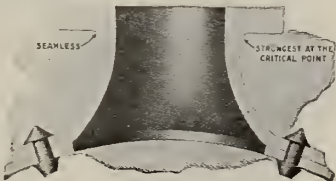


FIG. 7. SEAMLESS STEEL BOILER NOZZLE

STANDARD SPIRAL PIPE WORKS

TELEPHONE:
McKINLEY 3420

GENERAL OFFICE AND WORKS

2531 West 48th Street
CHICAGO, ILL.

NEW YORK, 2 Rector Street

PITTSBURGH, 1409 Arrott Building

DETROIT, Majestic Building

Products.

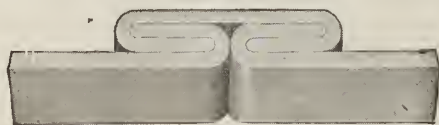
STANDARD REINFORCED SPIRAL PIPE, Asphalted and Galvanized; SHEET STEEL PIPE FITTINGS; STEEL FLANGES; RIVET SETS; GATE VALVES.

Hydraulic Supplies and Drop Forgings.

Standard Reinforced Spiral Pipe.

CONSTRUCTION—In the construction of Standard spiral pipe no rivets are employed, thus avoiding interruption to flow, or frictional resistance, by clogging, etc. The interlocking seam is a double lapped connection made in the following manner:

Two strips of steel are cut to required but different widths from long sheets of steel, and the ends are welded together; both strips are fed from large spools into a special machine at one end, rolled to shape and interlocked in such machine, coming out at the other end in shape of an endless pipe; strips are accompanied by a reinforcing band which gives 4 thicknesses of metal at spiral seam, running entire length of pipe. Ample folds on both strips and band prevent leaking, and give large bearing surface or contact at seam.



CONTINUOUS INTERLOCKING SEAM
Smooth inside

Interior of pipe is absolutely smooth—no rivet heads protruding therein to reduce diameter, collect particles and increase friction. Tensile strength and stiffness of steel permit lighter gages to be used, assuring installations more difficult and cheaper than are possible with riveted or any other pipe.

ADVANTAGES—Strength and stiffness are gained by the continuous interlocking seam, giving high collapsible and bursting resistance. Its lightness permits easy handling by common laborers. The elimination of rivets or projections on the inside gives a smooth interior waterway, thereby reducing the frictional resistance. The coating of the pipe and connections after assembling and before shipment insures a complete and thorough protection of metal against corrosion.

USES—For water supply lines, irrigation, dredging, sluicing, reclamation of swamps, brine circulation, paper and pulp mills, exhaust steam, compressed air, blow-pipe, pneumatic conveyors, suction and discharge, filtration piping, pumping and distributing mains, hydraulic mining, phosphate mining, ventilation, dust collecting system, vacuum cleaning system, smokestack, gas, oil and culverts.

USERS—The following are among many:

U. S. Reclamation Service; Halcomb Steel Co.; International Harvester Co.; Inland Steel Co.; Studebaker Co.; Ford Motor Co.; Chalmers Motor Co.; Armour & Co.; Morris & Co.; Butte Superior Copper Co.; Copley Cement Co.; Union Gas & Electric Co.; Anaconda Copper Co.; Eddy Paper Co.; City of Chicago; large gas companies and numerous railroads and other large corporations.

COATING—The life or lasting quality of steel pipe depends in great measure on the character of coating



STANDARD REINFORCED SPIRAL PIPE

material and its application. After removing from pipe all scale or signs of oxidation, spiral pipe is immersed in a bath of bitumite coating, which is kept at a high temperature. All connections, such as flanges, slip sleeves, etc., are invariably attached to pipe before coating. Bitumite coating is best for pipe buried underground or used for conveyance of water. The Western Union Telegraph Co., after exhaustive tests, has decided that the bitumite coating, which is put on by the STANDARD SPIRAL PIPE WORKS, has greater resistance to the action of alkali or other injurious elements, and actually protects steel. Large quantities of pipe have been coated for them. Bitumite coating resists action of acids, alkali and other corrosive or destructive elements found in air, water and soils.

CONNECTIONS—Joining lengths of Standard reinforced spiral pipe is similar to methods used by manufacturers of riveted pipe:

(1) Forged steel flange welded on to ends of pipes and furnished with bolts and gaskets complete, eliminating protrusion of rivet heads on inside of pipe. List price on next page.

(2) A slip sleeve joint—a seamless sleeve welded into one end of pipe; lugs welded on outside at both ends of pipe; one end of pipe slips into the other; pipes drawn together with wires over lugs, making a good joint for ordinary water pressures in flow lines.

(3) BB joint is simple, inexpensive, and very quickly and easily put together; consists of 2 half-round pieces of steel, welded to pipe at ends, and clamped by 2 pieces bolted together.

(4) Steel bolted joints, such as Dayton, Dresser, and others. List price on next page.

Steel Fittings.

Steel fittings of all descriptions including elbows, tees, crosses, laterals, return bends, and offsets, of varying dimensions, both center to face and radius, are now being supplied, made out of Standard reinforced spiral pipe, with flanges to match any fittings made. Can be supplied in much quicker time than special patterns could be made for the castings, and at a lower price.



STEEL FITTINGS

DATA, STANDARD SPIRAL PIPE

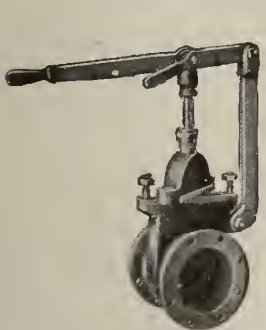
Inside diam., in.	Thickness gage	List per ft. plain end galvanized	List per ft. plain end asphalted	Est. wt. 100 ft. plain end	Approx. bursting pressure	Inside diam., in.	Thickness gage	List per ft. plain end galvanized	List per ft. plain end asphalted	Est. wt. 100 ft. plain end	Approx. bursting pressure
3	18	80.49	80.37	185	2000	22	10	87.30	85.20	4300	760
3	20	80.45	80.32	150	1500	22	12	6.00	4.25	3400	595
4	16	70.54	70.42	325	1875	22	14	4.55	3.30	2500	415
4	18	65.50	65.38	245	1500	22	16	4.00	2.95	2000	330
4	20	60.45	60.33	200	1125	24	10	7.95	5.65	4600	700
5	16	87.65	87.53	415	1500	24	12	6.50	4.50	3700	540
5	18	75.60	75.48	300	1200	24	14	4.95	3.55	2700	385
5	20	65.50	65.38	250	900	24	16	4.50	3.20	2100	277
6	14	1.20	1.18	85	675	26	10	8.00	6.10	5000	635
6	16	1.00	0.98	75	525	26	12	7.00	5.00	4000	500
6	18	0.85	0.83	65	425	26	14	6.06	4.30	3000	324
7	14	1.35	1.33	95	775	26	16	5.10	3.80	2600	255
7	16	1.15	1.13	85	625	28	10	9.00	6.40	5200	600
7	18	1.00	0.98	80	500	28	12	7.50	5.30	4300	465
8	14	1.60	1.58	115	875	28	14	6.40	4.9	3500	300
8	16	1.40	1.38	100	700	28	16	5.40	4.30	2600	237
8	18	1.20	1.18	85	575	30	10	9.85	7	5800	540
10	12	2.79	2.77	1500	1300	30	12	8.00	5.65	4700	410
10	14	2.10	2.08	1200	930	30	14	6.80	5.30	3800	280
10	16	1.70	1.68	800	650	30	16	5.75	4.75	2900	221
12	12	3.25	3.23	1900	1075	32	10	10.70	7.60	6300	510
12	14	2.50	2.48	1400	775	32	12	8.70	6.20	5000	405
12	16	2.05	2.03	1025	625	32	14	7.70	5.40	4200	262
14	12	4.00	3.98	2300	930	32	16	6.50	4.90	3100	208
14	14	3.00	2.98	1600	670	34	10	11.30	8.10	6500	475
14	16	2.45	2.43	1200	535	34	12	9.20	6.60	5400	375
16	10	5.50	3.95	3200	1050	34	14	7.75	6.00	4400	247
16	12	4.50	3.25	2600	810	34	16	6.75	5.40	3200	196
16	14	3.45	2.45	1800	580	36	10	11.95	8.50	6900	465
16	16	2.75	2.16	1375	460	36	12	9.75	6.95	5700	360
18	10	6.05	4.30	3500	930	36	14	8.40	6.50	4600	234
18	12	4.95	3.50	2800	730	36	16	7.00	5.90	3500	185
18	14	3.75	2.70	2000	510	40	10	13.30	9.45	7800	410
18	16	3.10	2.68	1550	415	40	12	10.75	7.70	6200	325
20	10	6.70	4.75	3900	830	40	14	9.00	7.00	5100	210
20	12	5.45	3.90	3100	655	40	16	7.80	6.20	4100	166
20	14	4.15	3.00	2300	465						
20	16	3.40	2.90	1675	375						



FLANGED WELDED STEEL AND CAST IRON FITTINGS
Used with spiral pipe and fitted with spiral pipe (R.P.M.) standard or American (A.S.M.E.) standard flanges

LIST PRICE, BLACK OR ASPHALT COATED

Size, in.	45° elbows	90° elbows	Tees	Special reduce tees	Laterals	Crosses	Size, in.	45° elbows	90° elbows	Tees	Special reduce tees	Laterals	Crosses
3	\$1.90	\$2.20	\$3.55	\$3.90	...	\$4.75	10	\$11.00	\$14.70	\$20.00	\$22.00	\$38.00	\$38.00
4	3.05	3.25	5.25	5.75	8.10	8.00	12	17.00	20.20	31.00	34.00	54.00	55.00
4	4.10	4.60	6.70	7.40	10.20	9.80	14	18.00	31.00	46.00	50.00	74.00	64.50
4	4.20	4.85	7.05	7.70	12.50	10.25	16	36.25	56.75	84.50	93.00	86.00	103.00
4	4.50	6.10	8.50	9.50	14.00	13.75	18	52.00	67.50	110.00	121.00	125.00	129.00
6	7.10	9.35	13.75	14.75	20.00	24.00	20	62.25	89.00	117.00	128.00	142.00	146.00



LEVER HANDLE SWING TOP GATE VALVE WITH R.P.M. FLANGES

Size, in.	Lever handle, each
3	\$25.80
4	33.50
5	35.50
6	38.00
8	55.50
10	76.00
12	103.00
14	140.00
16	190.00



LIGHT CAST IRON GATE VALVE WITH R.P.M. VALVES

Size, in.	Flanged, each
3	\$12.00
4	17.50
6	22.75
8	29.00
10	37.25
12	46.00
14	57.50
16	68.00
18	79.00
20	93.00
24	125.00

DIMENSIONS AND DRILLING OF STEEL FLANGES

In.	RPM ASME	O. D., in.	I. D., in.	Bolts	Size, in.	Bolt circle	In.	RPM ASME	O. D., in.	I. D., in.	Bolts	Size, in.	Bolt circle
3	RPM ASME	6 7/8	3 1/8	4	1/2 x 1 1/2	6 3/4	16	RPM ASME	21 1/4	16 1/4	12	1/2 x 2	19 1/4
4	RPM ASME	7	4 1/8	8	5/8 x 1 1/2	5 1/2	18	RPM ASME	23 1/4	18 1/4	16	5/8 x 2	21 1/4
5	RPM ASME	8	5 1/8	8	5/8 x 2	7 1/2	20	RPM ASME	25 1/4	20 1/4	16	5/8 x 2	23 1/4
6	RPM ASME	9	6 1/8	8	1/2 x 1 1/2	7 3/4	22	RPM ASME	28 1/4	22 3/4	16	5/8 x 2 1/4	26
7	RPM ASME	10	7 1/8	8	3/4 x 2	9	24	RPM ASME	30	24 3/4	16	5/8 x 2 1/4	27 3/4
8	RPM ASME	11	8 1/8	8	1/2 x 1 1/2	10 1/4	26	RPM ASME	32	26 3/4	24	3/4 x 2 1/4	29 1/4
10	RPM ASME	14	10 1/4	8	1/2 x 1 1/2	12 1/4	28	RPM ASME	34	28 3/4	28	3/4 x 2 1/4	31 3/4
12	RPM ASME	16	12 1/4	12	1/2 x 1 1/2	14 1/4	30	RPM ASME	36	30 3/4	28	3/4 x 2 1/4	33 3/4
14	RPM ASME	18	14 1/4	12	1/2 x 1 1/2	16 1/4							

RPM—Riveted and Spiral Pipe Manufacturers' standard. ASME—American Society of Mechanical Engineers or American standard.



STEEL FLANGE

DATA, STEEL FLANGES WELDED ON SPIRAL PIPE

For pipe diam., in.	O. D. of flange	Flange only, black	Flange only, galvanized	Black flange att. to pipe	Galvanized flange att. to pipe
3	6	\$0.80	\$1.05	\$1.70	\$1.95
4	7	.95	1.30	2.00	2.30
5	8	1.25	1.60	2.40	2.65
6	9	1.50	1.90	2.70	3.15
7	10	1.60	2.10	2.90	3.40
8	11	2.00	2.70	3.40	4.10
9	13	2.50	3.50	4.00	5.00
10	14	2.80	3.90	4.50	5.40
11	15	3.00	4.15	4.65	5.65
12	16	3.20	4.35	4.75	5.85
13	17	3.60	4.85	5.10	6.30
14	18	3.80	5.10	5.60	6.80
15	19	4.70	6.30	7.00	9.30
16	21 1/4	6.40	9.00	8.60	11.00
18	23 1/4	7.80	10.90	10.20	13.30
20	25 1/4	9.25	12.70	12.40	15.75
22	28 1/4	11.50	15.75	15.85	20.15
24	30	13.00	17.65	17.90	22.50
26	32	13.50	18.80	18.20	23.60
28	34	14.25	20.00	19.50	25.25
30	36	15.25	21.50	21.15	27.50
32	38	16.00	22.60	22.60	29.35
34	40	17.00	24.15	24.40	31.60
36	42	18.50	26.00	25.85	33.50
40	46	20.00	28.25	28.65	37.20

Rivet Sets.

Manufactured by a hammered and rolled process which produces a set much more uniform in quality than is obtained by the so-called drop forged process or as turned from the bar.

This hammering and rolling removes all undue strain in the steel, and is very much preferred by experienced riveters.

These rivet sets can be supplied finished and cupped ready for use, or unfinished.

Prices quoted on application. Immediate deliveries.



RIVET SET

LIST PRICES HAMMER ROLLED RIVET SETS

3/8 in. and 1/2 in.	Standard Button or Cone Head	\$1.35 each
5/8 in.	Standard Button or Cone Head	1.45 each
3/4 in.	Standard Button or Cone Head	1.50 each
1 in.	Standard Button or Cone Head	1.55 each
1 1/8 in.	Standard Button or Cone Head	1.60 each
1 1/4 in.	Standard Button or Cone Head	1.90 each
1 1/2 in. and 1 3/4 in.	Standard Button or Cone Head	2.10 each

THE M. W. KELLOGG COMPANY
Piping Engineers and Contractors
140 Cedar Street
NEW YORK, N. Y.

BOSTON PHILADELPHIA CHICAGO PITTSBURGH SAN FRANCISCO LOS ANGELES
MONTREAL, TORONTO, WINNIPEG, CAN., CANADIAN KELLOGG CO., LTD.

Products.

WELDED PIPE, FLANGES, TANKS and FITTINGS, KELLOGG IMPROVED VAN STONE JOINT, BENT PIPE and BAROMETRIC INJECTOR CONDENSER.

Also manufacturers of Expansion Joints, Cast Iron Pipe Fittings; Penstocks, Buoys, Seamless Welded Work of all description, Lap-welded Pipe, any diameter and thickness.

For Perforated Radial Brick Chimneys, see pages 636-37.

Services.

THE M. W. KELLOGG COMPANY are piping engineers, who make a specialty of pipe, fittings and flanges of all descriptions for the conveyance and control of high and low pressure steam, water, air, gas and oil. Our Engineering Department is ready to render any assistance in its power in designing the best piping system for any given purpose and location, which will then be made in our factory, and installed complete by our own erecting crews where desired.

Scope.

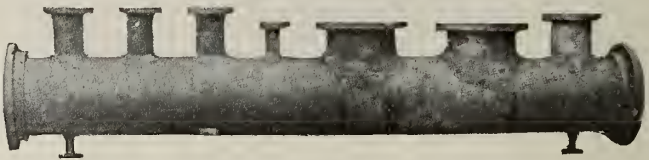
By our processes, lengths of pipe of any size can be welded together up to the limit set by shipping facilities. We make a specialty of forge welding flanges on wrought iron pipe and seamless steel tubing, any size, thickness or length. Also we can manufacture lap-welded steel pipe 12 ins. and above, of any diameter, thickness and length.

Demand for Welded Pipe.

To meet the increased pressures and temperatures at which gases and liquids for industrial purposes are conducted and controlled, engineers today demand a joint in which pipe and flange shall be one piece.

Kellogg System of Pipe Welding.

Both flanges and pipe are made of a special low carbon steel. The flanges are first shrunk on the pipe, which insures a tight fit between pipe and flange that prevents oxide forming between them. The weld is made in an oil or gas furnace so designed as to give a non-carbonizing or non-reducing heat under accurate control at the welding temperature. The silicate in the



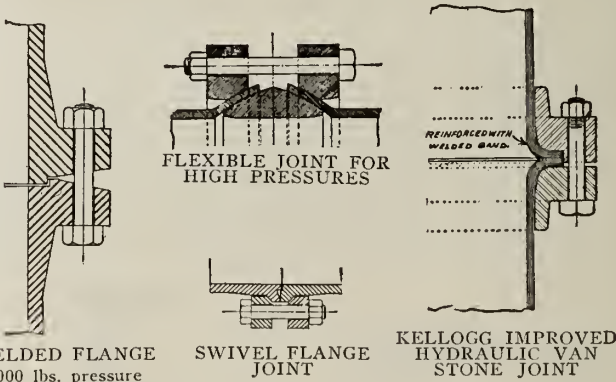
OUTLETS WELDED TO STEEL HEADER
Outlets ranging from 1½ to 12 ins. in diameter

highly heated fire brick furnace also has a tendency to act as a flux and thereby retard the formation of iron oxide until the weld has been completed under the hammer.

Exhaustive tests show a complete weld of the pipe and flange from face of flange to back of fillet. All flanges are machined and drilled, after welding, to insure perfect alignment with the axis of the pipe.

The faces of the flanges can be made with raised seats inside of bolt holes, ground joints, male and female, tongue and groove or bevel face.

This makes an especially good joint for step bearing lines on turbines, high pressure hydraulic lines (where the joint must not only stand high pressure, but also the great strain and shock of waterhammer), receiver pipes on locomotives, marine work, etc.



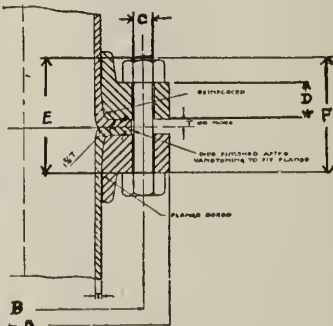
WELDED FLANGE SWIVEL FLANGE JOINT KELLOGG IMPROVED HYDRAULIC VAN STONE JOINT
2000 lbs. pressure



WELDED STEEL DISTRIBUTOR MANIFOLD
Large opening 72 ins. in diameter

DATA, KELLOGG STANDARD AND IMPROVED VAN STONE JOINTS

Size of pipe, ins.	A Outside diam., ins.	B Bolt circle diam., ins.	C Diam. bolt, ins.	D Thickness flange, ins.	Length bolts		No. bolts
					E Standard joint, ins.	F Improved joint, ins.	
4	10	7 7/8	1 1/4	1 1/4	3 3/4	4	8
4 1/2	10 1/2	8 1/8	1 1/8	1 1/8	4	4	8
5	11	9 1/4	1 1/8	1 1/8	4	4 1/4	8
6	12 1/2	10 5/8	1 1/8	1 1/8	4 1/4	4 1/2	12
7	14	11 3/8	1 1/2	1 1/2	4 1/2	4 3/4	12
8	15	13	1 5/8	1 5/8	4 3/4	5	12
9	16 1/4	14	1 7/8	1 7/8	5 1/4	5 1/2	12
10	17 1/2	15 1/4	2	2	5 1/2	5 3/4	16
12	20 1/2	17 3/4	2 1/8	2 1/8	6 1/4	6	16
14	23	20 1/4	2 1/2	2 1/2	6 1/4	6 1/4	20
15	24 1/2	21 1/2	2 3/4	2 3/4	6 1/4	6 3/4	20
16	25 1/2	22 1/2	3	3	6 1/2	6 3/4	20



KELLOGG IMPROVED VAN STONE JOINT

Cost compares favorably with the well-known Van Stone joint.

Welded Nozzles.

The numerous joints in a steam header may be greatly reduced by the welding of outlets directly into the pipe. In superheated steam work the advantages are numerous.

The nozzle may be located at any place and at any angle in the steam main with no increase of run joints.

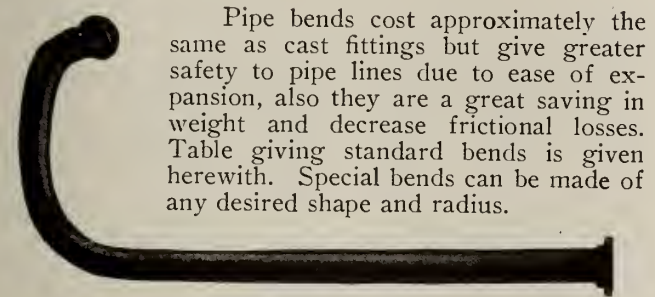
One-half to three-quarters of the run joints can be done away with, and the liability of a blown gasket or a leaky joint done away with to the same extent.

In this way practically all fittings are dispensed with. By cutting V-shaped pieces from the pipe before bending it and then welding the seam by the electric process we can make bends of a very small radius to take the place of a fitting.

Great saving in the cost of erecting and installing pipe lines.

Much less weight has to be borne by walls or trusses, and the cost of flange and fitting coverings is saved.

Pipe Bends.



KELLOGG PIPE BEND

Pipe bends cost approximately the same as cast fittings but give greater safety to pipe lines due to ease of expansion, also they are a great saving in weight and decrease frictional losses. Table giving standard bends is given herewith. Special bends can be made of any desired shape and radius.

Welded Steel Tanks.

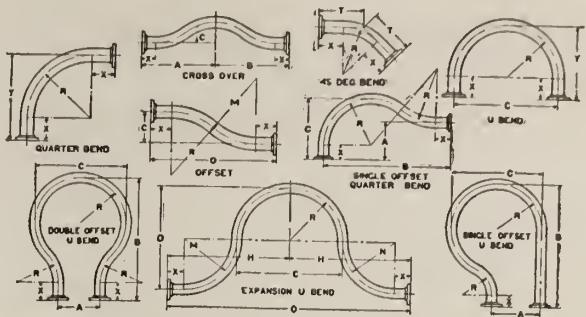
We manufacture welded steel tanks for all purposes of any size or description limited to size and shape only by transportation facilities. Joints in welded tanks are not subjected to corrosion nor liable to leak as in riveted joints. Drip pockets, outlets, intakes, gauge bosses, lugs, etc., are all welded to shell. A few of the uses best adapted to this type of tanks are as follows: Storage tanks for oil, water, gasoline, etc., air pressure receivers, blow-off tanks, caissons, brine tanks, cylinders for hydraulic work, steel buoys, etc. Information regarding capacity and dimensions of welded steel separators will be sent on application.



WELDED SEPARATOR

Guarantee of Joints.

Our guarantee for the joint covers anything that the pipe itself will stand. All our welded work is tested to twice the working pressure.



PIPE BENDS MADE FROM WELDED STEEL PIPE

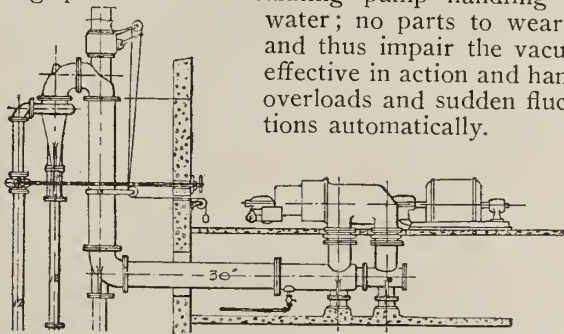
Size of pipe ins.	R-M-N ins.	T Center to end or face of flanges		Straight pipe ins.	Y		Lin. ft. of pipe in quarter bend		Lin. ft. of pipe in U-bend		Lin. ft. of pipe in 45° bend		Minimum radius of bends, extra strong pipe, ins.
		ft.	ins.		ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	
2½	12½	0	9 ¾	4	1	4½	2	3¾	3	11½	1	57 ½	7
3	15	0	10 ¾	4	1	7	2	7¾	4	7½	1	77 ½	8
3½	17½	1	1 ¼	5	1	10½	3	1½	5	5	1	11¾	10
4	20	1	1 ¼	5	2	1	3	5½	6	1	2	13¾	12
4½	22½	1	3 ¾	6	2	4½	3	11½	6	10¾	2	5¾	14
5	25	1	4 ¾	6	2	7	4	3¼	7	6¾	2	7¾	15
6	30	1	7 ½	7	3	1	5	1½	9	1¼	3	1½	20
7	35	1	10½	8	3	7	5	11	10	6	3	7¾	24
8	40	2	1 ¼	9	4	1	6	9	11	11¾	4	1½	28
9	45	2	5 ¾	11	4	8	7	8¾	13	7¾	4	9¾	35
10	50	2	8 ¾	12	5	2	8	6½	15	11½	5	3¼	40
12	60	3	2 ¾	14	6	2	10	14	18	14	6	3¼	50
14	70	3	9	16	7	2	11	10	21	...	7	3	65
15	75	3	11 ¾	16	7	7	12	6	...	...	7	7	70
16	80	4	3 ¼	18	8	2	13	5¾	...	...	8	2¾	78
18	108	5	2 ¾	18	10	6	17	1¼	...	...	10	7¾	88
20	120	5	7 ¾	18	11	6	18	8½	...	...	10	10¼	104
22	132	6	6 ¾	18	12	6	20	3	...	...	11	7¾	132
24	144	6	5 ¾	18	13	6	21	10	...	...	12	7¾	144

Full dimensions, sketch or blue print should accompany all requests for prices on pipe bends.
Drawings submitted should include dimensions A, B, C, D, H, and O where necessary, and any other variations from dimensions as given in the above table.

Bulkley Barometric Injector Condenser.

As the name indicates, this condenser removes non-condensable vapors by the injector action of the condensing water falling through a contracted throat of special design and dimension. This type of jet condenser can be placed inside or outside of building above the floor level, and can be used to great advantage with engines, high, low and mixed pressure turbines, vacuum pans, evaporators, stills, etc.

ADVANTAGES—Simplicity of operation, as the only moving part is the circulating pump handling cold water; no parts to wear out and thus impair the vacuum; effective in action and handles overloads and sudden fluctuations automatically.



ARRANGEMENT OF BULKLEY INJECTOR CONDENSER

COST OF OPERATION—The consumption of power of the prime mover required to operate this type of jet condenser is 1½% or less, maintaining a vacuum 28 ins., referred to a 30-in. barometer, with injector water at 70° Fahr., and where the source of supply is approximately at the same level as the overflow from the hot well.

NATIONAL VALVE & MANUFACTURING COMPANY

Manufacturers, Contractors, Power Pipe Materials

CABLE ADDRESS: "Navco"
Western Union Code

GENERAL OFFICE AND WORKS

PITTSBURGH, PA.

CLEVELAND

CHICAGO

BRANCH OFFICES
INDIANAPOLIS

ATLANTA

NEW YORK

Products and Services.

IRON and STEEL GATE VALVES, FITTINGS and FLANGES; PIPE BENDS; WELDED HEADER LINES and FABRICATED PIPE WORK.

INSTALLATION of all classes of PIPING SYSTEMS.

Personal attention and supervision of all work; supplying of special charts showing engineering data on saturated and superheated steam; curves giving sizes for steam headers and boiler connections for 200 h. p. to 10,000 h. p., gage pressures 125 lbs. to 300 lbs., velocities 3,000 ft. to 12,000 ft. per minute.

Welded Headers.

Illustration (Fig. 2) shows a 24-in. header with welded nozzles of extra heavy pipe, instead of flanged tees. Companion flanges are attached by means of National square lap joints. In this header 13 joints are eliminated.

Types of Header Connections.

The most approved methods of connecting boilers to header and of attaching flanges to pipe are illustrated

in Fig. 1. The National square lap joint is recommended; it gives the best gasket surface, a loose or swivel flange and minimum chances for leaks.

Many power plants have leaks in the various pipe connections equivalent to an opening $\frac{3}{16}$ in. in diameter, that, at 175 lbs. pressure, causes a loss of \$578.00 per year, which is about 6% on an investment of \$10,000.00. (See table accompanying.)

APPROXIMATE LOSS FROM STEAM PIPE LEAKS EQUIVALENT TO GIVEN CIRCULAR OPENINGS UNDER AVERAGE CONDITIONS

Basis: Cost of 1 h.p. per year of 300 days and 24 hrs. per day is \$38.40.

GAGE PRESSURE OF STEAM IN POUNDS

Diam. of opening, ins.	125 lbs.	150 lbs.	175 lbs.	200 lbs.	250 lbs.
$\frac{1}{8}$	\$ 47.00	\$ 55.30	\$ 63.60	\$ 72.60	\$ 89.30
$\frac{1}{16}$	186.00	221.00	255.00	286.00	356.00
$\frac{3}{16}$	423.00	500.00	578.00	648.00	800.00
$\frac{1}{4}$	756.00	880.00	1,020.00	1,140.00	1,420.00
$\frac{5}{16}$	1,175.00	1,395.00	1,600.00	1,755.00	2,220.00
$\frac{3}{8}$	1,550.00	1,980.00	2,280.00	2,580.00	3,190.00
$\frac{7}{16}$	2,300.00	2,725.00	3,150.00	3,520.00	4,360.00
$\frac{1}{2}$	3,000.00	3,530.00	4,080.00	5,020.00	5,660.00
$\frac{5}{8}$	4,680.00	5,520.00	6,360.00	7,200.00	8,950.00
$\frac{3}{4}$	6,770.00	7,970.00	9,250.00	10,330.00	12,840.00
1	12,050.00	14,200.00	16,320.00	17,300.00	22,800.00

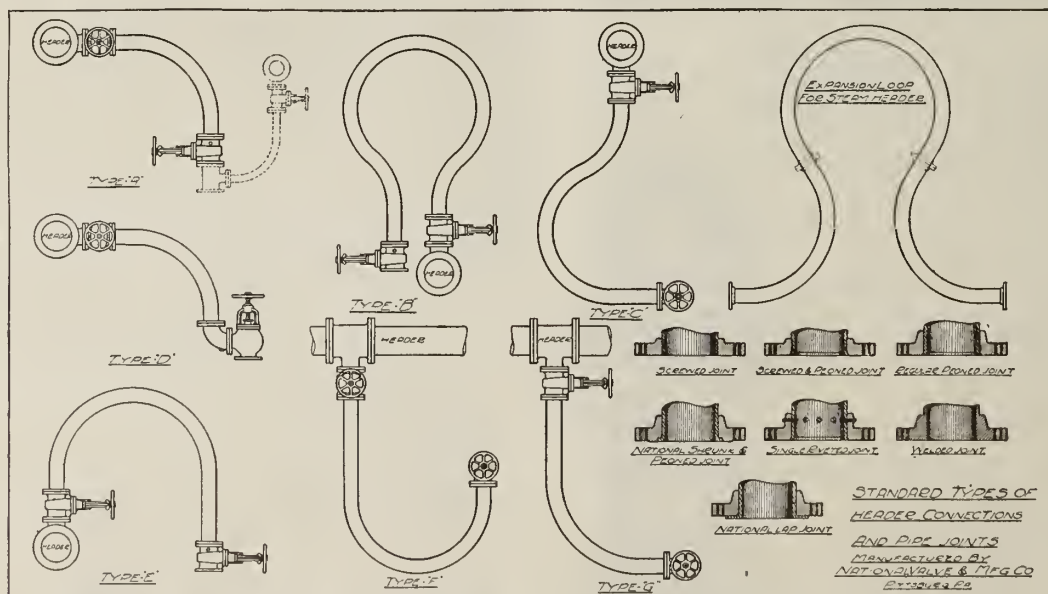


FIG. 1. STANDARD TYPES OF HEADER CONNECTIONS AND PIPE JOINTS

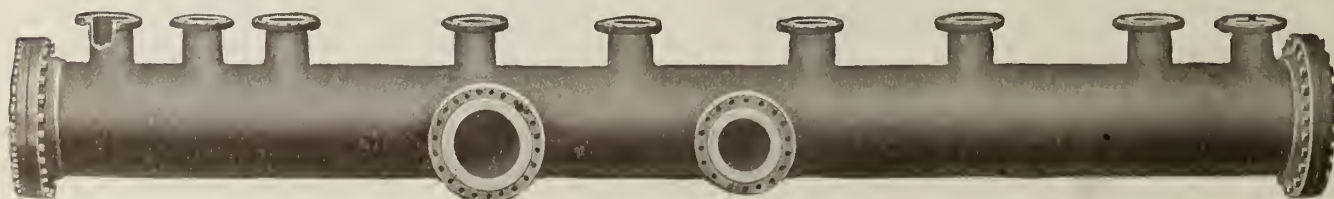


FIG. 2. 24-INCH HEADER, NINE 8-INCH NOZZLES, ONE 10-INCH NOZZLE AND ONE 12-INCH NOZZLE

PITTSBURGH PIPING AND EQUIPMENT CO.

35th, Charlotte and Smallman Streets
PITTSBURGH, PA.

BRANCH OFFICES

CLEVELAND, OHIO, American Trust Building

CHICAGO, ILL., People's Gas Building

NEW YORK, N. Y., St. Paul Building

BIRMINGHAM, ALA., American Trust Building

SAN FRANCISCO, CAL., Monadnock Building

CANADIAN REPRESENTATIVES

TORONTO, ONT., L. P. BURNS, LTD., Bank of Hamilton Building

Products and Services.

PIPING and FITTINGS, including Valves; Flanged Fittings and Flanges; Special Cast Iron and Cast Steel Flanged Fittings; Pipe Bends and Fabricated Piping; Van Stone and Sargol-Weld Pipe Joints, Slip and Copper Expansion Joints; Welded Headers; Steam Separators; Piping Systems; complete, ready for installation or delivered and erected.

Complete PIPING EQUIPMENTS are furnished and installed in power plants of all kinds, such as electric light plants, street railway powerhouses, blast furnaces, steel works and industrial plants of any and every description. The pipe is fabricated in the company's shops and erected with its skilled labor. Complete piping installations are furnished ready for erection, if the owners prefer to install same. Any make of valve, separator, trap or any steam or water specialty, that may be desired, can be supplied.

Piping Equipment.

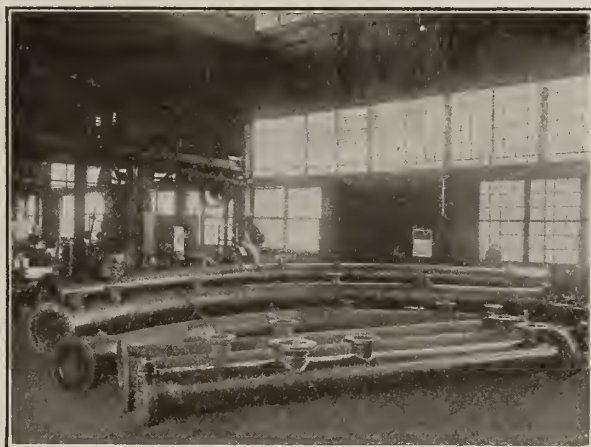
The installation of piping equipment is made a specialty. The officers of the company give personal attention to the supervision of contract work. Experts are in charge of every contract, which insures correct installations and satisfactory service.



48-INCH LONG RADIUS CAST IRON ELBOW

Construction.

The material manufactured and fabricated is prepared in the company's shops by skilled labor with special machinery and appliances. It is designed for the service required, so that whether it is to be used for hydraulic pressures, superheated steam or exhaust steam, it is made of proper material and sufficient strength to make it absolutely safe.



18-INCH PIPES AND PIPE BENDS WITH WELDED OUTLETS

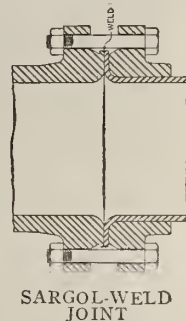
Pipe Bends.

Modern practice demands that pipe bends should be used when possible. They prevent leakage by allowing for expansion and contraction, reduce friction and loss of pressure. The cost is no more than that of the fittings displaced by their use.

Sargol-Weld Joint.

For high pressure superheated steam lines the Sargol-Weld joint, eliminating the use of gaskets, is the last word.

Write for particulars.



SARGOL-WELD JOINT

Contracts for Piping Installation.

This company is prepared to contract for piping installations at any place in the United States and Canada and for any service, including the highest pressure of superheated steam and hydraulic working pressures up to 5000 lbs.

ROESSING-ERNST COMPANY

Manufacturers of Pipe Coils and Pipe Bends

OFFICE AND WORKS
PITTSBURGH, PA.

Products.

PIPE COILS; PIPE BENDS.



Wide Scope of Use.

ROESSING-ERNST COMPANY manufactures pipe coils and pipe bends of every description for every purpose, from extra strong or double extra strong pipe—black or galvanized; also from brass, copper, aluminum and seamless drawn tubing. The illustrations show a few of the coils and bends most commonly used; but the coiling and bending of pipe and tubing is a distinct specialty. Orders are made in precise accordance with specifications, whether the order is small for a simple coil in common use or whether large for special coils of intricate design.

Coils made by this company in every conceivable shape, from 1/4-in. to 6-in. pipe, are rendering dependable service in practically every industry carried on in the United States where pipe coils are essential.

Manufacturing Facilities.

The company has complete facilities for making bends and coils from any pipe capable of being so treated, either hot or cold, of steel, wrought iron, seamless drawn tubing, brass, copper, aluminum or any other similar material.

This company is also equipped to make conduit bends of any size, utilizing special machinery for bending and reaming and cutting conduit threads.

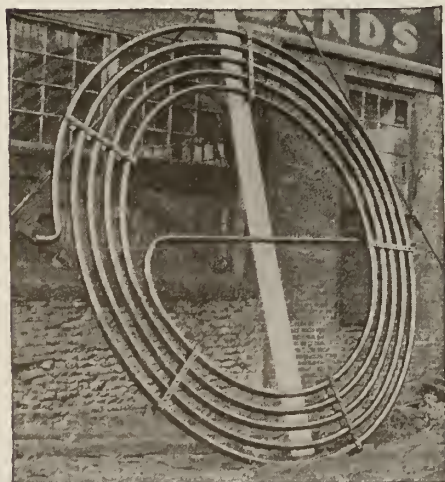
The location of the shops in the heart of the Pittsburgh district—the largest pipe producing center in the country—is an especial advantage, because it insures an adequate supply of pipe.

ROESSING-ERNST COMPANY's method of bending entirely eliminates scale from the inside of the pipe and the sections remain true to the original area. Coils requiring pipe longer than mill lengths are made of one continuous length, with the joints welded electrically so as to leave no projections either inside or outside the weld. All kinds of flanges can be attached to bends by any of the approved methods either before or after bending.

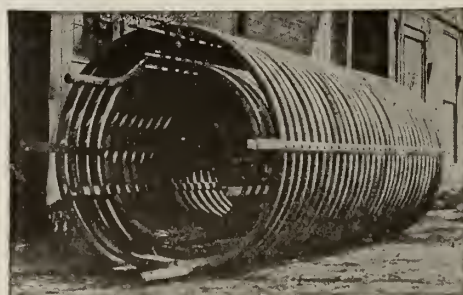
All coils and bends are carefully checked for absolutely correct angle and dimensions, avoiding the necessity of forcing pipe into place. Before leaving the shops all work is thoroughly tested to 350 lbs. air pressure submerged in water. If desired, tests are made with any specified hydraulic or line steam pressure.

Special Hydraulic Pipe.

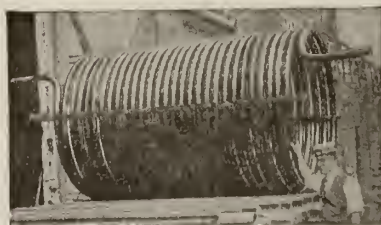
For special service on lines requiring the finest possible grade of materials and workmanship, ROESSING-ERNST COMPANY are prepared to furnish, to specifications, a special hydraulic pipe bored from solid forgings, including threading, making of bends and attaching special flanges for test or working pressures to 10,000 lbs. per sq. in.



2-in. Flat Spiral Coil 14 Ft. 6 In. Outside Diameter for Tank



2-in. Double Cylindrical Coils for Ammonia Condensers



2-in. Cylindrical Condenser Coils



2-in. Special Cooling Coils, for Hearth Jacket Plates

A FEW TYPES OF ROESSING-ERNST PIPE COILS AND THEIR ADAPTABILITY

ESTABLISHED 1842

WALWORTH MANUFACTURING COMPANY

Manufacturers of Fittings and Tools for Steam, Water, Gas and Air;
Specialists in Power Plant Piping

BOSTON, MASS.

For Branch and Sales Offices, see page 494

WESTERN DIVISION
OFFICES, CHICAGO, ILL.
WORKS, KEWANEE, ILL.

Products.

POWER PLANT PIPING COMPLETE, PIPE BENDS and FITTINGS, WALMANCO FLANGES, "GENUINE WALWORTH STILLSON" WRENCHES, "KEWANEE" UNIONS.

Oldest continuous manufacturers in the United States (since 1842) of a complete line of Valves, Fittings and Tools for Steam, Water, Gas and Air.

Originators of the famous "Genuine Walworth Stillson" Wrench and the "Kewanee" Union.

For Valves, see page 494.

Power Plant Piping.

This company will furnish complete piping equipments for power plants of every description for the highest pressures and superheats.

The company's exceptional facilities and extensive experience enables it to produce the very best in power piping.

Those having power piping problems to solve are invited to submit them to the Walworth engineers for a satisfactory solution.

WALMANCO JOINTS—Were the first joints of this type to be put on the market. Many years of actual service under the most severe conditions have shown them to be the best joints for any requirement. Their main advantages are: the pipe is not weakened by threading; the gasket bears on the face of the lap to prevent leaks; the flange swivels on the pipe, has maximum strength and is not subject to torsional strains in attaching.

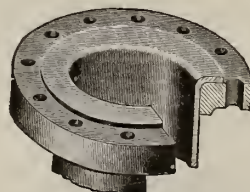
WROUGHT STEEL HEADERS WITH WELDED-IN NOZZLES AND CAST STEEL HEADERS—For modern requirements of high pressures and temperatures. Steel headers are particularly useful where strength and lightness are desired. Made up with Walmanco flanges.

PIPE BENDS—Bends of all shapes, radii and sizes in steel and wrought iron, made with standard and extra heavy fittings for all purposes.

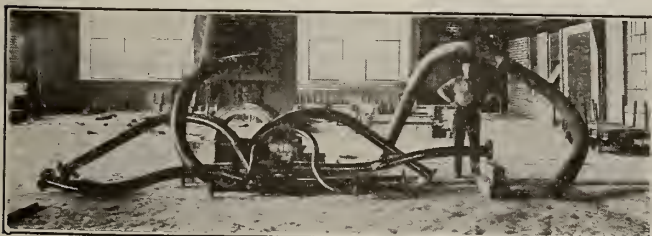
Table of standard bends sent on request.



STEEL HEADER WITH WELDED-IN NOZZLES



WALMANCO JOINTS



ONE ORDER OF WALWORTH PIPE BENDS

"Kewanee" Unions.

"Kewanee" unions have three parts and five reasons in their favor:

Brass to iron thread connection—no corrosion.

Brass to iron ball joint seat—no gasket required.

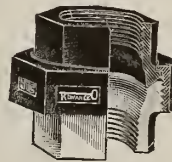
Extreme compressed air test under water—no defective fittings.

Solid three-piece construction—no inserted parts.

Easily disconnected—no force required.

Note savings effected through use of these unions: one nipple saved; fewer joints made, thereby reducing possibility of leaks; fewer connections made and labor bills reduced; gaskets eliminated and their cost saved.

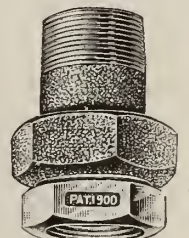
The "Kewanee" principle just described is also applied to various products of this company as follows: "Kewanee" flange unions; ells; tees; boiler couplings; service cocks; air pump, air drill, hydraulic and hose unions; circulating boiler fittings; globe, angle, gate and swing check valves.



Octagon Pattern



Hexagon Pattern



Male and Female Pattern

"KEWANEE" UNIONS

Made in black and galvanized iron

Size, in.	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4
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"Genuine Walworth Stillson" Wrenches.

This company is the originator of the "Genuine Walworth Stillson" wrench, which is famous all over the world and is so well known that a detailed description is not deemed necessary.

They are built for extremely hard usage due to the superior quality of material used, the simple design and careful inspection and testing during manufacture.

Made in sizes tabulated below.

Identified by the Diamond trade-mark.



6 to 14 in. Size, Wood Handle



6 to 10 in. Size, Steel Handle



14 to 24 in. Size, Steel Handle



36 and 48 in. Size, Steel Handle

"GENUINE WALWORTH STILLSON" WRENCHES

DATA, "GENUINE WALWORTH STILLSON" WRENCHES

Length open, in.	6	8	10	14	18	24	36	48
Takes pipe, in.	1/8 to 1/2	1/8 to 1/4	1/8 to 1	1/4 to 1 1/2	1/4 to 2	1/4 to 2 1/2	1/4 to 3 1/2	1 to 5

THE NATIONAL ASBESTOS MFG. CO.

Underground and Exposed Pipe and Stack Insulation

FACTORY AND GENERAL OFFICES

163-193 Henderson Street

JERSEY CITY, N. J.

Products.

PYRO-BESTOS SECTIONAL UNDERGROUND and OVER-HEAD EXPOSED STEAM and HOT WATER PIPE COVERINGS.

Pyro-Bestos Boards and Blocks, either flat or curved, for lining smokestacks, flues, breechings, for either hot blast or hot air, dry kilns, drying ovens, ceilings, etc.; National Brand Asbestos Air Cell Pipe and Boiler Coverings (sectional, blocks, board and plastic); High Temperature Cement.

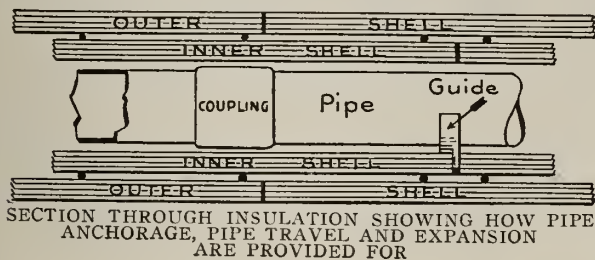
What Pyro-Bestos Is.

Pyro-Bestos is a most economical and efficient sectional waterproofed insulation for either steam or hot water lines in underground trenches, conduits or tunnels, and is the only underground insulation that is permanently and absolutely waterproof in itself. By reason of its great hardness, it will withstand a crushing strain of over 250 lbs. to the inch, and is strong enough to withstand any earth pressure it may be subjected to. In fact it does everything any tile or other conduit can do at very much less cost.

No wooden, brick or concrete trenches, tile or other conduits, or other so-called waterproof protection is necessary. Just lay in trench, fill in with earth—consider the saving.

Underground Pipe Insulation ("National" System).

The "National" system of underground pipe insulation furnishes a permanent, efficient and economical protection, at the same time providing for unhampered pipe travel due to expansion and contraction.

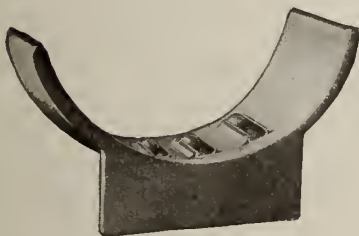


Pyro-Bestos Specifications and Prices.

Write for complete specifications and description. Prices will be quoted on application. State the quantity and sizes needed, as well as the steam pressure.

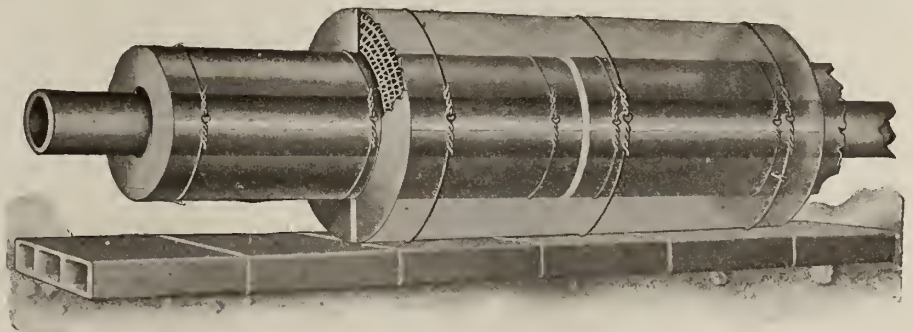
The service of this company's underground department is at the disposal of interested persons without obligation.

Specifications for special work made up on request.



PIPE GUIDE EQUIPPED WITH BALL BEARINGS

Used for 5-in. pipe and up



"NATIONAL" SYSTEM OF UNDERGROUND PIPE INSULATION
Showing broken joint method with both ends and all longitudinal seams permanently sealed. Pipe guides in position. Wire fastenings every 12 in.

THE RIC-WIL COMPANY

Manufacturers of Heat Insulating Products

CLEVELAND, OHIO

Products.

RIC-WIL UNDERGROUND CONDUIT and RIC-WIL UNDERGROUND PIPE COVERING used in the "RIC-WIL METHOD" of Insulating Underground Steam and Hot Water Pipes.

RIC-WIL
METHOD
TRADE-MARK

The Ric-wil Method.

The RIC-WIL METHOD of insulating underground steam and hot water pipes to prevent heat losses, presenting practical advantages in the utility and ease of construction, appeals to every engineer and large steam user. After the trench is dug and the levels determined, it is usual to begin the RIC-WIL METHOD with a concrete foundation on which the base drain is to be laid. The concrete foundation is of such a character that the levels are easily maintained.

BASE DRAIN—The base drain is both a base for supporting and aligning the conduit, and a drain for carrying away the water which might otherwise accumulate around it. It has, in all cases, ample free drainage area and is made the same length as the conduit, but the joints of base drain and conduit alternate, thus making an interlocking construction which preserves conduit alignment. The joints of the base drain are not sealed, but are left open, and crushed rock or coarse gravel is banked up along each side to act as a filter and keep dirt from entering the base drain and thereby prevent drainage by clogging it up. The base drain is connected at various intervals with a sewer or other free outlet. The base drain is the most important single factor in the success of RIC-WIL METHOD.

CONDUIT—The conduit is sectional, vitrified, salt glazed tile—the upper half being provided with a projecting lip to protect the longitudinal joint—in which is moulded before shipment a pipe covering of high efficiency, same prepared from a highly siliceous natural mineral. The conduit is readily split lengthwise on the job before installing same. RIC-WIL is the only sectional underground pipe covering manufactured where the waterproof casing and insulation are integral.

Generally, further insulation is provided with RIC-WIL filler when a steam pipe or a number of pipes conveying fluids at different temperatures are installed in the same conduit. This loose insulating material is packed around the pipe or pipes to entirely fill the hollow space between same and the insulation which is moulded to the inside of the tile. When properly installed, filler will not settle or shrink and is sufficiently elastic not to interfere with free expansion or contraction of the iron pipes. The insulation around the inside of the tile, together with the filler that is inserted, makes a continuous and efficient insulation.

PIPE SUPPORTS—Are usually placed 12½ ft. apart, entirely enclosed in the conduit, and are of a practical

and strong design, consisting of a malleable iron guide with pockets supporting steel spindles, on which rustproof rollers are free to turn. Guide has a large bearing surface and projecting pins which insure keeping the same in its proper relation to pipes and conduit.

CEMENT—Cement for sealing longitudinal joints of conduit is portland in all cases; the bell joints may be either portland or RIC-WIL Elastic and Waterproof.

INSTALLATION—RIC-WIL METHOD is complete; it is the easiest underground system to install and its durability and efficiency are established.



RIC-WIL COMPLETE

Sizes.

Conduits are made in sizes from 4 to 22 in. inside diameter; sizes up to and including 20 in. carried in stock, larger size made to order only. All sections of conduits are 2 ft. 6 in. long, except the 4-in. and 6-in. sizes which are 2 ft. long.

Base drain made in 3 sizes: small for conduits 4 and 6 in. in diameter; medium for conduits 8 to 14 in. in diameter, inclusive; large for conduits 16 in. and up.

Fittings.

RIC-WIL insulated fittings are carried in stock in all sizes up to and including 14 in. inside diameter of tile in the form of elbows 45° or 90°, reducers or increasers and tee branches. Larger sizes and other shapes made to order.

Shutters.

Specialty designed RIC-WIL shutters are used to close the ends of the conduit when entering buildings, manholes and anchor boxes.

Specification Data.

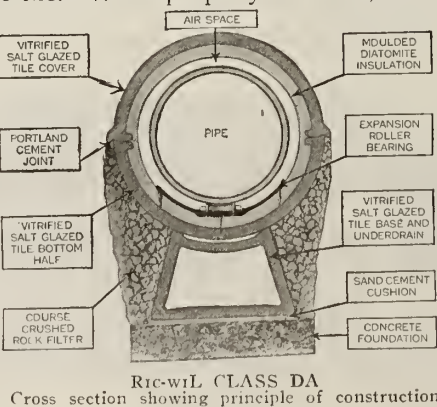
In preparing subdivision of heating specifications which embraces conduit and insulation, it is recommended that the engineer communicate with this company in regard to:

Sizes of conduit and standard equipment therefor, which will allow installation of certain size pipe combinations required for work contemplated. State conditions under which pipe system is to be operated, whether steam, hot water or oil transmission; and if the former, state pressure and if any superheat is to be carried, and, if so, how much. It would be well to state clearly kind of service for which each pipe is intended and if position of any pipe or pipes is definitely fixed in relation to any other pipes.

With the foregoing information to hand valuable suggestions based on a wide range of observation, contact and experience will be given. Representative will be sent, if desired.

Catalogue.

Complete catalogue which explains the RIC-WIL METHOD will be sent on request.



RIC-WIL CLASS DA
Cross section showing principle of construction

TYLER UNDERGROUND HEATING SYSTEM

PITTSBURGH, PA.

Products and Services.

Manufacturers and designers of UNDERGROUND HEATING SYSTEMS, including Casing, Piping, Ball Bearing Pipe Supports (for ditch or tunnel floor); Wall Brackets (to hold one, two, three, or four pipes) for tunnel or powerhouse work; Expansion Joints, and Anchors for tunnel or ditch construction.

WATER WEIGHING MACHINES for powerhouse work; CONDENSATION METERS that work on either gravity or vacuum systems; HOT WATER METERS for measuring quantity water and also temperature water; STEAM TRAPS; WATERPROOF MANHOLE COVERS, and INDIRECT HEATERS.

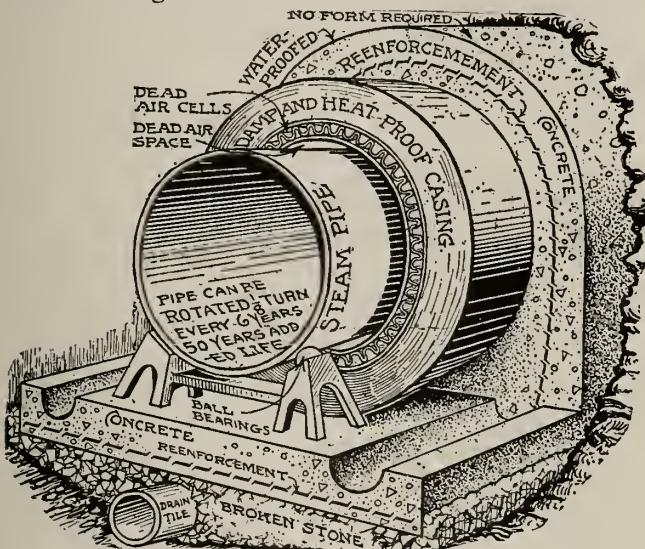
Engineering Service at disposal of clients.

Tyler Underground Heating System.

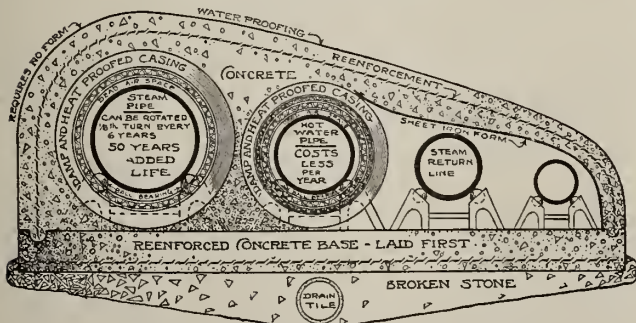
In designing the Tyler underground heating system the makers went farther than the consideration of first cost, making it secondary to permanency, durability and efficiency. Insulation, expansion and proper anchorage have been provided for as well as numerous other features which will prove extremely interesting to any one considering the installation of a system of this kind.

The advantages are as follows:

PROPER INSULATION—Tyler ditch construction is so thoroughly insulated that heat loss is almost negligible; in fact, if the pipe is buried but 18 in. it will not melt snow on the ground surface.



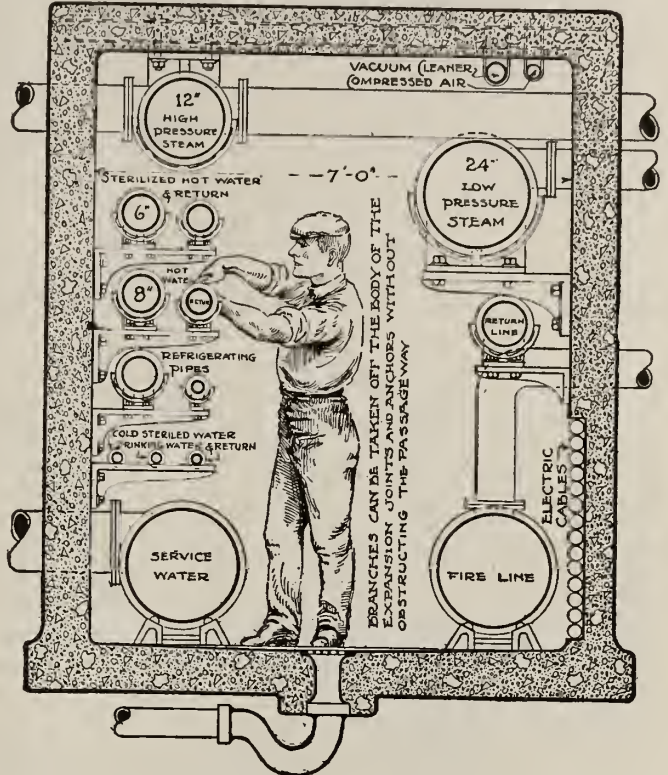
SINGLE PIPE DITCH CONSTRUCTION
(Patented Oct. 10, 1911)



COMBINATION MULTIPLE PIPE CONDUIT
(Patented Oct. 10, 1911)

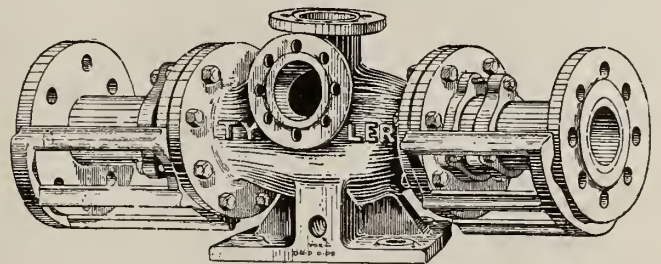
The concrete can not crack and no forms are required in placing it

PIPE EXPANSION—The construction of Tyler expansion joints allows the pipe to expand and travel freely and without leakage of steam.



TUNNEL CONSTRUCTION

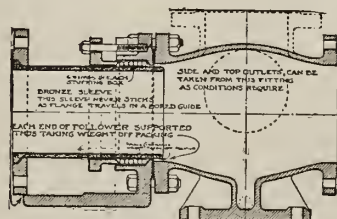
This construction allows ample room for man to walk and inspect or repair pipe



DOUBLE EXPANSION JOINT

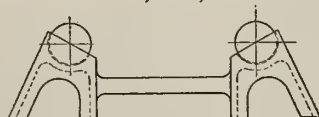
(Patented Oct. 10, 1911, and Oct. 17, 1911)

Joint is made to fasten to ceiling or base and is made either single or double

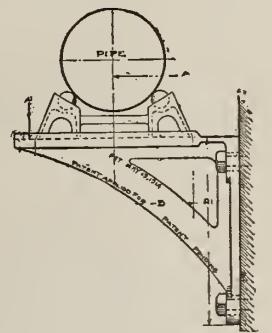


SINGLE EXPANSION JOINT

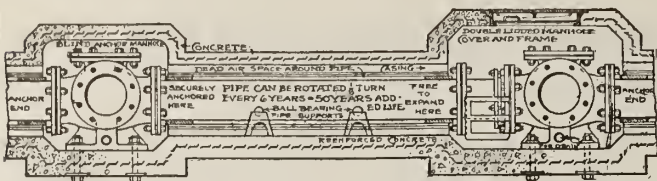
(Patented Oct. 10, 1911, and Oct. 17, 1911)



BALL BEARING PIPE SUPPORT
(Patented Oct. 10, 1911)



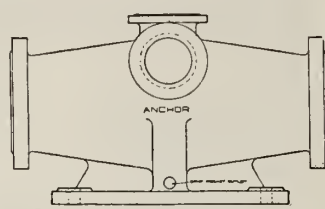
WALL BRACKET WITH BALL BEARING PIPE SUPPORT



LONGITUDINAL SECTION TYLER UNDERGROUND HEATING SYSTEM

ANCHORS—Anchors are designed so that full size outlets may be taken out of top or sides. Drip pocket outlet is provided.

PIPE MAY BE ROTATED—After the pipe is connected, it may be rotated so as to distribute the corroding effects of the condensation water. This feature adds from 30 to 40 years to the life of the pipe.



TYLER ANCHOR

BRIEF SPECIFICATIONS—A clear ditch shall be prepared, a drain tile laid in bottom and covered with broken stone.

On this as a bed, a reinforced concrete base shall be laid, and pipe rests placed on same, 12 ft. apart. The pipe shall be put in position, connected up, and anchored approximately every 150 ft., alternately with anchors and expansion joints.

Pipe shall then be cased in such a manner as to leave space between pipe and casing, and casing covered with cinder concrete.

Fittings shall be placed in properly reinforced manholes, the expansion joint being made accessible by a double lidded manhole—with gasket on inner lid. Where pipe enters expansion joint and anchor manholes, or enters walls of building, space between casing and pipe is closed by a special collar.

It shall be possible—after pipe is connected up—to easily rotate it every 5 or 6 years and thus distribute the corroding effects of the condensation water.

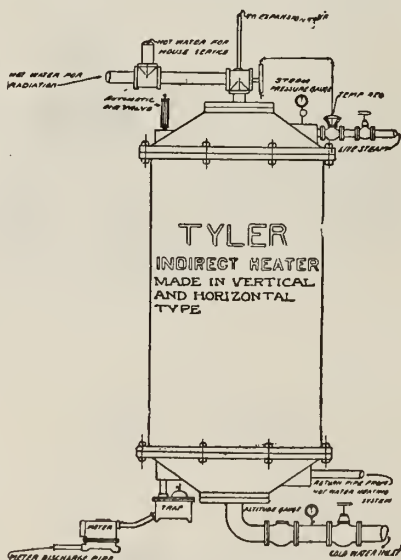
Casing shall be a hard casing—such as made by the TYLER UNDERGROUND HEATING SYSTEM of Pittsburgh, Pa.

In tunnels, or the interiors of buildings, pipe shall be covered by a special air-cell casing, coming in direct contact with the pipe. The pipe shall be supported by brackets specially constructed.

After underground conduit has been completed, exterior surface shall be waterproofed, when it will be ready for backfilling.

Tyler Indirect Heater.

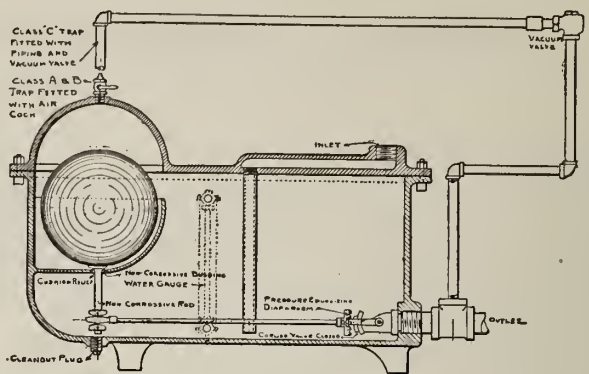
Used where it is desirable to connect hot water heating plants to available steam mains, without changing hot water system. Steam enters heater near hot water delivery, insuring high efficiency, and a maximum of hot water.



TYLER INDIRECT HEATER
Made in vertical and horizontal type

Tyler Steam Traps.

Simplicity and dependability are the chief characteristics of these traps. Made in three styles: Class "A" for street mains and other low pressures not to exceed 55 lbs.; class "B" for pressures from 60 to 185 lbs.; class "C" for vacuum systems or blast coils not to exceed 60 lbs. pressure.



TYLER STEAM TRAP

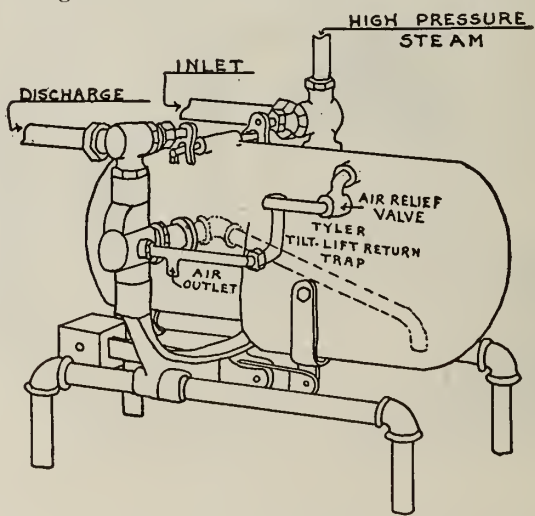
Valve will not wire-draw. Intermittent service. Guaranteed not to leak steam. Discharge opening has greater opening than inlet, thus making quick discharge. (Patented Oct. 21, 1913)

Size	Cap. lbs. per hour	Sq. ft. radiation	Lin. ft., 1-in. pipe	Pipe con., in.	Total height, in.	Total length, in.	Total width, in.	Class "A"		Class "B"		Class "C"	
								Weight, lbs.	Price	Weight, lbs.	Price	Weight, lbs.	Price
1	400	1350	4000	3/4	18	16	12	75	\$36.00	135	\$48.00	85	\$44.00
2	800	2700	8000	3/4	18	16	12	75	42.00	135	56.25	85	51.75
3	1200	4000	12000	1	18	20	12	95	47.00	165	63.75	105	56.50
4	1800	6000	18000	1	18	20	12	95	52.75	165	71.50	105	63.00
5	2500	8000	24000	1 1/4	18	23	12	175	59.00	260	79.50	185	70.00
6	3600	12000	36000	1 1/4	18	24	12	215	75.00	325	100.00	225	86.00

Tyler Tilt-Lift-Return Trap.

Will receive water of condensation and boiler feed water at any pressure and return it into a power or heating boiler at temperature of condensation when received. There are no interior parts.

In filling of trap, steam and outlet valve are closed and air relief valve open, giving condensation a non-resisting flow into drum. When filled the drum will tilt, close air relief valve, open steam and outlet valve and discharge contents, momentarily righting itself for the next charge.



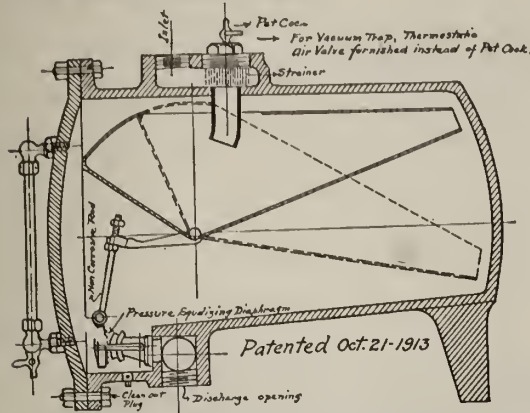
TYLER TILT-LIFT-RETURN TRAP
(Patent pending)

Valves of rotary type with full openings. Weight of drum is eliminated from trunnions packing by center connections with counterweight, making movement free and easy

Size no.	Dimensions, in.			Cap., lbs.	Sq. ft. radiation	List price
	Inlet	Outlet	Steam			
10	3/4	3/4	1 1/2	960	3200	\$160.00
11	1	1	3/4	1500	5000	195.00
12	1 1/4	1 1/4	1	2500	8300	240.00
13	1 1/2	1 1/2	1 1/4	4000	13300	320.00
14	2	2	1 1/2	7500	25000	430.00
15	2 1/2	2 1/2	2	12000	40000	553.00
16	3	3	2	22000	73500	705.00

For pressures up to 125 lbs. list price.
For pressures up to 250 lbs. list price plus 10%.

Tyler Bucket Steam Trap.



TYLER BUCKET STEAM TRAP

Designed for all pressures up to 300 lbs. Valves will not wire-draw. Intermittent service. Guaranteed not to leak steam. Discharge opening is greater than inlet, insuring quick discharge

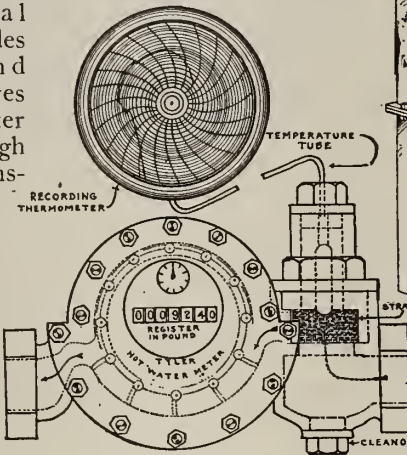
DATA, TYLER BUCKET STEAM TRAP

Size	Cap. per hour	Pipe Const. in.	Price			
			Class A	Class B	Class C	Class D
00	100	3/4	\$25.00	\$33.00	\$29.00	\$165.00
0	250	3/4	30.00	40.50	36.00	200.00
1	400	3/4	36.00	48.00	44.00	240.00
2	800	1	42.00	56.25	51.75	282.00
3	1200	1 1/4	47.00	63.75	56.50	319.00
4	1800	1 1/2	52.75	71.50	63.00	355.00
5	2500	1 3/4	59.00	79.50	70.00	398.00
6	3600	2	75.00	100.00	86.00	500.00
6A	5000	2 1/2	100.00	125.00	112.00	625.00
7	6000	2 3/4	125.00	150.00	137.00	750.00
8	11000	3	130.00	190.00	150.00	950.00
9	15500	3	160.00	235.00	190.00	1175.00

Class "A"—For street steam mains and other low pressures not to exceed 55 lbs.
Class "B"—For pressures from 60 to 185 lbs.
Class "C"—For vacuum systems or blast coils; not to exceed 60 lbs. pressure.
Class "D"—For heavy pressures up to 300 lbs.; 300° superheat cast steel body.

Tyler Hot Water Meter.

The principle of operation is that of non-corrosive metal disc with blades that open and close as it revolves with flow of water passing through meter and transmitted by gearing to register. All parts are made of non-corrosive and high grade steam metal bronze and are sensitive, accurate, durable and guaranteed within their capacity.



TYLER HOT WATER METER

(Patent pending)

May be use with or without temperature recorder placed close to the meter or 25 ft. away from it.
In ordering, state maximum and minimum boiler capacity and pressure.
Special prices without recording thermometer

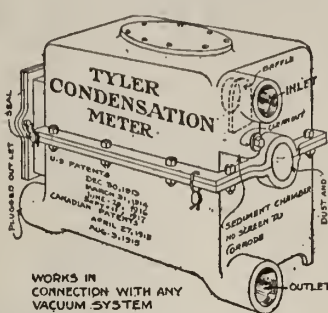
DATA, TYLER HOT WATER METER

Size pipe, in.	Cap. lbs. per hour	Price	Size pipe, in.	Cap. lbs. per hour	Price
1 1/2	3000	\$100.00	1 1/2	10000	\$250.00
1 3/4	3500	150.00	2	17000	300.00
2	5600	200.00	2 1/2	28000	350.00
2 1/2	7000	225.00	3	42000	400.00

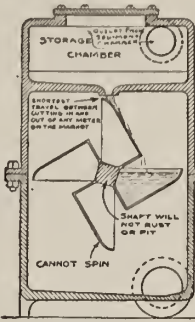
Tyler Condensation Meter.

For central station work. Works in connection with any vacuum system. This meter is so constructed

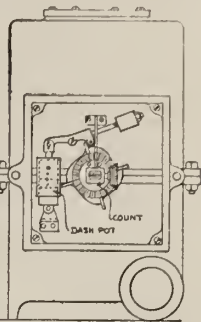
that every drop of water will be weighed. All mechanism is perfectly sealed, making it proof against water or dust.



Exterior Details



Sectional View through Center of Buckets



End View. Cover Removed Showing Count Mechanism and Trip Adjustment

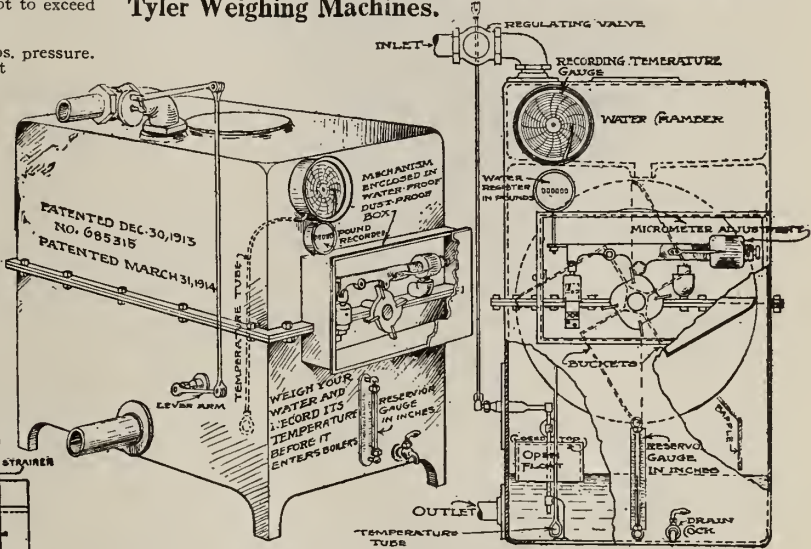
TYLER CONDENSATION METER

Weight on mechanism so adjusted that bucket begins to dump as soon as it has received proper weight of water, next bucket cutting in just before it starts to dump, weighing every drop of water. 60% less friction and 60% less parts than in any other meter. No pins in counter to break off

DATA, TYLER CONDENSATION METER

Size	Cap. lbs. per hour	Sq. ft. radiation	Inlet, in.	Outlet, in.	Total height, in.	Total length, in.	Total width, in.	Weight, lbs.	Price
1	400	1350	1 1/2	1 1/4	13 1/2	13 1/2	10 1/2	50	\$40.00
2	800	2700	1 1/2	1 1/4	13 1/2	12 1/2	10 1/2	60	60.00
3	1200	4000	3/4	1 1/4	13 1/2	18	10 1/2	80	100.00
4	1800	6000	3/4	1 1/4	13 1/2	18 1/2	10 1/2	90	130.00
5	2500	8000	1	1 1/2	13 1/2	28	10 1/2	115	180.00
6	3600	12000	1 1/4	1 1/2	13 1/2	28 1/2	10 1/2	135	220.00
7	6000	20000	1 1/2	2 1/2	24	30	17	200	380.00
8	11000	37000	2	3	31	32	21	330	695.00
9	15500	52000	2	3 1/2	31 1/2	32 1/2	21 1/2	390	775.00

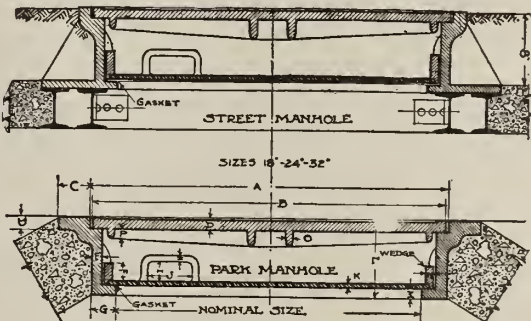
Tyler Weighing Machines.



TYLER WEIGHING MACHINE

Built with a weight on end of shaft, so adjusted that the bucket begins to empty as soon as it has received the proper weight of water, the next bucket cutting in just before it starts to dump, allowing every drop of water to be weighed and not a drop more

Tyler Waterproof Manhole Covers.



TYLER WATERPROOF MANHOLE COVER

A. WYCKOFF & SON CO.

Improved Steam Pipe Casing

ELMIRA, N. Y.

BRANCH OFFICE: ATLANTA, GA., H. H. WHITE, 385 Piedmont Avenue

Products.

Manufacturers of WYCKOFF'S IMPROVED STEAM PIPE CASING, for Underground or for Exposed Steam and Hot Water Pipe.

For Wyckoff's Wood Stave Pipe (machine-made), for water works systems, power plants, etc., see pages 400-401.

Wyckoff's Improved Steam Pipe Casing.

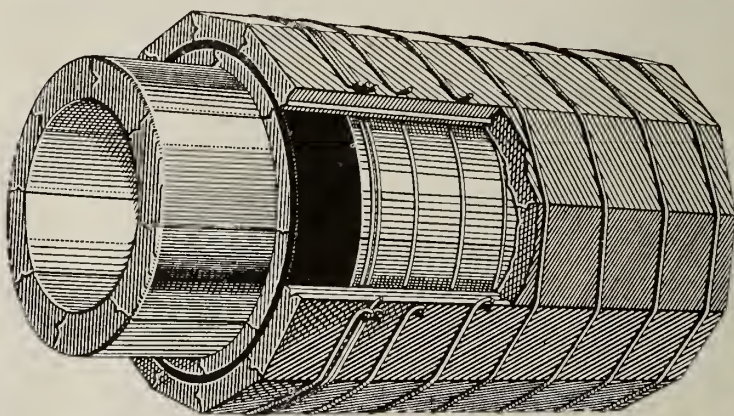
Casing is composed of selected and carefully inspected staves of cypress. The 2-in. staves for the inner shell are drawn together by heavy tension into the form of a tube, and firmly bound with galvanized steel wire, wound spirally with extra wrappings at each end. This is effected by bending over about 1 in. of the end of the wire, which is driven into the wood about 2 in. from the end of the casing. The spiral winding is then carried to the end of the casing back over itself and then to the other end of the casing, where it is again wrapped back over itself for about 2 in., and the final end of the wire securely fastened down by means of staples.

The next operation is placing 4 layers, 4 in. wide, of asphaltum packing on each end of the casing. This material is drawn around the casing as tightly as possible, and fastened. It is finished, by putting on the outside another casing of 1-in. cypress jointed staves, which is bound with heavy galvanized steel wire, the same as the inner shell, thus making 2 casings of cypress wood, the inner shell 2 in. thick and the outer shell 1 in. thick, with a $\frac{1}{4}$ -in. dead air space extending the entire length of the casing, between the shells, except the 4 in. on each end. This makes a combination of non-conductive materials which absolutely prevents the radiation of heat.

From our experience it has been found that asphaltum packing will absolutely prevent drain water from getting in between the two shells of cypress.

For underground use, the covering is completely coated on the outside with Montezuma asphalt and then rolled in sawdust, the sawdust acting as a binder, to prevent the coating from being scraped off in transit.

When used overhead, the coating is furnished painted on the outside with black asphaltum paint.



WYCKOFF'S IMPROVED STEAM PIPE CASING

Improvements: cypress used; doubling thickness of inner wood shell; increasing dead air space 50%. Used for high pressure steam lines. Coating omitted to show construction

The covering is made in lengths of from 4 to 12 ft. The lengths are connected by tenon and socket joint and have to be driven together, thus making a water-tight joint.

This improved covering is made to slip on over the pipes while they are being connected up. It can not be opened to apply on pipes already in place.

For opening casing to apply on pipes already in place, see our catalogue No. 40, pages 10 and 11.

For pipes conveying steam, where the pressure is more than 5 lbs., to intensify heat radiation, to keep a more uniformly high temperature in the line, and also more efficiently to protect the pipe, the covering is lined with AAAA charcoal tin.

Where the tin lined covering is used, no matter how high the steam pressure, the extra thickness of the inner cypress shell will positively prevent the danger of collapsing.

Prices.

Prices will be quoted for any size or quantity needed.

In naming size wanted, be sure and make allowance for slipping the covering over the couplings on the pipe to be covered, also state the approximate steam pressure to be carried.

ESTABLISHED 1841

E. B. BADGER & SONS CO.

Manufacturers of Expansion Joints for High and Low Pressure

63-75 Pitts Street
BOSTON, MASS.

SALES OFFICE: NEW YORK, N. Y., 101 Park Avenue

Products.

BADGER SINGLE and SELF-EQUALIZING CORRUGATED COPPER EXPANSION JOINTS.

For Water Cooling Systems and Air Washers, see page 798.

Badger Single Corrugation Expansion Joints.

Badger single corrugation expansion joints are made for connection between turbines and condensers and designed for any special requirements, particularly to take care of vibration and a very slight amount of expansion.

A great many joints of this type have been made in all sizes up to 84 in.

The company has facilities for manufacturing any joint of this type that may be required, whether its shape is round, oval or rectangular.



BADGER SINGLE CORRUGATION EXPANSION JOINT
FACE TO FACE DIMENSIONS IN INCHES

Size	Single corrugation	Size	Single corrugation
4	7	26	16
6	7	28	16
8	9	30	16
10	10	36	16
12	10	42	16
14	10	48	16
16	12	54	18
18	12	60	18
20	12	66	18
22	12	72	18
24	12	84	18

Badger Self-equalizing Expansion Joints.

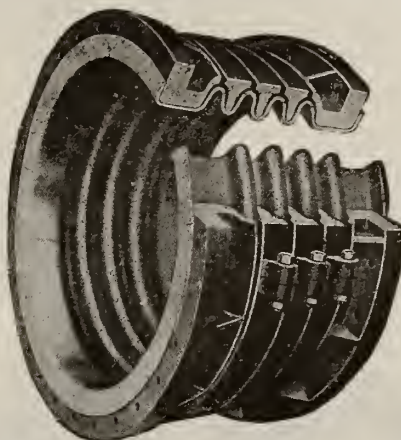
The Badger self-equalizing expansion joints are made of seamless copper tubes, of the best quality Lake copper, which is known to be the most ductile metal used in commercial engineering work. They are properly designed and rolled, with deep corrugations; and with the aid of the cast iron or steel equalizing rings, conforming to the shape of the corrugations, they take care of the changes in length in the pipe line, due to temperature changes, in a most efficient and economical manner: first, because they are a one-piece joint and never require packing, and, second, the corrugations are designed and rolled to stand repeated



changes of shape, and to care for a required amount of expansion on each corrugation.

The external equalizing rings equally distribute the expansion over each corrugation, thus eliminating the possibility of a fracture in the copper, due to the fact that one or two corrugations take care of the total amount of expansion. They also give the added strength to the copper to resist pressure.

Self-equalizing expansion joints are made with: 2 corrugations to care for 1-in. expansion; 3 corrugations to care for 1½-in. expansion; 4 corrugations to care for 2-in. expansion.



BADGER SELF-EQUALIZING EXPANSION JOINT
FACE TO FACE DIMENSIONS IN INCHES

Size	Two corrugations	Three corrugations	Four corrugations
6	12½	16	19
8	12½	16	19
10	12½	16	19
12	13	16½	20
14	13½	17	20
16	13½	17	20
18	14	17½	21
20	15	18½	21½
22	15	18½	21½
24	15½	19	22

Special Features of Badger Joints.

Badger expansion joints are:

SIMPLE—There are no complicated parts.

DURABLE—Made of best quality copper.

SAFE—Given a hydraulic test on every joint.

CONVENIENT—Installed as easily as any pipe fitting.

COMPACT—Greatest diameter usually less than flange.

EFFICIENT—They require no packing.

When Ordering Badger Joints.

State (1) size of pipe; (2) whether steam, water, gas or air line; (3) working pressure; (4) length and material of pipe; (5) face to face dimensions; (6) range of temperature; (7) how often heat is turned on or off; (8) whether subject to superheat; (9) outside diameter of flanges, diameter of bolt circle, number of bolts, diameter of bolt hole.

Catalogue.

Write for catalogue No. 13.

HOWARD IRON WORKS

Manufacturers of Expansion Joints
BUFFALO, N. Y.

Products.

HOWARD GUIDED EXPANSION JOINTS.

Description.

Howard guided expansion joints efficiently eliminate all troubles due to pipe line expansion and contraction. Types for low or high pressure, steam, hot water, gas, oil, chemicals or air; overhead or underground.

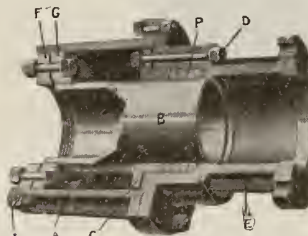
TYPE A—Designed with all mechanical weaknesses eliminated and with the following superior features:

Maximum of Traverse—Here the Howard with full 4-, 8-, 12- or 16-in. traverse very often by its greater capacity takes the place of two or more ordinary expansion joints.

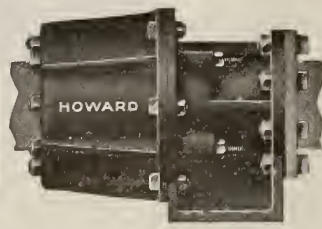
Elimination of Strains or Distortions—The Howard excels in preventing these, and all bursting troubles, the cylindrical sleeve being heavily reinforced and heavily bolted to body of joint. Outer connecting flanges are equally strong and insure firm hold on pipe. Steel stops prevent flanges pulling out of sleeve.

Perfect Alignment—The inner sleeve and flange peripheries are accurately machined, holding pipe and slip tube rigidly in line.

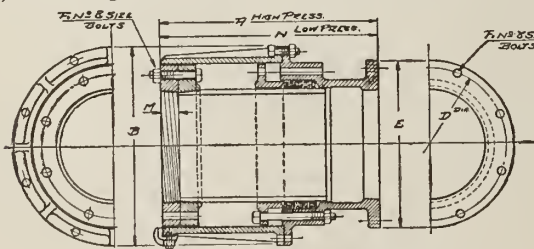
Tight Joints Without Attention—The rigidity and accurate machining of inner sleeve and flanges permit no strain on packing and slip tube of Howard bronze will not rust against it. Packing box large, and only a slight tightening of gland nuts, accessible on outside of joint, re-tightens packing. Packing easily reached by unbolting and slipping sleeve back.



TYPE A, EXPANSION JOINT
A—Reinforced sleeve; B—Bronze slip tube; C—Packing followers; D—Gland nuts; E—Body of joint; F-G—Companion flanges; I—Stops; P—Packing



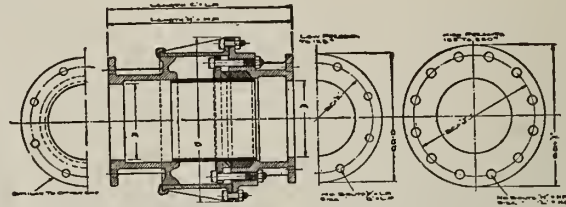
TYPE A, WITH ANCHOR BASE
Base cast as an integral part of body of joint.
Types B & C may also be had with same feature



TYPE "A" GUIDED EXPANSION JOINT

P.S.	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8	9	10	12
A	15 3/4	15 3/4	16 1/2	16 3/4	17 1/4	17 3/4	18 1/2	18 3/4	18 3/4	19 1/2	21 1/4	21 3/4	25 1/4	25 1/2	
B	3 3/4	4 1/2	5 1/2	5 3/4	6 1/2	6 3/4	7 1/2	7 3/4	8 1/2	9 1/2	10 1/2	11 1/2	12 1/2	13 1/2	14 1/2
C	5	6	6 1/2	7 1/4	8 1/4	9	10	10 1/2	11	12 1/2	14	15	16 1/4	17 1/2	20 1/2
D	4 1/2	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4
E	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4
F	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
G	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
H	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
I	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
J	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
K	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
L	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
M	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
N	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
O	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
P	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
Q	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
R	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
S	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
T	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
U	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
V	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
W	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
X	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
Y	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
Z	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19

NOTE—End to end dimensions of 8-, 12- and 16-in. traverses not given in tables but readily supplied on request. All table dimensions in inches.



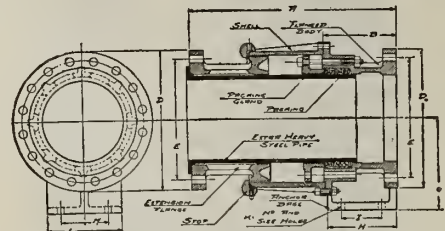
TYPE "B" GUIDED EXPANSION JOINT, EXTENSION FLANGE

A	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8	9	10	12
B	7 7/8	7 7/8	9 1/8	9 5/8	11 1/8	12	12	12 1/8	13 1/8	14 1/8	16 1/8	17 3/8	18 3/8	20 3/8	22 1/8
C	21 1/8	22 1/8	22 5/8	22 7/8	23 1/8	24 1/8	24 7/8	25 1/8	25 5/8	25 7/8	27 1/8	28 5/8	29	33 1/8	33 3/8
D	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
E	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4
F	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
G	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
H	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
I	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
J	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
K	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
L	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19

TYPE C—A most suitable joint for high pressure lines. Note extended slip tube and absence of screw parts. Adaptable for oil lines with steel slip tube and bronze bearings.

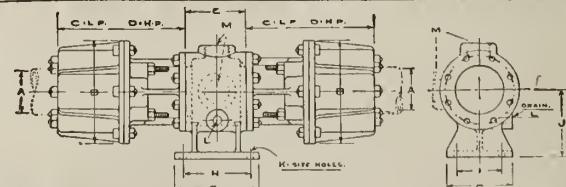


TYPE "C" (VAN STONE FLANGE)



TYPE "C" GUIDED EXPANSION JOINT

P. S.	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8	9	10	12
A	22 3/4	22 3/4	23	23 3/4	24 1/4	24 1/4	25 1/4	25 3/4	25 3/4	26 3/4	27 1/4	29 1/4	29 3/4	33 1/4	34 1/4
B	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2
C	5	6	6 1/2	7 1/4	8 1/4	9	10	10 1/2	11	12 1/2	14 1/2	15 1/2	16 1/2	17 1/2	20 1/2
D	3 3/4	4 1/2	5 1/2	5 3/4	6 1/2	6 3/4	7 1/2	7 3/4	8 1/2	9 1/2	10 1/2	11 1/2	12 1/2	13 1/2	14 1/2
E	22 3/4	22 3/4	23	23 3/4	24 1/4	24 1/4	25 1/4	25 3/4	25 3/4	26 3/4	27 1/4	29 1/4	29 3/4	33 1/4	34 1/4
F	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2
G	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
H	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4
I	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
J	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
K	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
L	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19
M	4 1/2	5	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	15	16	19



TYPE "E" HOWARD DOUBLE GUIDED EXPANSION JOINT WITH ANCHORAGE CHAMBER, DRAIN AND BRANCH OUTLETS

A	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12
B	7⅞	7⅞	9⅛	9⅝	11⅛	12	12	12⅞	13¼	14¼	16⅞	17⅜	18⅜	20⅜	22⅞
C	15⅓	15⅓	15⅝	16⅓	16⅝	17⅓	17⅓	17⅓	18⅓	18⅓	19⅓	20⅜	20⅜	24⅜	24⅜
D	5⅓	5⅓	5⅝	5⅝	5⅝	6⅝	6⅝	6⅝	8	8	11⅓	11⅓	11⅓	14⅜	14⅜
E	6	6	6	6	6	7	7	7	8	8	9	9	9	12	12
F	6	6	6	6	6	7	7	7	8	8	9	9	9	12	12
G	3⅞	3⅞	3⅞	3⅞	3⅞	4⅞	4⅞	4⅞	4⅞	4⅞	6	6	6	8	8
H	4	4	4	4	4	5	5	5	5	5	6	6	6	8	8
I	7⅞	7⅞	7⅞	7⅞	7⅞	9	9	9	9	9	11⅓	11⅓	11⅓	15⅜	15⅜
J	5⅞	5⅞	5⅞	5⅞	5⅞	⅔	⅔	⅔	⅔	⅔	⅔	⅔	⅔	⅔	⅔
K	1⅓	1⅓	1⅓	1⅓	1⅓	1⅓	1⅓	1⅓	1⅓	1⅓	1	1	1	1	1
L	1⅓	1⅓	1⅓	1⅓	1⅓	2	2	2	2	2	3⅓	4⅓	5	6	8
M	15⅓	15⅓	16⅓	16⅓	17⅓	17⅓	17⅓	18⅓	18⅓	18⅓	19⅓	21⅓	21⅓	25⅓	25⅓

ROSS HEATER & MFG. CO., INC.

1407 West Avenue
BUFFALO, N. Y.

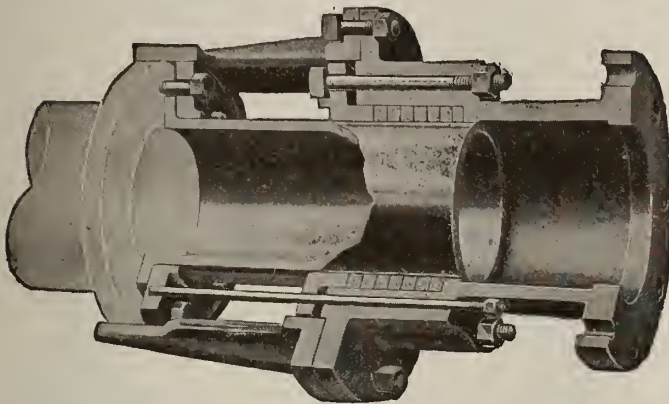
Products.

ROSS CROSSHEAD GUIDED EXPANSION JOINTS; OIL COOLERS; SURFACE CONDENSERS; EVACTOR JET VACUUM PUMPS; BOILER FEED WATER HEATERS; BRYANT RADIATOR MACHINES.

Also, Hot Water Service, Oil and Sugar Juice Heaters; Gravity and Forced Circulation Heaters for Heating Systems; Air and Water Coolers; Distilling Condensers; Main and Auxiliary Condensers for Marine Service; Evaporators for Marine Service.

Ross Crosshead Guided Expansion Joints.

The Ross Crosshead guided expansion joint was designed to fit the need of a high grade fitting to take care



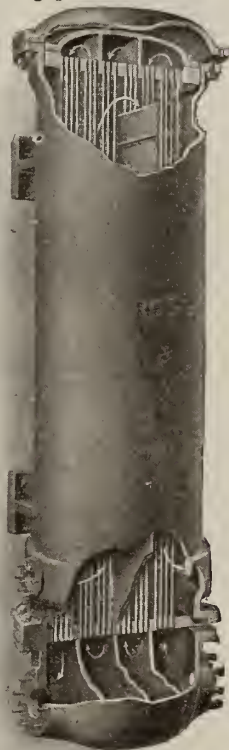
ROSS CROSSHEAD GUIDED EXPANSION JOINT

of the expansion and contraction in pipe lines due to temperature changes.

The crosshead guide principle used in the steam engine is improved upon to provide a much greater bearing surface and therefore eliminates friction, subject to the slightest variations in the length of pipe, it removes all serious strain on the pipe line and insures absence of warping, and distortion which is so well known to be the result in piping where variations of temperature are constant.

Ross Multi-Pass Oil Cooler.

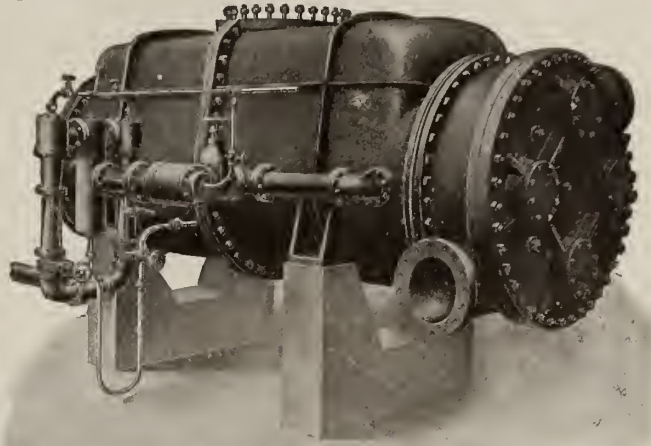
The Ross Multi-Pass oil cooler is of the straight tube type designed to most effectively transmit heat from the liquid or elastic fluid being cooled to the liquid or elastic fluid used as the cooling medium. Consists of a main shell of cast iron with cast iron water channel, channel cover and bonnet. The tubes are $\frac{3}{4}$ in. outside diameter, pure copper, expanded into a stationary head at one end and into a floating head at the other end.



ROSS MULTI-PASS OIL COOLER

Ross Surface Condenser with Evactor Air Pump.

Ross surface condensers are made with the same care, good materials and liberal rating as all other Ross products.



ROSS SURFACE CONDENSER WITH EVACTOR AIR PUMP

The cooling surface consists of brass or copper tubing so distributed throughout the shell that the entire tube surface is utilized and the highest possible efficiency and results obtained. These surface condensers are made in all sizes for both land and marine service.

The above illustration shows how easily the Evactor air pump can be attached directly to the condenser—eliminating foundations, reducing piping to a minimum, likewise eliminating the possibilities of leakage.

Ross Floating Head Heaters.

The Ross floating head heater is of cast iron construction except the tubes, which are of pure seamless



ROSS FLOATING HEAD HEATER

drawn copper. The life of the cast iron shell is many times longer than when steel plate is used. The copper tubes do not split the way brass tubes do. The tubes are expanded into a stationary tube head at one end and also expanded into floating heads at the other end, eliminating all packing boxes and unequal strains.

The Ross floating head heater is the ideal heater for heating boiler feed water, water for factory use, hot water heating systems, both gravity and forced circulation, domestic supply, swimming pools, etc. It can also be used for heating oil, sugar, juice or any liquid.

Bryant Radiator Machines.

Bryant radiator machines are built for the following operations:

Tapping, boring and facing column, wall, leg, school pin, angular and circular, steam radiator sections; threading right and left radiator nipples; turning push nipples; assembling radiator sections with screw and push nipples; drilling vent openings; testing radiator sections, etc.

THE CHAPMAN VALVE MANUFACTURING CO.

CABLE ADDRESS: "VALVE, INDIAN ORCHARD" GENERAL OFFICE AND WORKS INDIAN ORCHARD, MASS.

BOSTON, MASS., 141 High Street CHICAGO, ILL., Conway Building BRANCH OFFICES NEW YORK, N. Y., 180 Lafayette Street PHILADELPHIA, PA., 1011 Filbert Street

ATLANTA, GA., W. J. NEVILLE, 702 Candler Building SAN FRANCISCO, CAL., H. L. DICKINSON, First Street, corner Market Street REPRESENTATIVES DETROIT, MICH., H. J. CLEMENS, 1323 Majestic Building CLEVELAND, OHIO, C. F. WEBBER, 1025 Engineers Building

Products.

CHAPMAN SOLID WEDGE GATE VALVES, DOUBLE and SINGLE GATE VALVES, CHECK VALVES, DRIP VALVES, HYDRAULIC VALVES, MECHANISMS for OPERATING VALVES by Hand, by Floor Stand, by Hydraulic Lift, by Electric Motor, by Pneumatic Motor and by Pneumatic Cylinder.

Also, Blow-off Valves and Fire Hydrants.

For Sluice Gates, Shear Gates, Tide Flap Valves, Plug Valves, etc., see page 499.

Scope.

Made for a variety of services, including low and high pressure steam, water, gas, oil, ammonia, filtration, sewage, fire protection, hydraulic operations, oil refineries, etc., and listed in the following pages according to types and pressures.

Recommendations.

Some general recommendations as to the use of

CHAPMAN BRONZE VALVES

Pressure	Service	List No.
Low	Water or steam	1 and 4
Medium	Water or steam	4
High	Water or steam	11

CHAPMAN IRON BODY VALVES

Low	Water or steam	(2 to 10 ins., solid wedge) 24
		(2 to 10 ins., double wedge) 59 1/2
		(10 to 84 ins.) 58 1/2
Medium	Water or steam	42
High	Water or steam	42 1/2 and 43

CHAPMAN STEEL GATE VALVES

High	Superheated steam	63 1/2 and 65 1/2
------	-------------------	-------------------

List 1, Bronze Gate Valves.

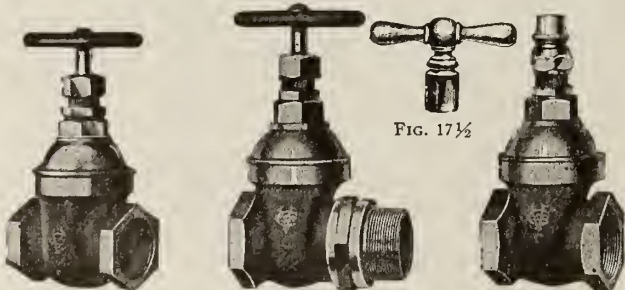


FIG. 1A. Screw End FIG. 2A. Union End FIG. 3A

BRONZE GATE VALVES

125 lbs. working pressure, 300 lbs. test

Size, ins.	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Fig. 1A, end to end, ins.	1 3/4	1 3/4	2	2 1/4	2 5/8	3	3 1/2	4	4 1/2	5
Fig. 2A, end to end, including nipple, ins.			3 3/8	3 3/4	4 1/8	4 1/2	5 1/8	5 7/8		

Chapman valves are given below for the convenience of engineers and purchasers when specifying or selecting valves for various purposes.

Facilities and Quality.

This company is the oldest and largest manufacturer of solid wedge gate valves in the United States. The shops are thoroughly equipped with up-to-date machines for rapidly turning out complete and accurately finished products.

Chapman valves and other products are recognized as standard for excellence of design, material and workmanship, and are not excelled in quality, finish or durability.

List 4, Bronze Gate Valves.



FIG. 1 FIG. 2 FIG. 3 BRONZE GATE VALVES 1/4 in. to 2 1/2 ins., 175 lbs. working pressure, 350 lbs. test 3 to 4 ins., 125 lbs. working pressure, 300 lbs. test

Size, ins.	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4
Fig. 1, end to end, ins.	2 1/8	2 1/8	2 3/8	2 3/4	3 1/8	3 1/4	4 1/8	4 3/4	5 3/8	6 3/8	8 3/8	8 1/2
Fig. 3, face to face, ins.	2 1/8	2 1/8	2 3/8	3 1/8	3 1/4	4 1/8	5 1/4	5 3/4	7	8 1/4	8 3/4	
Fig. 3, flg. diam., ins.	2 1/8	2 1/8	3	3 1/8	4	4 1/2	5	6	7	7 1/2	8 1/2	9

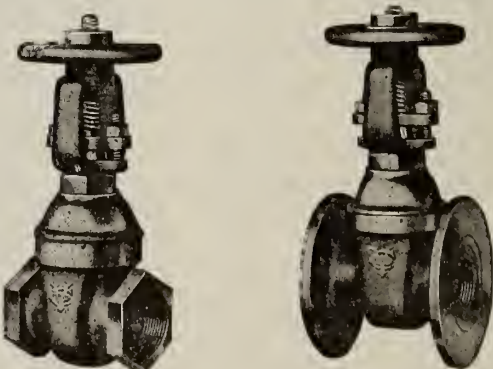


FIG. 6 FIG. 7

BRONZE GATE VALVES

Figs. 6 and 7, 175 lbs. working pressure, 350 lbs. test Figs. 8 and 9, 125 lbs. working pressure, 300 lbs. test

Size, ins.	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2
Fig. 6, end to end, ins.	2 1/8	2 1/8	2 3/8	2 3/4	3 1/8	3 1/4	4 1/8	4 3/4	5 3/8
Fig. 7, face to face, ins.	2 1/8	2 1/8	2 3/8	3	3 1/8	3 1/4	4 1/8	5 1/4	5 3/4

Bronze gate valves furnished in any size desired.

List 7 and 8, Bronze Hose Gate Valves; List 9, Drip Valve.




FIG. 18
(List 7)




FIG. 24




FIG. 26
(List 8)




FIG. 32
(List 9)

BRONZE HOSE GATE VALVES

Fig. 18, solid bronze seats, 150 lbs. working pressure, 300 lbs. test. Fig. 26, with babbitt seats, 175 lbs. working pressure, 350 lbs. test

BRONZE AUTO-MATIC DRIP VALVE

100 lbs. working pressure, 300 lbs. test

List 11, Extra Heavy Bronze Gate Valves.




FIG. 33




FIG. 40

EXTRA HEAVY BRONZE GATE VALVES

250 lbs. working pressure, 350 lbs. test

Size, ins.	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2
Fig. 33, Fig. 35, end to end, ins.	1 7/8	1 7/8	2 1/8	3 3/8	4	4 5/8	5 3/8	6	6 3/8
Fig. 34, Fig. 36, face to face, ins.	2 3/8	2 3/8	2 1/2	4	4 3/4	5 3/8	5 7/8	6 3/4	7 3/4

List 20 and 21, Regrinding Swing Check Valves.

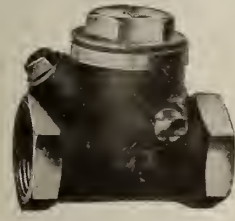


FIG. 64
(List 20)

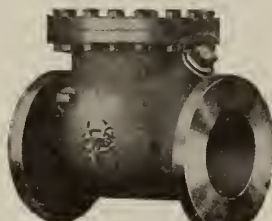


FIG. 68B
(List 21)

REGROUNDING SWING BRONZE CHECK VALVES, WITH ROTATING DISK

Fig. 64. (List 20), 150 lbs. working pressure, 350 lbs. test
Fig. 68B; (List 21), 400 lbs. working pressure, 800 lbs. test

Chapman regrinding swing check valves are straightway and have area fully equal to that of connecting pipes. All parts machined to jigs and interchangeable, facilitating repairs. Valve can be reground by removing angle plug and cap. A grinding mixture of oil and fine sand, or oil and ground glass should be applied to seat. Disk can then be revolved on seat until a perfect bearing is formed. Grinding material should then be wiped away to prevent further cutting

DATA, LIST 20

Size, ins.	1/4	3/8	1/2	3/4	1
Fig. 64, end to end, ins.	2 1/4	2 1/2	2 1/2	3	3 3/8
Fig. 65, face to face, ins.					4 3/4
Fig. 65, fig. diam., ins.					4

Size, ins.	1 1/4	1 1/2	2	2 1/2	3
Fig. 64, end to end, ins.	3 7/8	4 1/4	5 1/4	6 3/4	7 1/2
Fig. 65, face to face, ins.	5 1/4	5 3/4	6 3/4	8 1/4	9
Fig. 65, fig. diam., ins.	4 1/2	5	6	7	7 1/2

DATA, LIST 21

Size, ins.	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
End to end, ins.	2 3/4	2 3/4	2 3/4	3 1/4	3 3/4	4 1/4	4 1/2	5 1/2	6 3/4	7 3/4

Size, ins.	2	2 1/2	3	3 1/2	4
Fig. 67B, end to end, ins.	6 1/2	9 1/2	10 1/4	11	12 3/4
Fig. 68B, face to face, ins.	8 3/4	9 1/2	10 1/2	11 1/2	12 1/2
Fig. 68B, fig. diam., ins.	6 1/2	7 1/2	8 1/4	9	10

List 22, Single Disk Check Valve.




FIG. 69

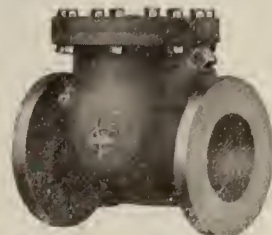


FIG. 69A

IRON BODY BRASS MOUNTED SINGLE DISK CHECK VALVES
150 lbs. working pressure, 300 lbs. test. Similar in appearance to Fig. 68B.

Size, ins.	2	2 1/2	3	3 1/2	4	5	6	7
Fig. 69, end to end, ins.	6 1/2	9 1/2	10 1/4	11	12 7/8	13 7/8	15 1/2	17
Fig. 69A, face to face, ins.	8 3/4	9 1/2	10 1/2	11 1/2	12 1/2	13 1/2	15	16 1/2
Fig. 69A, fig. diam., ins.	6	7	7 1/2	8 1/2	9	10	11	12 1/2

Size, ins.	8	10	12	14	16	18	20	24
Fig. 69, end to end, ins.	20	21	24 1/2	25 1/2	30	33	32 1/2	38
Fig. 69A, face to face, ins.	18 3/4	21 3/4	25 1/2	28	30	33	32 1/2	38
Fig. 69A, fig. diam., ins.	13 1/2	16	19	21	23 1/2	25	27 1/2	32

We also manufacture multiple disk valves in all sizes.

List 24, Iron Body Gate Valves.




FIG. 74




FIG. 70




FIG. 73

IRON BODY BRONZE MOUNTED SOLID WEDGE GATE VALVES FOR WATER

Made in sizes from 2 to 48 ins.

Fig. 71, Rising spindle, flanged end; Fig. 72, Rising spindle, screw end—not illustrated

Sizes 2 to 16 ins.—150 lbs. working pressure, 300 lbs. test
Sizes 18 to 30 ins.—100 lbs. working pressure, 250 lbs. test
Sizes above 30 ins.—80 lbs. working pressure, 200 lbs. test

Size, ins.	2	2 1/2	3	3 1/2	4	4 1/2	5
Fig. 70, Fig. 72, end to end, ins.	5 3/4	6 3/8	6 5/8	6 7/8	7 1/2	8	8 1/2
Fig. 71, Fig. 73, face to face, ins.	5 7/8	7 7/8	8 1/2	8 7/8	9 1/4	9 1/2	9 5/8
Fig. 71, Fig. 73, fig. diam., ins.	6	7	7 1/2	8 1/2	9	9 3/4	10

Size, ins.	6	7	8	9	10	12
Fig. 70, Fig. 72, end to end, ins.	9	9 1/2	10	10 3/4	11 1/2	12 3/4
Fig. 71, Fig. 73, face to face, ins.	10 1/8	10 3/8	10 3/4	11 1/2	12 1/8	12 3/4
Fig. 71, Fig. 73, fig. diam., ins.	11	12 1/2	13 1/2	15	16	19

Size, ins.	14	15	16	18	20	22	24
Fig. 71, Fig. 73, face to face, ins.	14	15 3/8	16 3/8	18	21	22	24
Fig. 71, Fig. 73, fig. diam., ins.	21	22 1/4	23 1/2	25	27 1/2	29 1/2	32

List 42, Medium Pressure, Iron Body Gate Valves.



FIG. 165A



FIG. 167A

MEDIUM HEAVY IRON BODY BRONZE MOUNTED GATE VALVES FOR STEAM AND WATER
175 lbs. working pressure

Size, ins.	2½	3	3½	4	4½	5
Fig. 164A, Fig. 166A, end to end, ins.	6¾	6⅝	6⅞	7½	8	8½
Fig. 165A, Fig. 167A, face to face, ins.	8	9½	10	10½	11	11½
Fig. 165A, Fig. 167A, flg. diam., ins.	7½	8¾	9	10	10½	11

Size, ins.	6	7	8	9	10	12
Fig. 164A, Fig. 166A, end to end, ins.	9	9½	10	10¾	11½	12¾
Fig. 165A, Fig. 167A, face to face, ins.	12	12½	13½	14	15	16
Fig. 165A, Fig. 167A, flg. diam., ins.	12½	14	15	16¼	17½	20½

List 42¼, Extra Heavy Gate Valves.



FIG. 168

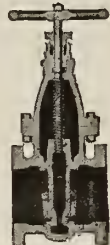


FIG. 169



FIG. 171

EXTRA HEAVY IRON BODY BRONZE MOUNTED GATE VALVES FOR STEAM AND WATER
250 lbs. working pressure. 600 lbs. test
Made in sizes from 2½ to 12 ins.

Size, ins.	2½	3	3½	4	4½
Fig. 168, Fig. 170, end to end, ins.	6⅝	7½	8¾	9¾	9¾
Fig. 169, Fig. 171, face to face, ins.	9½	9½	10½	10¾	11¾
Fig. 169, Fig. 171, flg. diam., ins.	7½	8½	9	10	10½

Size, ins.	5	6	7	8	9	10
Fig. 168, Fig. 170, end to end, ins.	10¼	11¾	12¾	12½	13¾	13¾
Fig. 169, Fig. 171, face to face, ins.	12¾	13¾	14	14	15	16
Fig. 169, Fig. 171, flg. diam., ins.	11	12½	14	15	16¼	17½

List 43, Extra Heavy Iron Body Gate Valves.



FIG. 180



FIG. 181



FIG. 183

EXTRA HEAVY IRON BODY BRONZE MOUNTED GATE VALVES FOR STEAM AND WATER
Suitable for extra high pressure steam and water service of all kinds. Extra heavy, with iron bodies, caps and wheels and removable bronze seat rings. 300 lbs. working pressure. 800 lbs. test
Made in sizes from 2 to 24 ins.

Size, ins.	2	2½	3	3½	4
Fig. 180, Fig. 182, end to end, ins.	7	8¾	9½	9¾	10
Fig. 181, Fig. 183, face to face, ins.	8½	9½	11½	11¾	12
Fig. 181, Fig. 183, flg. diam., ins.	6½	7½	8¼	9	10

DATA, IRON BODY BRONZE MOUNTED GATE VALVES FOR WATER—(CONTINUED)

Size, ins.	4½	5	6	7	8
Fig. 180, Fig. 182, end to end, ins.	11⅝	12¼	13¾	14½	15
Fig. 181, Fig. 183, face to face, ins.	13¼	15	15¾	16¼	16½
Fig. 181, Fig. 183, flg. diam., ins.	10½	11	12½	14	15

Size, ins.	9	10	12	14	15	16
Fig. 180, Fig. 182, end to end, ins.	16	17	19	21½	21½	21½
Fig. 181, Fig. 183, face to face, ins.	17	18	19¾	21½	21½	21½
Fig. 181, Fig. 183, flg. diam., ins.	16¼	17½	20½	23	24½	25½

List 58½, Iron Body Gate Valves.

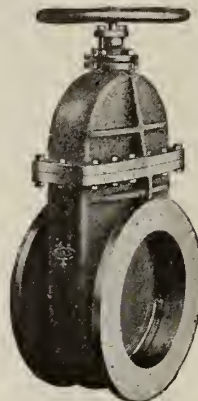


FIG. 250 BM



FIG. 251 BM

IRON BODY BRONZE MOUNTED DOUBLE DISK GATE VALVES
Designed for low pressure steam, water and gas
Sizes 10 to 24 ins.—30 lbs. working pressure, 70 lbs. test
Sizes 26 to 72 ins.—25 lbs. working pressure, 50 lbs. test

Size, ins.	10	12	14	16	18	20	22	24	26
Fig. 250 BM, Fig. 251 BM, face to face, ins.	10½	11	11½	12	12½	13	13¼	13¾	14½
Fig. 250 BM, Fig. 251 BM, flg. diam., ins.	16	19	21	23½	25	27½	29½	32	34¼

Size, ins.	28	30	32	36	42	48	54	60	66	72
Fig. 250 BM, Fig. 251 BM, face to face, ins.	14	15	15½	16	17½	19½	21	25	27	28½
Fig. 250 BM, Fig. 251 BM, flg. diam., ins.	36½	38¾	41¾	46	53	59½	66¼	73	80	86½

List 59½, Iron Body Double Disk Gate Valves.



FIG. 261



FIG. 263

IRON BODY BRONZE MOUNTED DOUBLE DISK GATE VALVES
Sizes 2 to 12 ins.—125 lbs. working pressure, 300 lbs. test
Sizes 14 to 24 ins.—75 lbs. working pressure, 175 lbs. test
Sizes 26 ins. and above—60 lbs. working pressure, 150 lbs. test

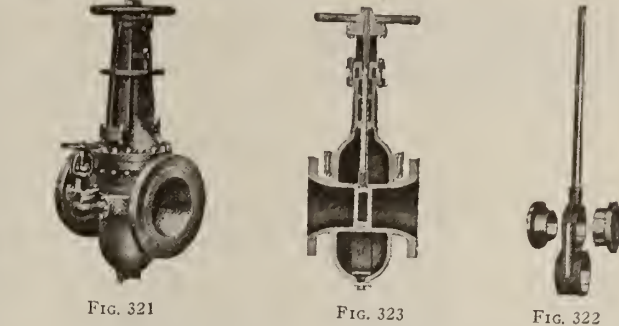
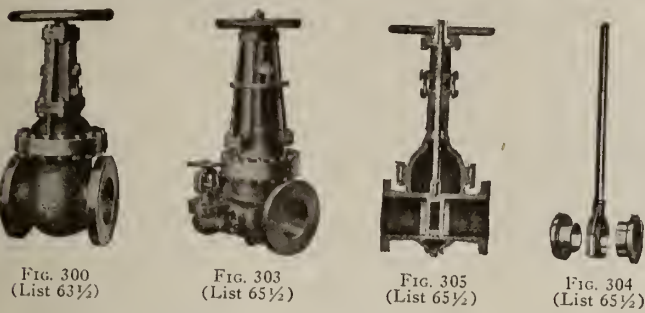
Size, ins.	2	2½	3	3½	4	4½	5
Fig. 261, Fig. 263, face to face, ins.	7	7½	8	8½	9	9½	10
Fig. 261, Fig. 263, flg. diam., ins.	6	7	7½	8½	9	9½	10

Size, ins.	6	7	8	9	10	12	14	16
Fig. 261, Fig. 263, face to face, ins.	10½	11	11½	12	13	14	14	14¾
Fig. 261, Fig. 263, flg. diam., ins.	11	12½	13½	15	16	19	21	23½

Size, ins.	18	20	22	24	30	36	42	48
Fig. 261, Fig. 263, face to face, ins.	15½	17	18	18½	21½	24½	27½	30½
Fig. 261, Fig. 263, flg. diam., ins.	25	27½	29½	32	38¼	46	53	59½

List 63½ and 65½, Steel Gate Valves for Superheated Steam.

List 65½, Venturi Type Valves.



STEEL GATE VALVES ESPECIALLY DESIGNED FOR HIGH PRESSURE SUPERHEATED STEAM

Fig. 300. Body and cap cast steel; monel seat rings and spindle; solid monel plug up to and including 6-in. size; sizes above 6 ins. have steel plugs with monel mountings rolled in; cap has condensation or cooling chamber.

Figs. 303, 305 and 304. Strongest design that can be made. Uniform thickness of metal insures even cooling. Seats are parallel. Disks rotating on axis have tendency to clean seats when closing. Body, cap and carrier block of cast steel; seat rings, disks, spindles and spindle seats of monel metal

STEEL VENTURI TYPE GATE VALVES DESIGNED ESPECIALLY FOR HIGH PRESSURE SUPERHEATED STEAM

Construction permits these valves to pass steam practically equal to the full carrying capacity of the pipe. Steam entering converging nozzle on inlet side has a portion of its pressure converted into kinetic energy, steam increasing in velocity, and dropping in temperature and pressure. At high velocity thus developed, it passes through orifice at valve seats. After which it enters diverging nozzle at high velocity, and in its passage converts its kinetic energy into increased pressure, temperature and velocity at which it entered converging nozzle on inlet side of valve.

Chance for leakage reduced on account of reduced area at seats, and valve can be opened quicker. When valve is open, disks and seat rings are protected. Bottom ring of carrier fills aperture in valve, making a continuous pipe line. No steam eddies, therefore increased efficiency in steam flow and long life.

Valves have parallel seats. Disks rotating on axis have tendency to clean seats when closing. Body, cap and carrier ring of cast steel; disks, seat rings, spindle seat of monel metal

DATA, STEEL GATE VALVES FOR SUPERHEATED STEAM, LIST 63½							
Size, ins.	2	2½	3	3½	4	4½	5
Face to face, ins.	8½	9½	11½	11¾	12	13¼	15
Flg. diam., ins.	6½	7½	8¾	9	10	10½	11

DATA, STEEL PARALLEL SEAT, DOUBLE GATE VALVES FOR SUPERHEATED STEAM, LIST 65½									
Size, ins.	6	7	8	10	12	14	16	18	20
Face to face, ins.	15¾	16¼	16½	18	19¾	22½	24	26	29¼
Flg. diam., ins.	12½	14	15	17½	20½	23	25½	28	30½

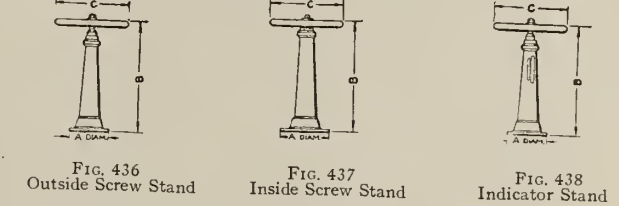
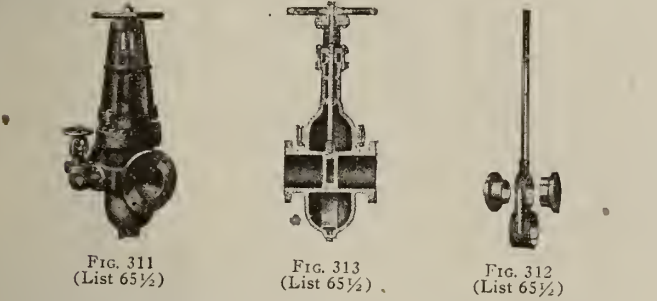
Size, ins.	4	6	7	8	10	12
Face to face, ins.	18½	19	20	20¾	22¾	23¾
Flg. diam., ins.	10	12½	14	15	17½	20½

Size, ins.	14	16	18	20	22	24
Face to face, ins.	25¾	32¾	33¼	35¼	35½	35¾
Flg. diam., ins.	23	25½	28	30½	33	36

List 76, Floor Stands.

Size, ins.	2½	3	3½	4	4½	5	6	7	8
Face to face, ins.	12½	14	14¾	18½	18½	18½	19	20	20¾
Flg. diam., ins.	7½	8¾	9	10	10½	11	12½	14	15

Size, ins.	9	10	12	14	16	18	20	22	24
Face to face, ins.	21¾	22¾	23¾	25¾	32¾	33¼	35¼	35½	35¾
Flg. diam., ins.	16¾	17½	20½	23	25½	28	30½	33	36



FLOOR STANDS FOR VALVES AND SLUICE GATES

DIMENSIONS, FIGS. 436 AND 436A						
Size, ins.		4 and less	4½ to 10	12 to 16	18 to 26	28 and above
Diam. base, ins.	A	9½	14	14	16	16
Diam. bolt circle in base, ins.		8¼	12½	12½	14½	14½
Number bolt holes in base, ins.		4	4	4	6	6
Diam. bolt holes in base, ins.		11 16	11 16	11 16	11 16	11 16
Height of stand, ins.	B	28½	36	36	36	36
Diam. hand wheel, ins.	C	12½	16	20	24¾	30

DIMENSIONS, FIGS. 437, 437A, 438 AND 438A

Size, ins.		4 and less	4½ to 16	18 and above
am. base, ins.	A	9½	14	16
am. bolt circle in base, ins.		8¼	12½	14½
umber bolt holes in base.		4	4	6
am. bolt holes in base, ins.		11	11½	11½
eight of stand, ins.	B	28½	36	36
am. hand wheel, ins.	C	11¾	16	24¾

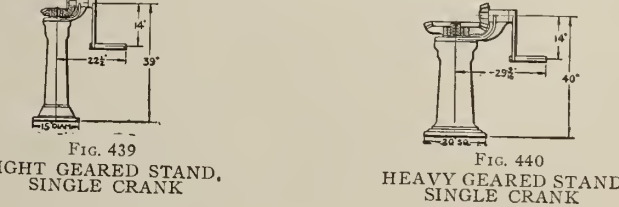
STEEL GATE VALVES ESPECIALLY DESIGNED FOR HIGH PRESSURE SUPERHEATED STEAM

350 lbs. working pressure, 800 lbs. test

Note construction. When valve is open, disks and seat rings are protected; bottom ring of carrier fills aperture in valve, making continuous pipe line. No steam eddies, therefore increased efficiency in steam flow and long life. Valves have parallel seats. Disks rotating on axis have tendency to clean seats when closing. Body, cap and carrier ring of cast steel; disks, seat rings, spindle and spindle seat of monel metal

Size, ins.	4	4½	5	6	7	8	9	10
Face to face, ins.	18½	18½	18½	19	20	20¾	21¾	22¾
Flg. diam., ins.	10	10½	11	12½	14	15	16¼	17½

Size, ins.	12	14	16	18	20	22	24
Face to face, ins.	23¾	25¾	32¾	33¼	35¼	35½	35¾
Flg. diam., ins.	20½	23	25½	28	30½	33	36



FOUNDED BY R. T. CRANE, 1855

CRANE CO.**Manufacturers of Valves and Fittings for any Pipe Line****836 South Michigan Avenue
CHICAGO, ILL.****FACTORIES: CHICAGO, ILL., BRIDGEPORT, CONN.****SALES OFFICES**

ABERDEEN
ALBANY
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SPOKANE
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ST. LOUIS
ST. PAUL
SYRACUSE
TACOMA
TERRE HAUTE
WASHINGTON
WICHITA

Products.

VALVES—Regrinding Globe, Angle, Cross and Check; Extra Heavy Gate; Forged Steel Globe and Angle; Extra Heavy Hydraulic Cast Steel Gate; Crane—Erwood Automatic Double Acting Non-return and Emergency Cut-out.

FITTINGS—Screwed and Flanged, Cast Iron, Malleable Iron, Brass, Cast Steel and Forged Steel.

UNIONS—Ground Joints, Brass to Iron Seats.

UNION FITTINGS—Ground Joints, Brass to Iron Seats.

STRAINER and SEDIMENT SEPARATORS.

JOINTS—Flanged Pipe, Crane Expansion.

HEADERS—Cast Iron, Ferrosteel, Cast Steel.

EXTRA HEAVY STEAM and OIL SEPARATORS.

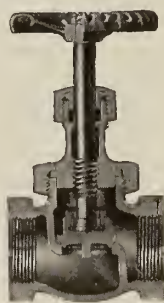
PIPE SUPPORTS, HANGERS and BRACKETS.

Other Power Plant Specialties: Traps—Cranetilt Steam and Vacuum; Fabricated Pipe and Bends; Valves—Pop Safety, Engine Stop, Exhaust Relief, Stop Check, Water Relief and Safety; Swivel Expansion Joints; Mine Piping; Pump Columns; Flanges; Bolts; Gaskets; Cocks for air lines; Pressure Regulators; Fittings—Screwed and Flanged, Sanitary Drainage, Long Sweep Water; and Plumbing Fixtures.

17,000 articles, including valves and fittings from 1/8 in. to 72 in. Made of brass, cast iron, malleable iron, ferrosteel, cast steel and forged steel. For water pressures up to 6000 lbs., for steam pressures up to 400 lbs., any superheat, and for air pressures up to 2000 lbs.

Regrinding Globe, Angle, Cross, Check Valves.

These valves are made of Crane special brass. They are fitted with our improved non-heating malleable iron wheel and may be repacked when open and under pressure. The body is reinforced by a heavy union ring and when pressure is applied any tendency of the body to stretch is counteracted by this ring and the contact between the body and the ring becomes more intimate as the pressure increases. Made in medium, extra heavy and hydraulic patterns.



NO. 70 GLOBE VALVE

Extra Heavy Gate Valves, Outside Screw and Yoke.

These valves are made of Crane ferrosteel with extra heavy hard metal seats which are screwed to shoulders in body, thereby insuring perfect joints. Seats can be removed at any time it may be necessary to renew them. The gate is made very stiff and is faced with hard metal. The guides in the gates are carefully finished, so as to slide smoothly on ribs in the body, thus

preventing any rattling when the valve is open, or any uneven wear of faces. Stuffing box flange is of malleable iron with a brass follower, giving additional strength and durability at that point. These valves may be packed when open. Tested to 800 lbs. hydraulic pressure per sq. in.

Forged Steel Globe and Angle Valves.

Meet the demand for a thoroughly reliable valve for use with hydraulic presses and extreme high pressure air or gas installations. The body is machined from a solid steel forging. The seat is easily renewable. These valves are recommended for cold water or oil working pressures up to 6000 lbs. hydrostatic. Valves for air or gas are special.



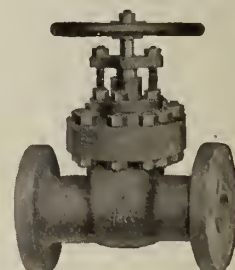
NO. 9-E GATE VALVE

Extra Heavy Hydraulic Cast Steel Gate Valves.

The bodies, bonnets, yokes and discs of these valves are made of Crane cast steel. In sizes above 2 in. the disc is faced with hard metal; size 2 in. has disc in solid hard metal. The construction of the seat and method of screwing it in the body, the strength and finish of the gate and stuffing box are similar to No. 9-E valve. Also they may be packed while under pressure. These valves are recommended for cold water or oil working pressures up to 3000 lbs. hydrostatic, and are tested to 3000 lbs. hydraulic pressure.



NO. 225-H FORGED STEEL VALVE



NO. 205-D GATE VALVE

Unions and Union Fittings.

Made with leakproof brass to iron seat, requiring no gaskets, and may be taken apart readily. The seat is non-corrosive. Unions are made of malleable iron for steam working pressures up to 250 lbs. Union fittings are for 200 lbs. working pressure.



No. 519

No. 591
UNIONS AND UNION FITTINGS

No. 596

Crane-Erwood Automatic Double Acting Non-return and Emergency Cut-out Valve.

The principal duties of the Crane-Erwood valve are boiler protection, header protection, automatic cut in, line protection. These valves are extra heavy, made of ferrosteel with hard metal seats and discs and are recommended for steam working pressures up to 250 lbs. The levers on the outside of the valve are in line with the discs and give a positive indication of their position and the operation of the valve at all times. The valve may be adjusted to close at any desired velocity. Adjustments are made from the outside while the valve is in operation.



NO. 36-E
CRANE-ERWOOD
AUTOMATIC
VALVE

Extra Heavy Hydraulic Malleable Iron Screwed Fittings.

The Crane line of extra heavy hydraulic malleable iron fittings includes all the necessary sizes and shapes for cold water or oil working pressures as follows:

1 in. and smaller.....	2000 lbs. hydrostatic
1¼ to 2 in.....	1500 lbs. hydrostatic
2½ to 4 in.....	1000 lbs. hydrostatic
5 and 6 in.....	800 lbs. hydrostatic
8 in.....	600 lbs. hydrostatic
10 and 12 in.....	500 lbs. hydrostatic

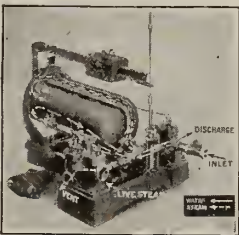
These fittings are tested to hydraulic pressures corresponding to the above working pressures.



NO. 260-H NO. 262-H NO. 264-H NO. 267-H
EXTRA HEAVY HYDRAULIC FITTINGS

Cranetilt Steam Traps.

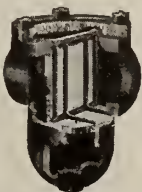
Designed as non-return, boiler feed, lifting, vacuum or metering traps. They are especially adapted for use on return lines handling condensation under varying pressures, especially where the pressure will vary from a vacuum to high steam pressure. The Cranetilt three-valve trap gives excellent service on returns on apparatus that has a varying pressure while in service or a low initial starting pressure and a high terminal pressure. Buy steam traps by their discharging capacity; not by pipe sizes.



THREE-VALVE TRAP

Strainer and Sediment Separator.

For water working pressures up to 250 pounds. These separators are constructed in a strong and substantial manner and will be found exceptionally valuable for use in connection with steam traps, pumps, injector and ejector suction pipes, feed water lines, etc., by preventing foreign substances from passing through and settling on valve seats and other places that should be kept entirely clear and free from such obstructions.



NO. 990
SEDIMENT
SEPARATOR

Headers.

CRANE Co. has exceptional facilities for making any required design of headers in cast iron, ferrosteel or cast steel, for all pressures and purposes.



WELDED HEADER

Flanged Pipe Joints.

With Crane cast steel or forged steel flanges these flanged joints are highly recommended for use in connection with pipe bends.



NO. 281-D
Screwed Joint,
with Cast Steel
Flange



NO. 295-E
Craneweld Joint,
with Forged Steel
Flange

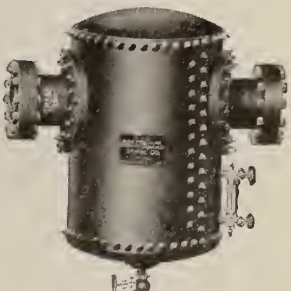


NO. 181-D
Cranelap Joint,
with Cast Steel
Flange

THREE STANDARD TYPES FLANGED PIPE JOINTS

Extra Heavy Steam and Oil Separators.

Have large areas and ample baffle surfaces, affording the highest degree of efficiency with the slightest loss in pressure. Their design is based upon the most approved mechanical and scientific principles. This superior line of separators is offered in competition with any steam or oil separating devices on the market.



NO. 014
STEAM AND OIL SEPARATOR

Standard steam separators for steam working pressures up to 125 lbs. Extra heavy steam separators for steam working pressures up to 250 lbs.

Cast steel steam separators for superheated steam working pressures up to 350 lbs. and total temperature of 800° Fahr.

Oil separators for steam working pressures up to 25 lbs.

Crane Expansion Joints.

Are made in brass, copper, cast iron, ferrosteel and cast steel for all pressures and purposes.

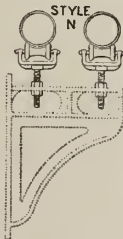
Expansion joints with anchor bases reduce the cost of installation.



NO. 49-E EXPANSION JOINT
With anchor base

Pipe Supports, Hangers and Brackets.

Are suitable for pipe lines up to 30 in.



Style N



Style H
PIPE SUPPORTS



Style C



WALL BRACKET
With walking board
attachment

Literature.

Catalogue No. 50, which describes complete line of 17,000 articles, will be mailed on request.

A. W. CADMAN MFG. CO.

Manufacturer of Valves

MAIN OFFICE AND WORKS
PITTSBURGH, PA.

NEW YORK OFFICE, 220 Broadway

DISTRICT SALES OFFICES

CHICAGO, ILL., R. D. BLISS

CLEVELAND, OHIO, R. E. BRONSON Co.

PHILADELPHIA, PA.

Products.

CADMAN INDESTRUCTIBLE BLOW-OFF VALVE; CADMAN GATO PLUG VALVES for Air, Gas, Oil, Water, Steam or Acid under any pressure.

Blow-off Valve.

The Cadman Indestructible Blow-off valve is available at all times for all boilers, including those working under superheated steam up to and including 300 lbs. per sq. in. working pressure. The reversible seats and disks are of monel metal, a metal known to resist the destructive action of dirt, scale, hot acids and alkalis, and boiler compounds. Monel metal is also absolutely impervious to superheated steam.

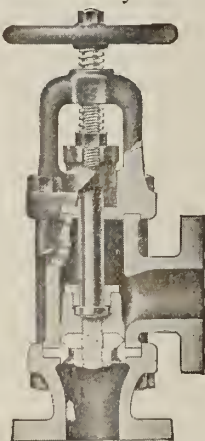
All cast parts are of air furnace semisteel of heavy construction with a factor of safety of 5, suitable for 300 lbs. per sq. in. Stem of special bronze, with high tensile strength and large proportions. Acme thread of coarse pitch is used, which gives more bearing surface than other types of threads, greater strength, and permits slow operation of valve which prevents water hammer.

A peculiar feature of the seat is a projecting flange held between the body and the base within a recess in the base, which makes it impossible for water to leak past, and expansion and contraction have no effect on it whatever.

The whirlpool inlet port used is obtained by a deflector on one side of the port, which prevents water, dirt and scale striking the valve body with full force when blowing, but causes it to take a course around the periphery of the body, causing the dirt, scale, grit and other heavy substances to go down through the center of the valve without coming in contact with the seating portion.

DIMENSIONS AND PRICES,
BLOW-OFF VALVES

Size, in.	1½	2	2½
Face of inlet to center of body, in.	4½	4½	5¼
Center of inlet to face of outlet, in.	5¾	6½	7½
Diam. of flanges, in.	6	6½	7½
Length over all, closed, in.	15½	17½	20½
Length over all, open, in.	17½	20½	24½
Screwed ends.	\$17.50	23.25	29.00
Flanged ends.	\$18.00	24.00	30.00



SECTION OF CADMAN INDESTRUCTIBLE BLOW-OFF VALVE
1914 pattern
(Patented)

Cadman Gato Plug Valve.

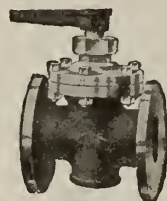
Cadman Gato plug valve has the straightway features of the gate valve; also, the quick opening advantages of the plug cock, though it is different because it closes tight and stays tight. It has adjustment for wear.

The valve is constructed on the wedge and screw principle, so that when closed the plug is expanded in the shell of the body. The plug is moved by a tee head on stem, which fits loosely in a suitable recess in the plug, and results in a slight lost motion between stem and plug.

This valve is adapted to various conditions of service, and specifications for requirements are invited.



Bronze Standard
Also made of special acid metal



Bronze Heavy
500 lbs. working pressure



Bronze Hydraulic
3000 lbs. working pressure

CADMAN GATO VALVES

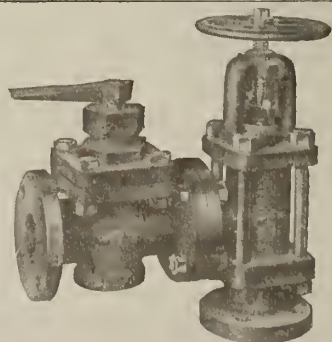
DIMENSIONS AND PRICES, GATO VALVES

Size of valve, in.	½	¾	1	1¼	1½	2	2½	3	4
BRONZE STANDARD, 250 LBS. WORKING PRESSURE									
Screwed, f. to f., in.	3¼	3¾	3½	4¼	4¾	5¾	6¾	7¾	10½
Price, f. to f.	\$3.43	3.81	5.60	7.60	9.16	14.00	26.30	39.50	85.00
Flanged, f. to f., in.			4¾	5½	6	6¾	8¾	9¼	14
Diam. flanges, in.			4	5	6	6½	7½	8¼	9
Price, f. to f.			\$7.50	8.00	9.90	19.00	31.00	50.00	95.00
BRONZE HEAVY, 500 LBS. WORKING PRESSURE									
Screwed, f. to f., in.	3¼	3¾	3½	4½	5½	6	6¾	7¾	
Price, f. to f.	\$5.00	6.50	8.75	10.50	13.50	20.00	37.00	60.00	
Flanged, f. to f., in.			5½	5¾	6¾	7¾	8¾	14½	
Diam. flanges, in.			4	5	6	6½	7½	8¼	
Price, f. to f.			\$10.50	14.25	18.00	25.00	49.00	78.00	
BRONZE HYDRAULIC, 1500 LBS. WORKING PRESSURE									
Screwed, f. to f., in.	3¾	4	4¾	5½	6	6½	7½		
Price, f. to f.	\$9.75	13.00	20.50	28.00	37.00	60.00	93.00		
Flanged, diam. flanges, in.		4	4¾	5½	6½	7½	8		
Price, f. to f.		\$19.50	28.00	35.00	49.00	78.60	125.00		
BRONZE HYDRAULIC, 3000 LBS. WORKING PRESSURE									
Screwed, f. to f., in.	3¾	4	4¾	5½	6	6½			
Price, f. to f.	\$17.50	23.00	32.00	39.00	46.00	70.00			
Flanged, diam. flanges, in.		4	4¾	5½	6½	7½			
Price, f. to f.		\$30.00	36.00	50.00	83.00	130.00			
SPECIAL ACID METAL									
Screwed, f. to f., in.							37.00	on application	
Flanged, f. to f., in.							\$34.00	45.00	
SEMISTEEL STANDARD, 300 LBS. WORKING PRESSURE									
Screwed, f. to f., in.					4¾	6	6¾	8	10½
Price, f. to f.					\$7.50	11.00	18.00	31.50	45.00
Flanged, f. to f., in.					8¼	9	10¾	11¾	14¾
Diam. flanges, in.					6	6½	7½	8¼	10
Price, f. to f.					\$9.00	13.25	23.50	35.00	50.00

Tandem Blow-off Valve.

Consists of the Indestructible Blow-off valve, 1914 pattern, and the Gato plug valve.

It is a great advantage to procure from one manufacturer a blow-off valve and auxiliary valve, both of the highest reputation, suitable for all boilers, including superheat up to and including 300 lbs. working pressure.



TANDEM BLOW-OFF VALVE

Size, in.	1½	2	2½
Screwed.	\$26.80	38.80	55.50
Flanged.	28.00	40.50	60.00

THE FISHER GOVERNOR CO.

Oil Field Specialties

5-11 Linn Street

MARSHALLTOWN, IOWA

Products.

SAFETY and VACUUM VALVES for Oil Stills and Agitators; GASOLINE TRAPS; RELIEF VALVES.

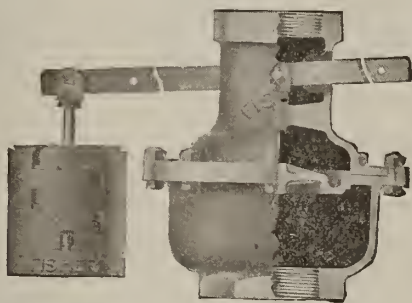
Gas Water Traps.

For Steam Specialties, see pages 522-23.

Fisher Safety and Vacuum Valves.

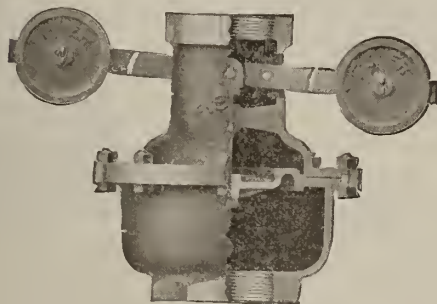
For use in oil refineries using low pressure stills, to protect shell of still from an excessive amount of pressure or vacuum. Made with heavy cast iron bodies; upper and lower parts of body securely bolted together. Inner valve made of mild bronze, and seats against a perfectly machined cast iron seat; seat ring cast separate from body casting. Both inner valve and seat removable, effecting a saving in upkeep.

Parts of safety valve interchangeable with parts of vacuum valve. Either can be converted into the other by reversing valve on stem, reversing position of cast iron seat ring, and changing leverage.



TYPE NO. 1515S SAFETY VALVE

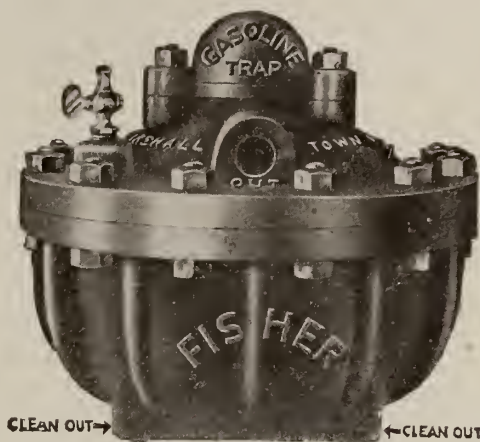
As regularly fitted, suitable for any pressure up to 20 lbs.



TYPE NO. 1515V VACUUM VALVE
Vacuum valves fitted to handle any vacuum

Fisher Gasoline Traps.

For use where gasoline is manufactured under pressure; also for taking gasoline out of gas lines. Intermittent open bucket types—the only type practical in this field. Vapor loss reduced to a minimum. Liability of freezing greatly lessened.



TYPE NO. 333 FISHER GASOLINE TRAP

All parts extra heavy, being specially constructed for gasoline service. Casting uniform in thickness. Body and cover heavily ribbed to give additional strength.

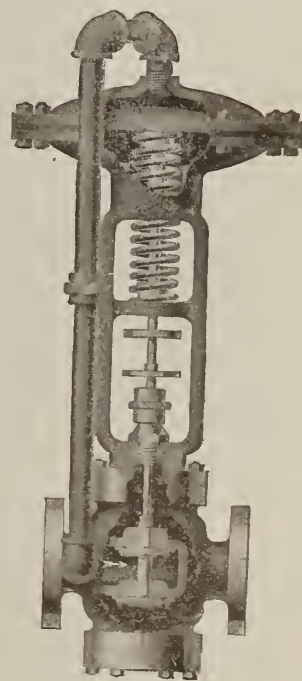
Fisher Relief Valves.

On weathering tanks as well as in other installations where a relief valve can be used, the Fisher Type 555 has proved superior to relief valves of other constructions.

Like other Fisher specialties is built with high grade cast iron body, with Duromite inner valve and seats. The Duromite insures long life and positive results.

Construction of this valve permits the use of a very long spring, which is compressed by the action of pressure on the diaphragm. This action of diaphragm and spring opens the inner valve and relieves the pressure to desired point.

Adjustment easily secured by releasing lock nut wheel and turning adjustment wheel in either direction. Fisher design of diaphragm rod and valve stem insures constant and perfect alignment, unaffected by adjustment.



TYPE 555 RELIEF VALVE

HOMESTEAD VALVE MANUFACTURING CO.

Manufacturers of Valves and Other Specialties

P. O. Box 1754
PITTSBURGH, PA.

WORKS
HOMESTEAD, PA.

Products.

HOMESTEAD QUARTER-TURN VALVES for various pressures, in Brass, Semisteel Body, All-semisteel and Cast Steel.

HOMESTEAD STRAIGHTWAY VALVES, THREE-WAY VALVES, FOUR-WAY VALVES, ANGLE VALVES.

"HOVALCO" RENEWABLE BLOW-OFF VALVES.

Also, Locomotive Blow-off Valves.

Advantages.

The simple construction gives the following advantages: The Homestead valve can be fully opened or closed with a quarter turn, which is important in times of emergency.

The straight and unobstructed passage through the Homestead valve, when open, makes it particularly suitable for the handling of heavy liquids or for carrying off sediment, as in the case of a blow-off valve.

The patent locking cam releases all pressure on the plug in turning, but locks the plug tight to the seat in the closed position.

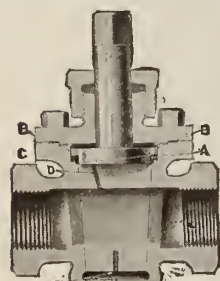
The seat is protected from wear when pressure is passing through valves.

Homestead Straightway Valves.

Made in all sizes up to 6 in., and for all pressures up to 5000 lbs. per sq. in.

The Homestead valve is unlike all others, especially globe and gate valves, for the reason that when the pressure passes directly through it, the seat is absolutely protected from wear. The plug is balanced and held in place by the pressure when open, and when closed it is locked in the seat by the patent wedging cam, insuring freedom from friction in seat while plug is turning.

This valve is so constructed that when it is closed the plug at the same time is forced firmly to its seat. This result is secured by means of the traveling cam "A," through which the stem passes. The cam is prevented from turning with the stem by means of the lugs "B," which move vertically in slots. Supposing the valve to be open, the cam will be in the lower part of the chamber in which it is placed, and the plug will be free to be easily moved.



SECTION THROUGH
HOMESTEAD VALVE

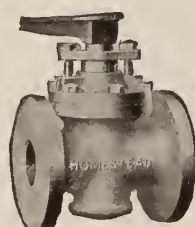


FIG. 3. Flanged Connections
200 lbs. working pressure. All brass

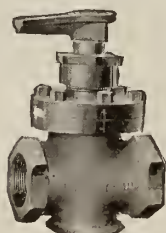


FIG. 5. Screwed Connections
500 lbs. working pressure. Special high grade bronze

HOMESTEAD STRAIGHTWAY VALVES

DATA, HOMESTEAD STRAIGHTWAY VALVES
200 LBS. WORKING PRESSURE. FLANGED CONNECTION. BRASS.

Size, in.	1	1½	2	2½	3	3½	4
Flgd. f. to f.	4¾	5	6	7¾	8	9½	12¼
Diam. of flgs.	3¾	4½	5	6	7	8	9
Price, \$	16.66	19.20	26.70	35.00	46.40	82.90	110.50
Drilling, net.				\$0.15	.25	.40	.65

DATA, HOMESTEAD STRAIGHTWAY VALVES—(Continued)
200 LBS. WORKING PRESSURE. SCREWED CONNECTION. BRASS.

Size, in.	½	¾	1	1½	2	2½	3	3½	4
Scr. e. to e.	2½	2½	2½	2½	3½	4½	6½	8½	8½
Price, \$	3.83	3.83	4.00	4.50	5.37	7.17	9.60	13.40	23.30

500 LBS. WORKING PRESSURE. SCREWED AND FLANGED CONNECTION. BRONZE.

Size, in.	½	¾	1	1½	2	2½	3	3½	4
Scr. e. to e.	2½	2½	2½	2½	3½	4½	6½	8½	8½
Flgd. f. to f.									
Price, scr.			\$5.00	7.30	9.16	11.70	16.60	21.30	28.10
Price, flgd.						\$23.30	25.00	29.00	

Size, in.	2	2½	3	4	5	6
Scr. e. to e.	6¾	7¾	10	12½	12½	17½
Flgd. f. to f.	8½	9¾	11	12½	14	16
Price, scr.	\$31.60	50.00	95.30	160.23	183.33	233.30
Price, flgd.	\$45.00	70.00	116.60	193.30	226.60	288.10
Drilling, net.	\$0.15	.25	.40	.65	.75	1.00

BRASS VALVES FOR 1500 LBS. WORKING PRESSURE

Size, in.	½	¾	1	1½	2	2½	3
Scr. e. to e.	3½	3½	3½	5½	6	7	7¾
Flgd. f. to f.							
Price, scr.	\$6.40	6.40	10.60	15.60	24.20	31.30	41.90
Price, flgd.					\$31.87	44.90	58.60
Drilling, net.					\$0.15	.25	.40

VALVES FOR 3000 LBS. WORKING PRESSURE

Size, in.	¾	1	1½	2	2½	3
Scr. e. to e.	5½	6	7	7¾	9¾	10
Flgd. f. to f.	6	7	8	8½	11	11
Price, scr.	\$15.96	29.76	38.26	53.13	63.76	73.13
Price, flgd.			\$48.90	59.50	82.86	138.13

VALVES FOR 5000 LBS. WORKING PRESSURE

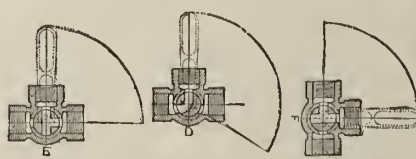
Size, in.	½	¾	1	1½	2	2½	3
Scr. e. to e.	5½	6½	6¾	7¾	9¾	10	11
Price, scr.	\$17.00	23.36	38.26	51.00	63.76	89.26	165.76
Price, flgd.					\$80.76	137.10	225.26

Homestead Three-way Valves.

Suitable for various working pressures for either water, air or steam. Made according to same principle as Homestead straightway valves. It has the internal locking device, which forces the plug tight to seat of valve at both extremes of the arc in which plug turns.

Three arrangements of ports or openings shown can be used.

Valve with the two-port plug, shown in figure D, is used in majority of cases; and if not otherwise specified, is always shipped.



HORIZONTAL SECTIONS OF THREE-WAY VALVES

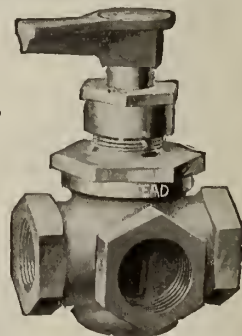


FIG. 9. HOMESTEAD THREE-WAY VALVE
Brass. 200 lbs. working pressure

DATA, HOMESTEAD BRASS THREE-WAY VALVES
200 LBS. WORKING PRESSURE

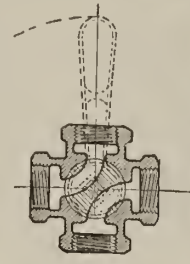
Size, in.	¾	1	1½	2	2½	3	4
Scr. e. to e. of run.	2½	3	3¾	4¾	5½	6¾	7½
Scr. cent. of run to end of side opening	1½	1½	1¾	2½	2¾	3¾	5¼
Price, scr.	\$6.34	6.67	9.90	15.80	19.30	22.90	36.60
Flgd. f. to f. of run	4	4¾	5¾	7½	9½	10¾	13¾
Diam. of flgs.	4½	4½	5	6	7	7½	9
Price, flgd.	\$21.30	26.60	33.20	50.00	80.80	99.86	180.00
Drilling, net.				\$0.15	.25	.40	.65

DATA, HOMESTEAD BRASS THREE-WAY VALVES—(Continued)
600 LBS. WORKING PRESSURE

Size, in.	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
Scr. e. to e. of run. .	3 1/2	4 1/4	4 3/4	4 1/2	4 3/4	5 3/4	6 3/4	9	9 3/4	12 1/4
Scr. cent. of run to end of side op'ng		2 3/8	2 3/8	2 3/8	2 3/8	3 1/8	4 1/4	4 1/2	5	6 1/8
Price, scr.	\$10.00	12.20	20.00	24.33	31.26	36.03	47.83	71.73	119.56	208.26
Flgd. f. to f. of run. .										
Diam. of flgs.				4 1/4	5 3/4	6 1/8	8	10	10 3/4	
Price, flgd.				\$31.86	39.33	46.77	68.00	102.00	148.76	255.06
Drilling, net						\$0.15	.25	.40	.65	.75

Homestead Four-way Valves.

The Homestead four-way valve is made to hold any pressure to and including 3000 lbs. It is made with the patent device which limits the plug to a quarter turn and forces it to its seat at each extreme of this quarter turn.



HORIZONTAL SECTION FOUR-WAY VALVE



FIG. 14. HOMESTEAD FOUR-WAY VALVE
For 600 lbs. working pressure

DATA, BRASS FOUR-WAY VALVES
600 LBS. WORKING PRESSURE

Size, in.	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Scr. e. to e.	4 1/4	5	5 7/8	6 1/8	7 1/4	9 1/4	11 1/4	11 3/4	11 3/4
Price,	\$12.77	20.10	25.10	45.10	51.00	64.60	90.90	122.10	180.60

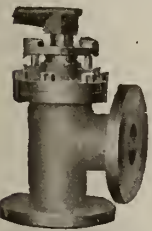


FIG. 16. HOMESTEAD ANGLE VALVE



FIG. 17. HOMESTEAD STRAIGHTWAY VALVE



FIG. 19. HOMESTEAD THREE-WAY VALVE

200 lbs. working pressure, semisteel body

DATA, HOMESTEAD BRASS ANGLE VALVES
200 LBS. WORKING PRESSURE

Size, in.	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2
Scr. outlet to face of inlet. .	1 1/2	1 3/4	2 1/4	2 1/2	2 5/8	3 1/2	4
Flgd. outlet to face of inlet. .					4	4 1/4	4 3/4
Price, scr.	\$7.20	8.70	13.30	15.00	16.60	29.20	40.00
Price, flgd.				\$18.30	20.80	35.83	49.73

500 LBS. WORKING PRESSURE

Size, in.	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Price, scr. . .				\$8.33	10.00	15.83	18.33	23.33	33.33	50.00	
Price, flgd. . .						\$23.33	25.00	30.00	46.66	73.33	123.33

Homestead Semisteel Valves.

Homestead semisteel valves are used extensively on superheated lines. This is particularly true in the oil industry, where valves are used with entire success on vapors superheated to 700° Fahr. Homestead semisteel valves are also used on superheated steam lines in the power plant, where the results are at least equal to those usually obtained from cast steel valves.

DATA, HOMESTEAD SEMISTEEL BODY STRAIGHTWAY VALVES
200 LBS. WORKING PRESSURE

Size, in.	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6
Scr. e. to e. . .	4 1/8	4 3/8	5	6 1/2	7 1/4	10	12 1/2	12 1/2	17 1/2	
Flgd. f. to f. . .	4 7/8	6 1/4	6 1/4	8 1/2	9 3/8	11	12 1/2	14	16	
Diam. of flgs. . .	4 1/2	5	6	6 1/2	7 1/2	8 1/4	10	11 1/4	12 1/2	
Price, scr. . . .	\$10.22	10.22	12.80	16.66	24.00	35.55	62.22	97.82	137.82	151.15
Price, flgd. . .		\$12.22	15.55	20.00	31.69	47.55	82.22	120.00	166.66	217.77

DATA, HOMESTEAD SEMISTEEL BODY THREE-WAY VALVES
200 LBS. WORKING PRESSURE

Size, in.	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6
Scr. e. to e. of run. .	4 3/4	5 7/8	6	6 3/4	9	10	12 1/4		
Scr. cent. of run to end of side op'ng	2 1/2	3 1/8	3 1/4	3 1/2	4 1/2	5 3/4	6 1/8		
Flgd. f. to f. of run. .		5 3/4	6 1/8	8	10	10 3/4			
Price, scr.	\$19.86	23.33	26.66	40.00	55.55	75.55	127.77	177.77	244.44
Price, flgd.	\$26.66	31.11	34.66	52.76	75.60	100.05	155.55	200.00	271.15

DATA, HOMESTEAD ALL-SEMISTEEL STRAIGHTWAY VALVES
200 LBS. WORKING PRESSURE

Size, in.	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6
Scr. e. to e. of run. .	4 1/8	4 3/8	5	6 1/2	7 1/4	10	12 1/2	12 1/2	17 1/2
Flgd. f. to f. of run. .	4 7/8	6 1/4	6 1/4	8 1/2	9 3/8	11	12 1/2	14	16
Diam. of flgs.	4 1/2	5	6	6 1/2	7 1/2	8 1/4	10	11 1/4	12 1/2
Price, scr.	\$10.66	14.67	16.00	21.92	36.00	60.00	88.00	124.00	170.00
Price, flgd.	\$14.67	16.00	21.33	28.53	46.83	78.03	108.00	150.03	196.00

Similar to Fig. 3.

DATA, HOMESTEAD ALL-SEMISTEEL THREE-WAY VALVES
200 LBS. WORKING PRESSURE

Size, in.	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6
Scr. e. to e. of run. .	4 3/4	5 7/8	6	7	9	10	12 1/4		
Scr. cent. of run to end of side op'ng	2 1/2	3 1/8	3 1/4	4	4 1/2	5 3/4	6 1/8		
Flgd. f. to f. of run. .		5 3/4	6 1/8	8	10	10 3/4			
Price, scr.	\$21.33	26.66	29.33	40.00	57.33	75.63	144.00	186.66	220.00
Price, flgd.	\$26.66	32.00	34.66	47.04	64.00	85.33	160.00	202.64	244.00

DATA, HOMESTEAD ALL-SEMISTEEL FOUR-WAY VALVES
200 LBS. WORKING PRESSURE

Size, in.	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Scr. e. to e. of run.		6	6 1/2	7 1/4	9 1/4	11 1/4	11 3/4
Price, scr.	\$23.68	42.35	48.00	60.80	77.33	114.93	160.00

Homestead Cast Steel Valves.

These valves are constructed on the same principle as the other Homestead valves described before. See data tabulated below.

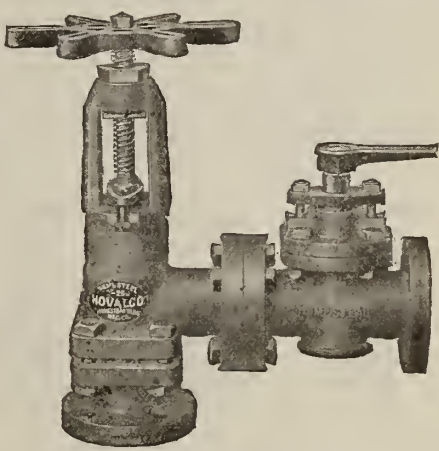
DATA, HOMESTEAD CAST STEEL VALVES

Size, in.	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6
Scr. e. to e.	4 1/8	4 3/8	5	6 1/2	7 1/4	10	12 1/2	12 1/2	17 1/2
Flgd. f. to f.	4 7/8	5 1/4	6 1/4	8 1/2	9 3/8	11	12 1/2	14	16
Price, scr.	\$16.00	24.00	26.66	48.00	66.66	146.66	242.66	266.66	333.33
Price, flgd.	\$34.66	37.33	48.00	66.66	88.00	186.66	266.66	346.66	413.33
Drilling flgs. net. . .			\$0.25	.35	.60	1.00	1.25	1.75	2.25

"Hovalco" Blow-off Valves.

Exceptionally well constructed. Body is made of semisteel and seat and disk of special composition. Passage is free and unobstructed, and seat or disk can easily be removed, renewed or re-ground.

Once installed, valve should outlast the boiler.



COMBINATION OF "HOVALCO" RENEWABLE BLOW-OFF VALVE AND HOMESTEAD QUARTER TURN VALVE

Designed for use in connection with the Homestead quarter turn valve when a double blow-off valve is required. Combination shown of these two valves is approved and used in many power plants today

DATA, "HOVALCO" BLOW-OFF VALVES
250 LBS. WORKING PRESSURE

Size, in.	1 1/2	2	2 1/2	3
Price, scr. . . .	\$22.00	27.00	32.50	41.00
Price, flgd. . .	\$23.00	28.32	33.56	43.00



SECTION OF "HOVALCO" BLOW-OFF VALVE

JENKINS BROS.

Manufacturers of Valves and Sheet Packing

80 White Street 524 Atlantic Avenue 133 North 7th Street 646 Washington Boulevard
NEW YORK, N. Y. BOSTON, MASS. PHILADELPHIA, PA. CHICAGO, ILL.

JENKINS BROS., LIMITED: CANADIAN WORKS AND HEAD OFFICE, MONTREAL, QUE., 103 St. Remi Street
JENKINS BROS., LIMITED: LONDON OFFICE, 6 Great Queen Street, Kingsway
JENKINS RUBBER CO.: WORKS AND HEAD OFFICE, ELIZABETH, N. J.

Products.

VALVES in BRASS, IRON BODY and CAST STEEL, for all pressures and purposes; MECHANICAL RUBBER GOODS, including SHEET PACKING, GASKETS, GASKET TUBING, VALVE DISCS, UNION RINGS and the like; PUMP VALVES.

Gauge Cocks, Steam Traps, Compressed Asbestos Jointing and Gaskets.



lbs. working pressure. Sizes 1/8 to 3 in. screwed or flanged.

Jenkins brass swing check valves, standard pattern, are made with globe shaped bodies, adapted for either horizontal or vertical installation; have renewable disc feature same as the horizontal pattern; and are suitable for same working pressures. Sizes 1/8 to 3 in., screwed or flanged.

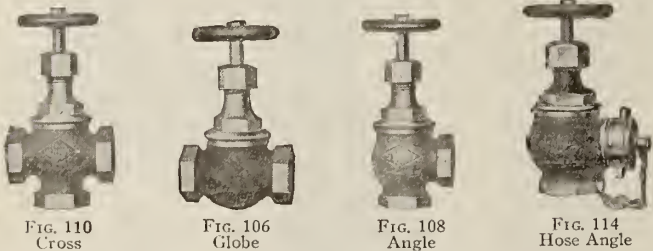
Jenkins Valves, Standard Pattern.

They represent a distinct type of valve as compared with regrinding, bevel or flat-seated valves. Instead of using a solid metal clapper, they contain a disc holder of brass or other suitable metal, and a removable disc of softer material, preferably Jenkins composition disc. This disc in service presents a slightly yielding surface to the valve seat and is flexible enough to adapt itself to any slight inequalities in the seat, insuring perfect contact. Should the disc be injured, it is only necessary to remove it and replace with a new one, which can be done by any mechanic.

Jenkins valves have full opening. They are made of a special high grade steam metal and contain, besides the Jenkins disc, other features found only in the genuine Jenkins valves.

Jenkins Brass Globe, Angle and Cross Valves.

Screwed or flanged, are regularly furnished with Jenkins No. 119 discs, suitable for 150 lbs. working steam pressure. When specified for cold water, valves are fitted with No. 93 discs, suitable for working water pressure up to 250 lbs. Regular sizes 1/8 to 3 in. Larger sizes in brass made from iron body patterns.



BRASS VALVES, STANDARD PATTERN

BRASS CHECK VALVES, STANDARD PATTERN—Jenkins brass horizontal, angle and vertical check valves correspond to same standard as the standard pattern globe and angle valves. Regularly furnished with Jenkins disc of semihard composition which will soften slightly under the action of hot water as required for boiler feed lines. When specified for cold water, air or gas, a softer and more flexible rubber disc is supplied, usually Jenkins No. 93 composition. Suitable for 150



BRASS CHECK VALVES, STANDARD PATTERN

JENKINS Y VALVES—Besides their extensive use for blow-off service, they are particularly desirable for handling muddy or gritty water. Have renewable seat rings and Jenkins discs; suitable for 150 lbs. working steam pressure, or 250 lbs. working water pressure. Brass valves, sizes 3/8 to 3 in.; iron body valves, 2 to 8 in., inclusive.



Fig. 124
BRASS Y VALVE

DIMENSIONS OF BRASS VALVES, STANDARD PATTERN

Size, in.	Fig.	*	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Globe, scr.....	106	A	1 3/16	2 1/8	2 3/8	2 3/4	3 1/8	3 1/2	4 1/4	4 7/8	5 3/4	6 5/8	8 1/2
Globe, flg.....	107	B	1 1/8	2 1/8	3 1/8	3 1/2	3 3/8	4	4 7/8	5 1/2	6 1/4	7 1/2	9 1/4
Angle, scr.....	108	C	1 1/8	1 3/8	1 3/4	2 1/8	2 1/4	2 1/2	2 3/4	3 1/4	3 3/4	4 1/4	5 1/4
Angle, flg.....	109	D	1 1/8	1 3/8	2 1/8	2 1/4	2 1/2	2 3/4	3 1/4	3 3/4	4 1/4	5 1/4	6 1/4
Globe,scr. or flg.	106-107	G	2 3/8	3 3/8	4 3/8	5 3/8	6 3/8	7 3/8	8 3/8	9 3/8	10 3/8	11 3/8	12 3/8
Angle,scr. or flg.	108-109	G	2 3/4	3 3/4	4 3/4	5 3/4	6 3/4	7 3/4	8 3/4	9 3/4	10 3/4	11 3/4	12 3/4
Horiz.check,scr.	117	A	1 1/8	2 1/8	2 3/8	2 3/4	3 1/8	3 1/2	4 1/4	4 7/8	5 3/4	6 5/8	8 1/2
Horiz.check,flg.	120	B	1 1/8	2 1/8	3 1/8	3 1/2	3 3/8	4	4 7/8	5 1/2	6 1/4	7 1/2	9 1/4
Angle check,scr.	118	C	1 1/8	1 3/8	2 1/8	2 1/4	2 1/2	2 3/4	3 1/4	3 3/4	4 1/4	5 1/4	6 1/4
Angle check,flg.	120A	D	1 1/8	1 3/8	2 1/8	2 1/4	2 1/2	2 3/4	3 1/4	3 3/4	4 1/4	5 1/4	6 1/4
Horiz. and angle	117-120A	GC	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3 1/4	3 3/4	4 1/4	5 1/4
Vertical, scr....	119	HC	1 3/4	2 3/8	2 1/4	3 1/4	3 1/2	4 1/4	4 7/8	5 3/4	6 5/8	8 1/2	10 1/4
Vertical, flg....	120B	I	1 1/8	2 1/8	3 1/8	3 1/2	3 3/8	4	4 7/8	5 1/2	6 1/4	7 1/2	9 1/4
Y, scr.....	124	A	1 1/8	2 1/8	2 3/8	2 3/4	3 1/8	3 1/2	4 1/4	4 7/8	5 3/4	6 5/8	8 1/2
Y, flg.....	125	B	1 1/8	2 1/8	3 1/8	3 1/2	3 3/8	4	4 7/8	5 1/2	6 1/4	7 1/2	9 1/4
Y, scr. or flg...	124-125	G	1 1/8	2 1/8	2 3/8	2 3/4	3 1/8	3 1/2	4 1/4	4 7/8	5 3/4	6 5/8	8 1/2
Swing check,scr.	352	A	1 1/8	2 1/8	2 3/8	2 3/4	3 1/8	3 1/2	4 1/4	4 7/8	5 3/4	6 5/8	8 1/2
Swing check,flg.	353	B	1 1/8	2 1/8	3 1/8	3 1/2	3 3/8	4	4 7/8	5 1/2	6 1/4	7 1/2	9 1/4
Swing check,scr. or flg.....	352-353	GC	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3 1/4	3 3/4	4 1/4	5 1/4

*A—Face to face, screwed. G—Center to top of hand wheel, open.
B—Face to face, flanged. GC—Center to top of cap.
C—Angle, center to face, screwed. HC—Vertical, face to face, screwed
D—Angle, center to face, flanged. I—Vertical, face to face, flanged.

JENKINS BRASS WHISTLE VALVES—Quick acting, spring and lever operated valves. A pull of lever opens them and they automatically close by means of spring as soon as lever is released.

Can be used for steam whistles, for hydraulic presses, for emergency stop, for shower baths, etc., wherever a quick opening valve is required. Made in brass with malleable iron levers, from 3/8 to 3 in.

Continued on next page

Jenkins Iron Body Valves, Standard Pattern.

These are heavier and stronger than the average iron body valves. They have renewable seat rings and Jenkins discs; and are suitable for same working pressures as the standard pattern brass valves. Globe and angle valves made in sizes 2 to 24 in., inclusive; cross valves up to 8 in. Flanges A. S. M. E. standard dimensions.

Jenkins iron body horizontal, angle, vertical and swing check valves made in sizes 2 to 10 in.; suitable for working pressures up to 150 lbs.

Fig. 142
GlobeFig. 143
AngleFig. 146
CrossFig. 294
Check

IRON BODY VALVES, STANDARD PATTERN

DIMENSIONS OF IRON BODY, GLOBE, ANGLE, CHECK AND Y VALVES, STANDARD PATTERN

Size, in.	Fig.	*	2	2½	3	3½	4	4½	5	6	7	8	9	10	12	14	16	18	20	24
Globe, scr.....	141	A	6½	7¾	9¾	10	12	12½	13¼	16	16½	18¾	20	21½	25¾	30½	34	38	42	50
Globe, fig.....	142	B	7½	8	9½	10	11¾	12½	13½	16	16½	18½	20	21¼	24½	30	34	38	42	50
Angle, scr.....	143	C	3½	3¾	4½	5	6	6½	6¾	8	8½	9¾	10	10¾	12½	15	17	19	21	25
Angle, fig.....	144	D	3¾	4½	4¾	5½	5¾	6½	6¾	8	8	9¼	10	10½	12¼	15	17	19	21	25
Globe, scr. or fig.....	141-142	G	9¼	11	12½	13½	14¾	15¼	17	18½	21	22	22½	24½	29	32½	39½	40	42¾	47½
Angle, scr. or fig.....	143-144	G	10¼	11¾	13¾	14¾	15	15¾	17½	19	21¾	23¾	24	25	31	33	40½	41	45½	51½
Horiz. check, scr.....	151	A	6½	7¾	9¾	10	12	12½	13¼	16	16½	18¾	20	21½	25¾	30½	34	38	42	50
Horiz. check, fig.....	153	B	7½	8	9½	10	11¾	12½	13½	16	16½	18½	20	21¼	24½	30	34	38	42	50
Angle check, scr.....	152	C	3½	3¾	4½	5	6	6½	6¾	8	8½	9¾	10	10¾	12½	15	17	19	21	25
Angle check, fig.....	153A	D	3¾	4½	4¾	5½	5¾	6½	6¾	8	8	9¼	10	10½	12¼	15	17	19	21	25
Horiz. and angle.....	151-153A	GC	4	4¾	5¾	5¾	6¼	7	7¾	9	9	10¼	11	12½	14½	17¾	19	19¾	23¾	
Swing check, scr.....	294	A	6½	7¾	9¾	10	12	12½	13¼	16	16½	18¾	20	21½	25¾	30½	34	38	42	50
Swing check, fig.....	295	B	7½	8	9½	10	11¾	12½	13½	16	16½	18½	20	21¼	24½	30	34	38	42	50
Swing check, scr. and fig.....	294-295	GC	3¼	4½	4¾	5¼	5¾	6¾	7¾	8½	9¾	10	11	11¾	11	13¾				
Y or blow-off, scr.....	296	A	8	9½	11½	12	14	15	16	18	19	21	22	24	28	32	36	40	44	52
Y or blow-off, fig.....	297	B	9½	11	12½	14	16	18	19	21	22	24	25	27	31	35	40	44	48	56
Y or blow-off, scr. or fig.....	296-297	GC	12	14	16	18	20	22	24	26	28	30	32	34	38	42	46	50	54	62
Adams or Y, scr.....	149	A	8	9½	11½	12	14	15	16	18	19	21	22	24	28	32	36	40	44	52
Adams or Y, fig.....	150	B	9½	11	12½	14	16	18	19	21	22	24	25	27	31	35	40	44	48	56
Adams or Y, scr. or fig.....	149-150	G	12	14	16	18	20	22	24	26	28	30	32	34	38	42	46	50	54	62

*A—Face to face, screwed.
B—Face to face, flanged.

C—Angle, center to face, screwed.
D—Angle, center to face, flanged.

G—Center to top of hand wheel, open.
GC—Center to top of cap.

HC—Vertical, face to face, screwed.
I—Vertical, face to face, flanged.

Jenkins All-iron Valves.

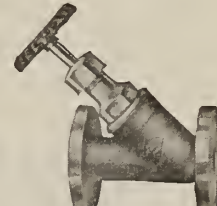
These are recommended for service in places where, on account of possible corrosion, no brass mountings of any kind can be employed, as in the handling of solutions of cyanide, saltpetre, caustic potash, and the like.

All-iron globe and angle valves, with screwed bonnets, sizes ½ to 2 in.; with yoke, sizes to 2½ in. and up; horizontal and angle check valves, ½ in. and up.

All-iron gate valves with solid iron double face wedge, with screwed bonnets, sizes ¼, ⅜ and ½ in.; with bolted bonnets, ¾ in. and up.

Fig. 97
GateFig. 79
Globe

ALL-IRON VALVES

Fig. 128
GlobeFig. 129
GlobeFig. 130
AngleFig. 135
Y or Blow-offFig. 263
Horizontal
CheckFig. 132
Angle
CheckFig. 260
Swing
Check

BRASS GLOBE, ANGLE, Y AND CHECK VALVES, EXTRA HEAVY PATTERN

Size, in.	Fig.	*	¼	⅜	½	¾	1	1¼	1½	2	2½	3
Globe, scr.....	128	A	2¼	2½	2¾	3¼	4½	4¾	5¾	6¼	7½	8¾
Globe, fig.....	129	B	3	3½	3¾	4¼	4¾	5¾	6¼	7½	8¾	9¾
Angle, scr.....	130	C	1½	1¾	1¾	2¼	2¾	2¾	2¾	3¾	3¾	4¾
Angle, fig.....	131	D	1½	1¾	2¼	2¾	2¾	3¾	3¾	4¾	4¾	5¾
Globe, scr. or fig.....	128-129	G	4	4¼	4¾	5¾	6¾	7½	8¾	9¾	11¾	12¾
Angle, scr. or fig.....	130-131	G	3¾	4¼	4¾	5¾	6¾	7½	8¾	10¾	12¾	13¾
Horiz. check, scr.....	263	A	2¼	2½	2¾	3¼	4½	4¾	5¾	6¼	7½	8¾
Horiz. check, fig.....	133	B	3	3½	3¾	4¼	4¾	5¾	6¼	7½	8¾	9¾
Angle check, scr.....	132	C	1½	1¾	1¾	2¼	2¾	2¾	2¾	3¾	3¾	4¾
Angle check, fig.....	133A	D	1½	1¾	2¼	2¾	2¾	3¾	3¾	4¾	4¾	5¾
Horiz. and angle.....	263-133A	GC	2½	2¾	3¼	3¾	4½	4¾	5¾	6¼	7½	8¾
Swing check, scr.....	260	A	2¼	2½	2¾	3¼	4½	4¾	5¾	6¼	7½	8¾
Swing check, fig.....	262	B	3	3½	3¾	4¼	4¾	5¾	6¼	7½	8¾	9¾
Swing check, scr. or fig.....	260-262	GC	2½	2¾	3¼	3¾	4½	4¾	5¾	6¼	7½	8¾
Y, scr.....	134	A	3½	4¼	4¾	5¾	6¾	7½	8¾	9¾	11¾	12¾
Y, fig.....	135	B	4½	5	5¾	6¾	7½	8¾	9¾	11¾	12¾	13¾
Y, scr. or fig.....	134-135	G	5¾	6¾	7½	8¾	9¾	10¾	12¾	15	16½	18½

*A—Face to face, screwed.

B—Face to face, flanged.

C—Angle, center to face, screwed.

D—Angle, center to face, flanged.

G—Center to top of hand wheel, open.

GC—Center to top of cap.

Iron Body Valves, Extra Heavy Pattern.

The extra heavy pattern iron body globe, angle, cross and Y valves are suitable for 250 lbs. working steam pressure, or 400 lbs. working water pressure. The bodies, yokes and disc holders are high grade cast iron; the spindles are of manganese bronze; the renewable seat rings and discs of durable steam metal composition.

All flanged valves have 1/16-in. raised faces inside of bolt holes, and flange dimensions are in accordance with the American extra heavy standard. When drilling is ordered, it will also be in accordance with the American extra heavy standard, unless otherwise ordered.



Fig. 162a
Globe, Screwed



Fig. 162
Globe, Flanged



Fig. 164c
Angle, Flanged

IRON BODY GLOBE AND ANGLE VALVES, EXTRA HEAVY PATTERN

DIMENSIONS OF IRON BODY GLOBE, ANGLE, CHECK AND Y VALVES, EXTRA HEAVY PATTERN

Size, in.	Fig.	*	2	2½	3	3½	4	4½
Globe, scr.....	162A	A	7¾	9	10¼	11½	12¾	14
Globe, flg.....	162	B	9	10	11¾	12¾	13¾	14½
Angle, scr.....	163A	C	3¾	4½	5½	5¾	6¾	7
Angle, flg.....	163	D	4½	5	5¾	6¼	6½	7¼
Globe, scr. or flg.....	162A-162	G	12½	14½	15¾	16¾	17¾	18¾
Angle, scr. or flg.....	163A-163	G	14	15	16	17½	18¾	19¾
Horiz. check, scr.....	265	A	7¾	9	10¼	11½	12¾	14
Horiz. check, flg.....	266	B	9	10	11¾	12¾	13¾	14½
Angle check, scr.....	267	C	3¾	4½	5½	5¾	6¾	7
Angle check, flg.....	268	D	4½	5	5¾	6¼	6½	7¼
Horiz. and angle.....	265-268	GC	4½	4¾	5¼	5¾	6	6¾
Swing check, scr.....	338	A	7¾	9	10¼	11½	12¾	14
Swing check, flg.....	339	B	9	10	11¾	12¾	13¾	14½
Swing check, scr. or flg.....	338-339	GC	4½	4¾	5¼	5¾	6	6¾
Y or blow-off, scr.....	336	A	9	10	11¾	12¾	13¾	14½
Y or blow-off, flg.....	337	B	10¾	12½	14	.....	.....	.....
Y or blow-off, scr. or flg.....	336-337	G	14¾	16½	18½	.....	.....	.....

Size, in. (continued)	Fig.	*	5	6	7	8	9	10	12
Globe, scr.....	162A	A	15	17	18	19½	21	23	26
Globe, flg.....	162	B	15½	17	18½	20	21½	23	26
Angle, scr.....	163A	C	7½	8½	9	9¾	10½	11½	13
Angle, flg.....	163	D	7¾	8½	9¼	10	10½	11½	13
Globe, scr. or flg.....	162A-162	G	19¾	22½	23½	25	26½	28¾	32
Angle, scr. or flg.....	163A-163	G	20¾	23½	24½	25½	27	29¼	32½
Horiz. check, scr.....	265	A	15	17	18	19½	21	23	26
Horiz. check, flg.....	266	B	15½	17	18½	20	21½	23	26
Angle check, scr.....	267	C	7½	8½	9	9¾	10½	11½	13
Angle check, flg.....	268	D	7¾	8½	9¼	10	10½	11½	13
Horiz. and angle.....	265-268	GC	6¾	7¾	8½	9¼	10	10¾	12½
Swing check, scr.....	338	A	15	17	18	19½	21	23	26
Swing check, flg.....	339	B	15½	17	18½	20	21½	23	26
Swing check, scr. or flg.....	338-339	GC	6¾	7¾	8½	9¼	10	10¾	12½

*A—Face to face, screwed. D—Angle, center to face, flanged.
B—Face to face, flanged. G—Center to top of hand wheel, open.
C—Angle, center to face, screwed. GC—Center to top of cap.

Cast Steel Valves.

To meet the requirements of high pressure superheated steam and hydraulic service, JENKINS BROS. manufacture a line of cast steel valves. The globe, angle and cross valves have bodies and bonnets of cast steel; and the spindles, seat rings, discs and disc rings are of monel metal. All connecting flanges are made with 1/16-in. raised faces inside of bolt holes. When ordered with flanges faced and drilled, the bolt holes will always be spot faced unless otherwise specified. Globe, angle, cross and swing check valves in sizes 2 to 12 in., inclusive, suitable for working steam pressure up to 350 lbs., and total temperature of 800° Fahr.

Automatic Equalizing Stop and Check Valves.

These valves are designed to shut off, automatically, the flow of steam from the header to a boiler in case a tube should burst or other internal rupture occur, thereby suddenly reducing the pressure in the boiler. They also serve to equalize the pressure in a battery of boilers and prevent one boiler from working at a lower pressure than the others. As the valves can only be opened by the pressure in the boiler, it is impossible to turn steam accidentally into a boiler which is being cleaned. To prevent chattering, the valve is cushioned by an internal dashpot, made of bronze, which eliminates all danger of sticking through corrosion. The stuffing boxes can be packed when valve is wide open and under full pressure. Each iron body valve is carefully tested to 800 lbs. hydraulic pressure, and is guaranteed for working steam pressures up to 250 lbs. When made with cast steel bodies and bonnets, and monel metal trimmings, they are suitable for 350 lbs. working steam pressure. Sizes 4 to 8 in.



FIG. 293
AUTO.
EQUALIZ-
ING STOP
AND
CHECK
VALVE

Jenkins Gate Valves.

All Jenkins gate valves are of the solid wedge, double face type. The bodies are globe shaped, a design which secures great strength, good proportion and neat appearance. All patterns are made with inside screw, stationary spindle, or outside screw and yoke, rising spindle. The latter are particularly recommended for the higher pressures, as the spindle is more easily lubricated, increasing its durability. The traveling spindle also serves as an indicator, by means of which it can be seen at a glance whether the valve is open or closed. All the valves can be repacked under pressure when wide open, and all parts are renewable and interchangeable. The iron body and cast steel valves in the larger sizes are made with or without by-pass.

Valves can also be furnished with hub ends and square head stem, with spur, bevel or special styles of gearing, with floor stands or indicator posts, and various other operating mechanisms.

STANDARD PATTERN—Brass, sizes ¼ to 3 in. Iron body, sizes 2 to 30 in. For working pressures 125 lbs. steam, 175 lbs. water. All-iron, sizes, ¼ to 30 in.

MEDIUM PRESSURE PATTERN—Brass, sizes ¼ to 3 in. Iron body, sizes 2 to 18 in. For working pressures 175 lbs. steam, 250 lbs. water.

EXTRA HEAVY PATTERN—Brass, sizes ½ to 3 in. Iron body, sizes 1½ to 24 in. For working pressures 250 lbs. steam, 400 lbs. water.

EXTRA HEAVY PATTERN—Cast steel, sizes 1½ to 24 in. For working pressures 350 lbs. steam, and total temperature of 800° Fahr.

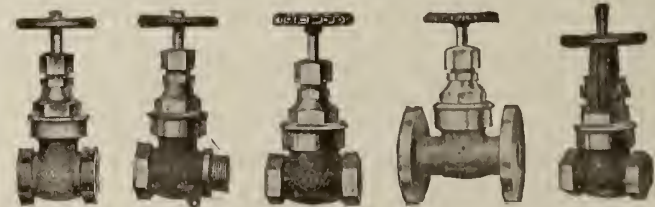


FIG. 370
Standard Pattern
FIG. 372
FIG. 280
FIG. 281
Extra Heavy Pattern
FIG. 282
BRASS GATE VALVES

DIMENSIONS OF BRASS GATE VALVES

Size, in.	Fig.	*	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
I. S., scr.	370	A	1 1/4	1 3/8	1 1/2	2 1/8	2 1/4	3	3 3/8	4	4 1/4	5 3/4
I. S., flg.	371	B	2 1/4	2 5/8	2 1/2	3 3/8	3 1/4	4 1/2	4 5/8	5 3/4	6 1/2	7 3/8
I. S., scr. or flg.	370, 371	G	3 1/2	3 3/8	3 1/4	4 1/8	4 1/4	5 1/2	5 3/4	6 3/4	7 3/4	8 3/4
O. S. and Y.	368	G	3 1/2	3 3/8	3 1/4	4 1/8	4 1/4	5 1/2	5 3/4	6 3/4	7 3/4	8 3/4
O. S. and Y.	368, 369	H	3 1/2	3 3/8	3 1/4	4 1/8	4 1/4	5 1/2	5 3/4	6 3/4	7 3/4	8 3/4
I. S., scr.	270	A	2 1/4	2 5/8	2 1/2	3 3/8	3 1/4	4 1/2	4 5/8	5 3/4	6 1/2	7 3/8
I. S., flg.	271	B	2 1/4	2 5/8	2 1/2	3 3/8	3 1/4	4 1/2	4 5/8	5 3/4	6 1/2	7 3/8
I. S., scr. or flg.	270, 271	G	3 1/2	3 3/8	3 1/4	4 1/8	4 1/4	5 1/2	5 3/4	6 3/4	7 3/4	8 3/4
O. S. and Y.	275, 276	G	3 1/2	3 3/8	3 1/4	4 1/8	4 1/4	5 1/2	5 3/4	6 3/4	7 3/4	8 3/4
O. S. and Y.	275, 276	H	3 1/2	3 3/8	3 1/4	4 1/8	4 1/4	5 1/2	5 3/4	6 3/4	7 3/4	8 3/4
I. S., scr.	280	A	2 1/4	2 5/8	2 1/2	3 3/8	3 1/4	4 1/2	4 5/8	5 3/4	6 1/2	7 3/8
I. S., flg.	281	B	2 1/4	2 5/8	2 1/2	3 3/8	3 1/4	4 1/2	4 5/8	5 3/4	6 1/2	7 3/8
I. S., scr. or flg.	280, 281	G	3 1/2	3 3/8	3 1/4	4 1/8	4 1/4	5 1/2	5 3/4	6 3/4	7 3/4	8 3/4
O. S. and Y.	282, 283	G	3 1/2	3 3/8	3 1/4	4 1/8	4 1/4	5 1/2	5 3/4	6 3/4	7 3/4	8 3/4
O. S. and Y.	282, 283	H	3 1/2	3 3/8	3 1/4	4 1/8	4 1/4	5 1/2	5 3/4	6 3/4	7 3/4	8 3/4

*A—Face to face, screwed.
B—Face to face, flanged.

G—Center to top of hand wheel, open.
H—Center to top of spindle, rising spindle, open.

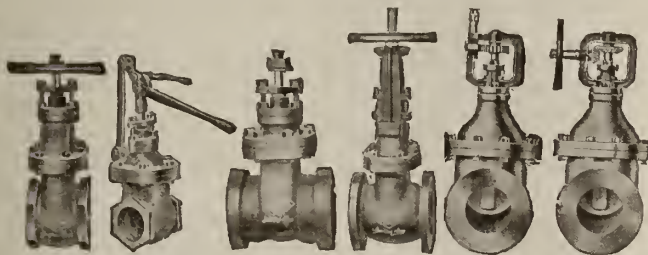


FIG. 325 Inside Screw
FIG. 334 Quick Opening, Sliding Stem and Lever
FIG. 327 Hub Ends
FIG. 331 With Yoke
FIG. 346 With Spur Gear
FIG. 348 With Bevel Gear

IRON BODY, COMPOSITION MOUNTED GATE VALVES, STANDARD PATTERN



FIG. 204b O. S. and Y. Rising Spindle with By-pass
FIG. 204 O. S. and Y. Rising Spindle Without By-pass
FIG. 203 Inside Screw, Stationary Spindle

EXTRA HEAVY IRON BODY, COMPOSITION MOUNTED GATE VALVES

DIMENSIONS OF IRON BODY, COMPOSITION MOUNTED GATE VALVES, STANDARD PATTERN

Size, in.	Fig.	*	2	2 1/2	3	3 1/2	4	4 1/2	5	6
I. S. or O. S. and Y., scr.	325, 330	A	5 1/8	5 7/8	6 1/8	6 1/2	6 7/8	7 1/8	7 3/8	7 3/4
I. S. or O. S. and Y., flg.	326, 331	B	7	7 1/2	8	8 1/2	9	9 1/2	10	10 1/2
I. S., scr. or flg.	325, 326	G	10 5/8	11 1/8	13 1/8	14 1/8	15 5/8	16 1/2	18 3/8	20
O. S. and Y., scr. or flg.	330, 331	G	11 1/8	13	15 1/8	16 3/4	18 7/8	20	22 3/8	25 1/4
O. S. and Y.		H	14	15 1/4	18 1/2	20 3/8	23 1/4	24 3/4	27 1/2	31

Size, in. (continued)	Fig.	*	7	8	9	10	12	14	15	16
I. S. or O. S. and Y., scr.	325, 330	A	8 1/4	8 3/4	9 1/4	9 3/4	11 1/8			
I. S. or O. S. and Y., flg.	326, 331	B	11	11 1/2	12	13	14	15	15	16
I. S., scr. or flg.	325, 326	G	22 1/4	25	26 7/8	29 3/8	33	37 1/2	39	40 1/2
O. S. and Y., scr. or flg.	330, 331	G	28 1/4	31 7/8	34 3/8	36 3/4	43 3/8	51	53 1/2	58
O. S. and Y.		H	36	39 3/4	42 3/8	48 3/4	57 1/8	66 1/4	69 3/4	74 3/4

Size, in. (continued)	Fig.	*	18	20	22	24	26	28	30
I. S. or O. S. and Y., scr.	325, 330	A							
I. S. or O. S. and Y., flg.	326, 331	B	17	18	19	20	23	26	30
I. S., scr. or flg.	325, 326	G	46 1/2	49 3/4	53 1/2	60	63 1/2	68	73
O. S. and Y., scr. or flg.	330, 331	G	63 1/2	69	75	83	90	96	100 1/2
O. S. and Y.		H	86	91	100	109	117 1/2	125	133

DIMENSIONS OF IRON BODY, COMPOSITION MOUNTED GATE VALVES (MEDIUM PRESSURE)

Size, in.	Fig.	*	2	2 1/2	3	3 1/2	4	4 1/2	5	6	7
I. S. or O. S. and Y., scr.	251, 277	A	5 1/2	6	7 1/4	7 1/2	7 3/4	8 1/4	8 1/2	8 3/4	9 1/4
I. S. or O. S. and Y., flg.	255, 252	B	7 1/2	8	9 1/2	10	10 1/2	11	11 1/2	12	12 1/2
I. S., scr. or flg.	251, 255	G	11 1/4	12 1/4	14	14 3/4	16 1/4	17	19	21	22 1/2
O. S. and Y., scr. or flg.	277, 252	G	11 1/4	12 1/4	14 7/8	16 1/2	18 3/4	20	22 3/8	25 1/4	28
O. S. and Y.		H	14	15 1/2	18 3/8	20 1/2	23 3/4	25	28 1/2	31 1/2	35 3/4

Size, in. (cont'd)	Fig.	*	8	9	10	12	14	15	16	18	20
I. S. or O. S. and Y., scr.	251, 277	A	10	10 3/4	11 1/2	12 1/2					
I. S. or O. S. and Y., flg.	255, 252	B	13 1/2	14	15	16	18	18 3/4	19 1/2	21	22 1/2
I. S., scr. or flg.	251, 255	G	25 1/2	27 1/2	30 1/2	33 3/4	38 1/2	41	44 3/4	47 1/2	51 1/2
O. S. and Y., scr. or flg.	277, 252	G	31 3/4	34 1/4	38 3/8	43 5/8	49 3/4	52 3/4	57	63 3/8	69 3/4
O. S. and Y.		H	40 3/4	44 1/4	49 3/4	56 1/2	64 1/2	68 3/4	74 1/2	82 1/2	90 3/4

(EXTRA HEAVY)

Size, in.	Fig.	*	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2
I. S. or O. S. and Y., scr.	203A, 204A	A	6 1/4	7	8	9	10	11	12 1/4
I. S. or O. S. and Y., flg.	203, 204, 386	B	7 1/4	8 1/2	9 1/2	11 1/4	11 1/2	12	13 1/4
I. S., scr. or flg.	203A, 203, 386	G	9 1/4	10 1/2	12 1/2	14 3/4	15 3/4	17 1/2	18 1/2
O. S. and Y., scr. or flg.	204A, 204, 388	G	10 1/4	11 1/4	14 3/8	16 3/4	18 1/8	19 1/2	22 1/2
O. S. and Y.		H	12 1/2	13 1/4	17 1/8	20 1/2	22 1/4	24 1/2	27 1/4

Size, in. (continued)	Fig.	*	5	6	7	8	9	10	12
I. S. or O. S. and Y., scr.	203A, 204A	A	13 1/2	15 7/8	16 1/4	16 1/2	17	18	
I. S. or O. S. and Y., flg.	203, 204, 386	B	15	15 1/2	16 1/4	16 1/2	17	18	19 1/4
I. S., scr. or flg.	203A, 203, 386	G	20 1/2	22 1/4	24 3/4	28	30 1/4	33 3/4	37
O. S. and Y., scr. or flg.	204A, 204, 388	G	24 1/2	27 1/4	30 3/8	34	37 3/4	41 3/4	47
O. S. and Y.		H	30 1/4	34 1/4	38 3/8	42 7/8	47 1/4	52 1/4	60

Size, in. (continued)	Fig.	*	14	15	16	18	20	24
I. S. or O. S. and Y., scr.	203A, 204A	A						
I. S. or O. S. and Y., flg.	203, 204, 386	B	22 1/2	22 1/2	24	26	28	31
I. S., scr. or flg.	203A, 203, 386	G	43	43	46			
O. S. and Y., scr. or flg.	204A, 204, 388	G	53 1/4	53 1/4	57 3/4	64 1/2	70	82 1/2
O. S. and Y.		H	68 1/2	68 1/2	75	84	91 1/2	108 1/4

*A—Face to face, screwed.
B—Face to face, flanged.

G—Center to top of hand wheel, open.
H—Center to top of spindle, rising spindle, open.

Mechanical Rubber Goods.

This company offers engineering requisites which are the result of over 50 years of progressive effort. They are the original manufacturers of rubber composition discs for valves and unvulcanized sheet packing.

Jenkins '96 is a high grade unvulcanized rubber sheeting, suitable for saturated steam joints under high or low pressure, hot water and other fluids.

Jenarco is a vulcanized red rubber sheeting, very tough and pliable, equally suitable for steam, hot or cold water and other joints.

Oiltite sheet packing is specially compounded for joints in lines carrying gasoline, kerosene, crude oil, etc.

SHEET PACKINGS

Approximate weights per sq. yd. 36 in. wide

Thickness	3/32	1/16	3/32	1/8	5/16	3/4
Jenkins '96 regular, lbs.	2 3/4	5 1/2	8 1/4	11	16 1/2	22 1/2
Jenkins '96 brass wire insertion, lbs.		8	10 3/4	13 1/2	19	25
Jenarco, regular, lbs.	2 3/4	5 1/2	8 1/4	11	16 1/2	22 1/2
Jenarco, brass wire insertion, lbs.		8	10 3/4	13 1/2	19	25
Oiltite, regular, lbs.	2 3/4	5 1/4	7 7/8	10 1/2	15 3/4	21

Cut gaskets in any size or shape promptly supplied. If shape is irregular, send drawing or template.

PUMP VALVES—A few of the Jenkins service tested compounds:

- No. 80—for hot water temperature above 180°.
- No. 88—for warm water up to 175 lbs. pressure.
- No. 93—for cold water pressures up to 175 lbs.
- No. 94—for cold water, low pressures.

Any size and compounds promptly supplied. When ordering always give outside diameter, thickness, and size of hole. When in doubt, mention service conditions.

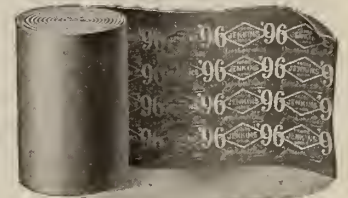


FIG. 224 JENKINS '96 PACKING

THE KELLY & JONES CO.

Power Plant Equipment, Brass, Iron and Steel Valves, Fittings and Cocks

WORKS
GREENSBURG, PA.

OFFICES

NEW YORK, N. Y., 2509-10-11 Park Row Building
PITTSBURGH, PA., 131-7 Water Street and 132-38 First Avenue
CHICAGO, ILL., 416 Ashland Block and 155 North Clark Street

ST. LOUIS, MO., 705 Laclede Gas Building
CINCINNATI, OHIO, 1008-12 Sycamore Street
SAN FRANCISCO, CAL., Fifth and Bluxome Streets
BUFFALO, N. Y., 672 Ellicott Square

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Experience and Facilities.

Extensive operations in the fields of steam power and heating plant erection, plumbing and hydraulic work, carried on for many years prior to the establishment as manufacturers, have given THE KELLY & JONES Co. a thorough knowledge of the wants of the trade. This knowledge is of inestimable value to the company in designing and manufacturing a comprehensive line of brass, iron and steel specialties for steam, gas, water, air and oil.

The company's factories are advantageously located in the heart of the great iron and fuel producing section of the United States, with ideal shipping facilities, and are equipped with the latest and best automatic machinery, much of which has been designed by this company's engineers for various special purposes.



TRADE-MARK

Tests.

In every department, from foundries to finishing shops, none but the highest skilled mechanics are employed under the constant supervision of capable engineers. In addition, the use of the best material insures a perfect product.

All work is subjected to the most thorough inspection and test during the process of manufacture and after completion.

Co-operative Services.

THE KELLY & JONES Co. offers the services of a corps of experienced engineers who will co-operate with engineers, contractors and operators in the solution of difficult power plant equipment problems.

Cast Steel Valves.

Owing to the increased demand for steel valves and to the lack of uniformity and quality in castings purchased from steel foundries making a miscellaneous product, this company has installed its own steel foundry in order to make and maintain a high grade of steel products.

The steel valves are safely recommended under normal conditions. The quality, strength, elasticity, elongation, reduction and bending are in accordance with the strictest specifications.

The seats, or any other wearing surface requiring same, are monel metal, which will not corrode and will contract and expand correspondingly with the steel in the body of the valve.

These cast steel valves are designed for high pressure, saturated and superheated steam lines and extreme hydraulic service.



Outside Screw and Yoke, Wedge Gate



With By-pass

CAST STEEL VALVES, FLANGED

For superheated steam up to 350 lbs. working pressure and a total temperature of 800°

Extra Heavy Cast Steel Straightway Valves, Flanged.

The body, bonnet, yoke and disc of these valves are made of cast steel. In the 2-in. size the disc is solid hard metal; on the sizes above 2 in. the disc is hard metal faced.

The stem of the inside screw non-rising valve is made of brass. The stem in the outside screw and yoke valve is made of rolled steel.

Unless otherwise specified, cast steel flanged valves when ordered faced and drilled are always furnished with spot faced bolt holes. Likewise flanged valves are furnished with male face and companion flanges when ordered with valves are furnished with female face unless otherwise specified.

Tested under 3000 lbs. hydraulic pressure for cold water working pressures up to 3000 lbs.

THE KELLY & JONES Co. designs and manufactures a valve for every purpose and applies a suitable test to each valve, assuring a strong dependable product of correct design.

Any of the cast iron, screwed or flanged valves and fittings shown in this or any other Kelly & Jones catalogue can be furnished in steel or bronze if desired. Blue prints and specifications for special steel casting are solicited.



Non-rising Stem with By-pass



Non-rising Stem

EXTRA HEAVY CAST STEEL STRAIGHTWAY VALVES
DIMENSIONS, EXTRA HEAVY CAST STEEL VALVES

Size, in.	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	6	7
F. to F., flgd., in.	6 1/2	7 1/2	8 1/2	9 1/2	11 1/2	11 7/8	12	13 1/4	15	15 7/8	16 1/4
Length, serd., in.	5 1/2	6 1/4	7	8 1/4	9	10	10 1/2	11	12 1/2	13 1/2	14
Diam., flgs., in.	5	6	6 1/2	7 1/2	8 1/4	9	10	10 1/2	11	12 1/2	13 1/2
Thickness, flgs., in.	3/4	1 1/4	1 1/2	1 3/4	1 7/8	2	2 1/4	2 1/2	2 3/4	3	3 1/4
C. to T., non-rising stem, in.	8 3/4	9 5/8	10 1/2	12 1/4	14 5/8	15 1/2	17 3/4	18 3/4	20 1/4	23	24 3/4
C. to T., stem, O. S. & Y., open, in.	10 5/8	12 1/4	13 3/4	16	19 1/2	22	24 1/2	27	29 3/4	34 1/2	38
Diam., wheel, in.	5	5 1/2	6 1/2	7 1/2	9	10	12	12	14	16	18
Size, by-pass, in.										1 1/2	1 1/2
C. to outside of by-pass, in.										13	14 1/2
No. of turns to open	12	11	14	15	14	16	18	21	23	28	30

Size, in.	8	9	10	12	14	15	16	18	20	22	24
F. to F., flgd., in.	16 1/2	17	18	19 3/4	22 1/2	22 1/2	24	26	28	29 1/2	31
Length, serd., in.	16 1/2	17	18	19 3/4	22 1/2	22 1/2	24	26	28	29 1/2	31
Diam., flgs., in.	15	16 1/4	17 1/2	20 1/2	23	24 1/2	25 1/2	28	30 1/2	33	36
Thickness, flgs., in.	1 5/8	1 3/4	1 7/8	2	2 1/8	2 1/4	2 1/2	2 3/4	2 3/4	2 5/8	2 3/4
C. to T., non-rising stem, in.	28 3/4	30 1/2	33 3/4	37 1/4							
C. to T., stem, O. S. & Y., open, in.	42 3/4	47	52 3/4	60							
Diam., wheel, in.	20	20	22	24	24	27	30	30	36	36	36
Size, by-pass, in.	1 1/2	1 1/2	1 1/2	2	2	2	3	3	4	4	4
C. to outside of by-pass, in.	15 1/2	16 3/8	16 3/8	19 1/2	20 5/8	20 5/8	25 1/4	26 1/2	30 1/2	32 1/4	33
No. of turns to open	34	40	39	46							

GLOBE, ANGLE AND CHECK VALVES

Size, in.	2	2 1/2	3	3 1/2	4	4 1/2	5
F. to F., flgd., in.	10 1/4	11 1/4	12 1/2	13 1/4	14	15	15 3/4
Cr. to F. of inlet or outlet, flgd., in.	5 1/4	5 3/4	6 1/4	6 3/4	7	7 1/2	7 3/4
Diam., flgs., in.	6 1/2	7 1/2	8 1/4	9	10	10 1/2	11
Thickness, flgs., in.	1	1 1/8	1 1/4	1 1/2	1 3/4	1 3/4	1 3/4
C. to T., stem, O. S. & Y., open, in.	13 3/4	14 1/2	17 1/2	17 1/2	19 1/2	19 1/2	21 1/2
Diam., wheel, in.	7 1/2	9	10	10	14	14	16
Size, by-pass, in.							
C. to outside of by-pass, in.							

Size, in.	6	7	8	10	12	14	15
F. to F., flgd., in.	17 1/2	19 1/4	21	24 1/2	28	33	33
Cr. to F. of inlet or outlet, flgd., in.	8 3/4	9 5/8	10 1/2	12 1/4	14	16 1/2	16 1/2
Diam., flgs., in.	12 1/2	14	15	17 1/2	20 1/2	23	24 1/2
Thickness, flgs., in.	1 1/4	1 1/2	1 5/8	1 7/8	2	2 1/2	2 1/2
C. to T., stem, O. S. & Y., open, in.	25	26 1/4	29 1/2	33 1/2	39	42	42
Diam., wheel, in.	18	20	24	27	30	36	36
Size, by-pass, in.					1 1/2	2	2
C. to outside of by-pass, in.					13 3/4	14 3/4	19 3/4

Iron Body Wedge Pattern Gate Valves.

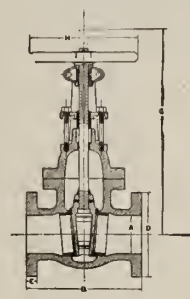
The iron body wedge pattern gate valves are made in many different designs and for various working pressures.

The guides on the discs and ribs in the body are so constructed as to insure an easy movement of the disc and eliminate all possible danger of the disc coming in contact with the seat, except at the point of closing.

The discs are made of iron, with bronze seat rings.



Inside Screw



Sectional Details



Outside Screw and Yoke with By-pass

EXTRA HEAVY STRAIGHTWAY VALVES

Iron body, wedge gate, brass mounted
Also furnished in cast steel or bronze at special prices

Size, in.	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	6	7
F. to F., flgd., in.	6 1/2	7 1/2	8 1/2	9 1/2	11 1/2	11 7/8	12	13 1/4	15	15 7/8	16 1/4
Length, serd., in.	5 1/2	6 1/4	7	8 1/4	9	10	10 1/2	11	12 1/2	13 1/2	14
Diam., flgs., in.	5	6	6 1/2	7 1/2	8 1/4	9	10	10 1/2	11	12 1/2	13 1/2
Thickness, flgs., in.	3/4	1 1/4	1 1/2	1 3/4	1 7/8	2	2 1/4	2 1/2	2 3/4	3	3 1/4
C. to T., non-rising stem, in.	8 3/4	9 5/8	10 1/2	12 1/4	14 5/8	15 1/2	17 3/4	18 3/4	20 1/4	23	24 3/4
C. to T., stem, O. S. & Y., open, in.	10 5/8	12 1/4	13 3/4	16	19 1/2	22	24 1/2	27	29 3/4	34 1/2	38
Diam., wheel, in.	5	5 1/2	6 1/2	7 1/2	9	10	12	12	14	16	18
C. of run to outside of by-pass, in.										14 3/4	14 3/4
Size, by-pass, in.										1 1/2	1 1/2
No. of turns to open	12	11	14	15	14	16	18	21	23	28	30

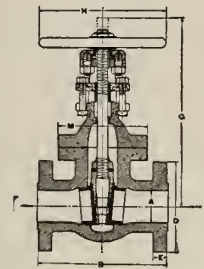
Size, in.	8	9	10	12	14	15	16	18	20	22	24
F. to F., flgd., in.	16 1/2	17	18	19 3/4	22 1/2	22 1/2	24	26	28	29 1/2	31
Length, serd., in.	16 1/2	17	18	19 3/4	22 1/2	22 1/2	24	26	28	29 1/2	31
Diam., flgs., in.	15	16 1/4	17 1/2	20 1/2	23	24 1/2	25 1/2	28	30 1/2	33	36
Thickness, flgs., in.	1 5/8	1 3/4	1 7/8	2	2 1/8	2 1/4	2 1/2	2 3/4	2 3/4	2 5/8	2 3/4
C. to T., non-rising stem, in.	28 3/4	30 1/2	33 3/4	37 1/4							
C. to T., stem, O. S. & Y., open, in.	42 3/4	47	52 3/4	60							
Diam., wheel, in.	20	20	22	24	24	27	30	30	36	36	36
C. of run to outside of by-pass, in.	15 1/2	16 3/8	16 3/8	19 1/2	20 5/8	20 5/8	25 1/4	26 1/2	30 1/2	32 1/4	33
Size, by-pass, in.	1 1/2	1 1/2	1 1/2	2	2	2	3	3	4	4	4
No. of turns to open	34	40	39	46							

Extra Heavy Hydraulic Straightway Valves.

Semisteel, wedge gate, brass mounted. Tested to 2,000 lbs. hydraulic pressure per sq. in. For 800 lbs. water working pressure.



Inside Screw



Outside Screw and Yoke

EXTRA HEAVY SEMISTEEL HYDRAULIC STRAIGHTWAY VALVES

Also furnished in cast steel or bronze at special prices

Size, in.	1 1/2	2	2 1/2	3	4	5	6	7	8	10	12
F. to F., flgd., in.	10	11 1/2	13 1/2	14 1/2	16 1/2	18 1/2	20	21 1/2	23	26 1/2	29 1/2
Length, serd., in.	10	11 1/2	13 1/2	14 1/2	16 1/2	18 1/2	20	21 1/2	23	26 1/2	29 1/2
Diam., flgs., in.	6 1/2	7 1/2	8 1/4	10	11 1/2	13 1/2	15	16 1/2	17	21	23 1/2
Thickness, flgs., in.	1 1/2	1 1/2	1 3/4	1 3/4	1 3/4	1 3/4	2 1/4	2 1/4	2 1/4	2 3/4	3 1/2
C. of run to top of non-rising stem, in.	12 3/4	14 1/4	16	18 1/4	20 3/4	25 3/4	27 3/4	29	33	38 1/4	45 1/4
C. of run to top of rising stem, in.											
O. S. & Y., open, in.	15 1/2	18 1/4	20 1/2	23 1/4	26 3/4	34	37 1/2	41 1/4	45 1/4	54 1/4	63 1/2
Diam., wheel, in.	8	10	12	14	16	20	20	24	24	27	30
C. of run to outside of by-pass, in.							14 3/8	15	17 3/8	18 3/8	21 1/2
Size, by-pass, in.							1 1/4	1 1/4	1 1/4	1 1/2	2
Width, bonnet flg., in.							14 1/2	15 1/2	16 3/8	18 1/4	19 3/4
Length, bonnet flg., in.							8 1/4	9 1/4	10 3/8	12 3/8	28 3/4
No. of turns to open	8	9 1/2	12	14	18	23	26 1/2	26 1/2	30 1/4	37 3/4	45 3/4

Standard Iron Body Straightway Valves.

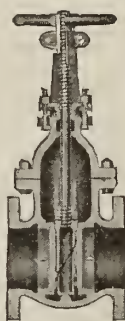
The double disc iron body straightway valve provides, when open, an absolutely unobstructed passage-way for the steam, water, air, or other materials controlled by it.

The faces of the discs and seats being parallel and the principle on which the disc is constructed make it self-adjustable, and at all times insure at least one disc closing, making the valve a positive shut-off. This important operation of the discs is accomplished by means of a wedge bearing between them, which permits of sufficient play in any direction, eliminates all danger of the discs sticking to the seats, and provides for the expansion and contraction strains, shocks or sagging of the pipe line.

The iron body double disc straightway valve is heavy and well designed, and opens by turning to the left. It is made of the very best grades of gray iron and bronze composition, and thoroughly tested before shipment.

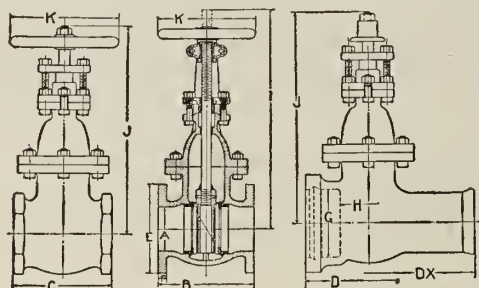


Non-rising Stem



Parallel Seat

STANDARD IRON BODY STRAIGHTWAY VALVES
Also furnished in cast steel or bronze of special prices



DIMENSION DIAGRAMS, IRON BODY STRAIGHTWAY VALVES
Iron body, brass mounted, double disc, parallel or taper seats, open to the left

STANDARD—FOR 125 LBS. WORKING PRESSURE

Size, in.	2	2½	3	4	5	6	8	10	12	14	16
F. to F., flgd., in.	5½	6¼	6¾	8¼	10¾	11¾	11	13¾	14½	15¾	16
E. to E., serd., in.	5½	6¼	7	7¾	11	11¾	12¾	13¾	13¾	15¾	16
Length, hub end, in.	9	9½	11½	12½	13½	14¾	16	17	17	19	20½
Length, spigot end, in.	17½	18	20¾	22¾	24¾	26¾	29¾	31½	31½	34½	36
Diam., flgs., in.	6	7	7½	9	10	11	13½	16	19	21	23½
Thickness, flgs., in.	3½	4½	5½	6½	7½	8½	10½	12½	14½	16½	18½
Inside diam., hub, in.	3½	4½	5½	6½	7½	8½	10½	12½	14½	16½	18½
E. to E. pipe in hub, in.	3½	4½	5½	6½	7½	8½	10½	12½	14½	16½	18½
C. to top of stem O. S. & Y. open, in.	14½	15½	18½	22½	23½	25½	29½	33½	35	39½	41½
C. to top of stem, non-rising, in.	11½	12½	14	16½	18½	20½	24½	28½	30	34½	36½
Diam., wheel, in.	6½	7	8	9	10	12	14	16	18	22	24
No. of turns to open	7	8½	10¼	8¾	11	13	17¼	21¼	26	30	34

EXTRA HEAVY—FOR 250 LBS. WORKING PRESSURE

Size, in.	2	3	4	5	6	8	10	12
F. to F., flgd., in.	8½	11½	12	15	15½	16½	18	19½
E. to E., serd., in.	8	9½	10½	12½	13½	15½	17½	19
Diam., flgs., in.	6½	8¼	10	11	12½	15	17½	20½
Thickness, flgs., in.	7	11	11½	13	14	16	18	20
Bolt circle, in.	5	6½	7½	9¼	10½	13	15¼	17¾
No. of bolts	4	8	8	8	12	12	16	16
Size, bolts, in.	5	3¼	3¼	3¼	3¼	3¼	3¼	3¼
Length, bolts, in.	2½	3¼	3¼	3¼	3¼	4¼	5	5¼
C. to top of non-rising stem, in.	12½	15¼	17½	19½	21½	24½	27½	30½
C. to top of stem O. S. & Y. open, in.	15½	19½	24½	30½	33½	38½	42½	47½
Diam., wheel, in.	7½	9	12	14	16	20	22	24
No. of turns to open	7	10	9	11	13	17	21	26

The standard pattern is used extensively for hot water washout systems and in water conserving plants.

For wood preserving plants, these valves are furnished with monel stems and trimmings; and the flanged joints are made up with special gaskets. Prices on application.

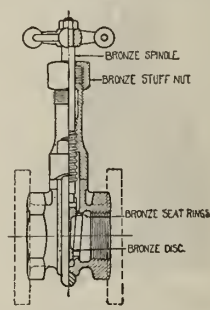
Standard Saddle Type Straightway Valves.

Can be furnished either black or red japanned, as desired. This saddle style is a very durable and compact valve, and economical, owing to the simplicity of construction. The steel saddle around body of valve holds bonnet securely in place, and can easily be removed, permitting of access to interior. Opens to left and has rising spindle. The solid disc is very narrow and V-shaped at bottom and can, therefore, be seated more readily when dirt or sediment is collected between the seats in the valve.

For 125 lbs. working pressure. All-iron or iron body, brass mounted. When furnished iron body, brass mounted, all parts are iron, except disc, stuffing nut and stem, which are high quality brass. All-iron style recommended very highly, for use in connection with cyanide, creosote, etc.



Solid Disc



Wedge Gate

SADDLE TYPE STRAIGHTWAY VALVES

Size, in.	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6
E. to E., serd., in.	2	2¼	2½	2¾	3	3½	4	4½	5	5½	6	6½
F. to F., flgd., in.	3	3¼	3½	3¾	4	4½	5	5½	6	6½	7	7½
C. of valve to top of spdl., open, in.	5½	6½	7½	8½	9½	10½	11½	12½	13½	14½	15½	16½
Extreme diam., hand wheel, in.	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8

Underwriters' Pattern Standard Straightway Valves.

A strong, reliable, iron body valve especially adapted for fire service. Gate and seat rings made of best bronze with machined faces. Bronze stem has a tape collar which engages with a recess at the top of the bonnet when valve is open, making a tight joint and facilitating

DIMENSIONS (INCHES), UNDERWRITERS' PATTERN, STANDARD STRAIGHTWAY VALVES

Size, in.	2½	3	3½	4	5	6	7	8	10	12	14
F. to F., flgd., in.	7½	8	8½	9	10	10½	11	11½	13	14	15
E. to E., serd., in.	5½	6½	6¾	7	7½	7¾	8¼	8¾	9¾	11½	12½
Length, hub end, in.	11¼	11¼	11¼	11¼	11¼	11¼	11¼	11¼	11¼	11¼	11¼
Length, spigot end, in.	19½	19½	19½	19½	19½	19½	19½	19½	19½	19½	19½
Diam., flgs., in.	7	7½	8	9	10	11	12½	13½	16	19	21
Thickness, flgs., in.	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½
Inside diam., hub, in.	5½	5½	5½	5½	5½	5½	5½	5½	5½	5½	5½
E. to E. pipe in hub, in.	4¼	4¼	4¼	4¼	4¼	4¼	4¼	4¼	4¼	4¼	4¼
C. to top O. S. & Y., open, in.	16½	18½	20½	22½	24½	27½	31	36¼	40¼	48	57¼
C. to top non-rising stem, in.	12½	13½	14½	15½	16½	18½	20½	23½	25½	29½	33½
Diam., wheel, in.	7	8	8	10	12	12	14	14	16	18	22
C. to top of stem, indicator valve, in.	13½	15½	16½	17½	18½	20½	22½	25½	27½	31½	35½
No. of turns to open	8¼	10	11¼	8¾	10¾	13	15	17	21¼	25¼	30

Underwriters' pattern

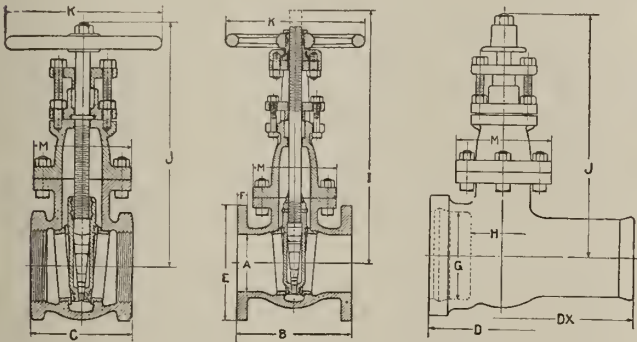
repacking while under pressure. Yoke and gland nuts are made of high quality bronze. The gland and the opening through bonnet for stem are bronze bushed. Indicators on inside screw, non-rising gate valves are made reversible and can be adjusted to read correctly when valve is fixed in an upside down position.

On valves up to and including 4 in., yoke is cast solid to bonnet. On sizes above 4 in., yoke is bolted to bonnet. The letters "S.V." cast on bonnet identify these valves.

Standard Straightway Valves, Brass Mounted.



Iron Body, Screwed Wedge Gate, Flanged Brass Mounted, Hub End
STANDARD STRAIGHTWAY WEDGE GATE VALVES
For 125 lbs. working pressure. Tested to 150 lbs. hydraulic pressure per sq. in. with valve closed
Also furnished in cast steel or bronze at special prices



DIMENSION DIAGRAMS, STANDARD STRAIGHTWAY VALVES

TABLE, IN INCHES

Size—A	2	2½	3	3½	4	4½	5	6	7	8
B	7	7½	8	8½	9	9½	10	10½	11	11½
C	5½	5½	6½	6½	6½	7½	7½	7½	8½	8½
D	8½	9	11½	11½	10½	10½	10½	10½	13	13
DX					19½	21½	21½	21½	24	24
E	6	7	7½	8½	9	9½	10	11	12½	13½
F	5½	6½	7½	8½	9	9½	10	11	12½	13½
G	3½	4	4½	5	5½	6	6½	7½	9	10½

Size—A	2	2½	3	3½	4	4½	5	6	7	8
H	3		3½		4½		4½	4½	4½	5
I	14	16½	18½	20½	22½	25½	27½	31	36½	40½
J	11¾	12½	13½	14½	15½	17½	18½	20½	23½	25½
K	7	8	8	10	10	12	12	14	14	14
L		13½	15½	16½	17½	20½	22½	25½	27½	27½
M	5½	6½	6½	6½	6½	6½	7½	7½	8½	8½
N	5½	7½	7½	8½	9½	10½	11½	13	13	14½
Turns to open	7½	8½	10	11½	8½	9½	10½	13	15	17

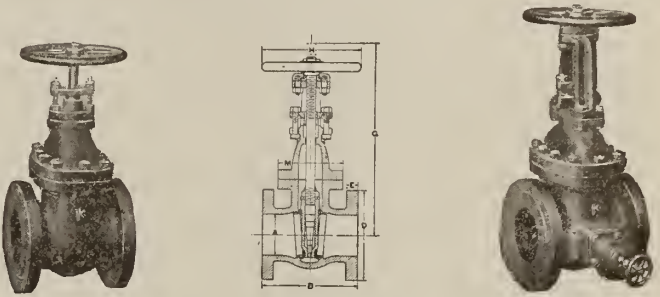
Size—A	9	10	12	14	15	16	18	20	22	24
B	12	13	14	15	15	16	17	18	19	20
C	9½	9½	11½	15½						
D	13½	14½	14½							
DX	26	28	30							
E	15	16	21	22½	23½	25	27½	29½	32	
F	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½
G		12½	14½	16½	18½	21	23		27½	
H		5½	6½	7½						
I	44½	48	57½	66½	69½	74½	86	91	100	109
J	27½	29½	33½	39½	41½	42½	48½	52½	55½	62
K	16	16	18	22	27	27	30	32	30	33
L		31½	35½							
M	8½	10½	11	12	13½	14½	15	16½	16½	20
N	15½	17	19½	22½	23½	25	28	30	32½	36
Turns to open	19½	21½	25½	30	31½	33½	35½	42½	46	50



Outside Screw and Yoke Quick Opening With Indicator
STANDARD STRAIGHTWAY VALVES
Also furnished in cast steel or bronze at special prices

Medium Straightway Valves.

A well designed, substantially constructed valve of the wedge gate type with iron body, brass mounted. It is provided with stationary stem and opens to the left. Designed for 175 lbs. working pressure. Tested to 500 lbs. hydraulic pressure per sq. in.



Inside Screw Detailed Section Outside Screw and Yoke with By-pass
MEDIUM STRAIGHTWAY VALVES
Iron body, wedge gate, brass mounted. For 175 lbs. working pressure. Tested to 500 lbs. hydraulic pressure per sq. in.
Also furnished in cast steel or bronze at special prices

Size, in.	2	2½	3	3½	4	4½	5
F. to F., flgd., in.	7½	8	9½	10	10½	11	11½
E. to E., serd., in.	5½	6	7½	7½	7½	8½	8½
Diam., flgs., in.	6½	7½	8½	9	10	10½	11
Thickness, flgs., in.	7½	1	1½	1½	1½	1½	1½
C. to top, non-rising stem, in.	11½	12½	13½	14½	15½	17½	18½
C. to top, O. S. & Y., open, in.	14	16½	18½	20½	22½	25½	27½
Diam., wheel, in.	7	7	8	8	10	10	12
C. of run to outside of by-pass, in.							
Width, bonnet flg., in.		6½	6½	7	7½	7½	7½
Length, bonnet flg., in.		7½	8½	9	9½	11½	11½
Size, by-pass, in.							
No. of turns to open	7	8½	10	11½	8½	9½	22

Size, in.	6	7	8	9	10	12	14	15	16	18
F. to F., flgd., in.	12	12½	13	14	15	16	18	18½	19½	21
E. to E., serd., in.	8½	9½	10	10½	11½	12½	13½	14½	15½	16½
Diam., flgs., in.	12½	14	15	16½	17½	20½	23	24½	25½	28
Thickness, flgs., in.	1½	1½	1½	1½	1½	2	2½	2½	2½	2½
C. to top, non-rising stem, in.	20½	23½	25½	27½	29½	33½	39½	41½	42½	48½
C. to top, O. S. & Y., open, in.	31	36½	40½	44½	48	57½	66½	69½	74½	86
Diam., wheel, in.	12	14	14	16	16	18	22	22	27	27
C. of run to outside of by-pass, in.	14½	15½	15½	16½	17½	18½	19½	20½	22½	24½
Width, bonnet flg., in.	8½	9	9	10	10½	11½	12½	13½	14½	15½
Length, bonnet flg., in.	12½	14	14½	15½	17½	20½	23	24	25	28
Size, by-pass, in.	1½	1½	1½	1½	2	2	2	2	3	3
No. of turns to open	25½	30	34½	37½	42	50½	55	63	66½	75

Medium Iron Body Valves.

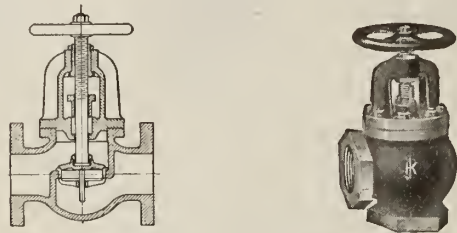
Made any size from 2 to 12 in., inclusive, both screwed and flanged.

These valves are designed to meet the requirements and increasing demand for a valve suitable for a pressure between standard and extra heavy. They are mechanically correct in every detail. The material used in their construction is of the highest quality, insuring strength where the greatest amount of strain is caused due to the expansion and contraction of the piping.

When it is necessary to use medium valves larger than 6 in., flanged valves are recommended. Valves 8 in. and larger should have a by-pass.

These medium iron body valves can be repacked while under pressure; but in order to do so, the valve must be wide open.

Regularly furnished with $\frac{1}{16}$ in. raised face.



MEDIUM IRON BODY VALVES

For 175 lbs. working pressure with yoke, with or without by-pass
Also furnished in cast steel or bronze at special prices

Size, in.	2	2½	3	3½	4	4½	5	6	7	8	10	12
Size, by-pass, in.	9	10	11	12	13	13½	14½	16	17½	20	22½	25½
F. to F., figd., in.	4½	5	5½	6	6½	6¾	7¾	8	8¾	10	11¼	12¾
C. to F., angle, figd., in.	7¾	8	8¼	9½	10½	11¼	12¼	14	17	18½	22½	25½
E. to E., serd., in.	3½	4	4½	4¾	5¼	5¾	6½	7	8½	9¼	11¼	12¾
Diam., wheel, in.	7½	7½	9	9	10	10	14	14	16	16	20	24
Thickness, figs., in.	7½	1	1½	1½	1½	1½	1½	1½	1½	1½	1½	2
Diam., figs., in.	6½	7½	8¼	9	10	10½	11	12½	14	15	17½	20½

DIAMETER OF FLANGES AND TEMPLATE FOR DRILLING—
MEDIUM FLANGED VALVES AND FLANGED FITTINGS

For 175 lbs. Working Pressure

Size, in.	Diam. of figs., in.	Thickness of figs., in.	Bolt circle, in.	No. of bolts	Size of bolts, in.	Length of bolts, in.
1	4½	1½	3¼	4	1½	2
1½	5	1½	3¾	4	1½	2¼
2	6	1½	4½	4	1½	2½
2½	6½	1½	5	4	1½	2½
3	7½	1½	5½	4	1½	3
3½	8½	1½	6½	8	1½	3¼
4	9	1½	7¼	8	1½	3¼
4½	10	1½	7¾	8	1½	3½
5	10½	1½	8½	8	1½	3½
6	11	1½	9¼	8	1½	3½
7	12½	1½	10½	12	1½	4
8	14	1½	11½	12	1½	4
9	15	1½	13	12	1½	4¼
10	16½	1½	14	12	1½	4¾
12	17½	1½	15¼	16	1½	5
14	20½	2	17½	16	1½	5½
16	23	2½	20¼	20	1½	6
18	24½	2½	21½	20	1½	6
20	25½	2½	22½	20	1½	6
22	28	2½	23¾	24	1½	6¼
24	30½	2½	27	24	1½	6¾
26	33	2½	29¼	24	1½	7
28	36	2½	32	24	1½	7¼

These drilling templates are in multiples of four, so that fittings may be made to face in any quarter and bolt holes straddle the center line.

Extra Heavy Iron Body Valves.

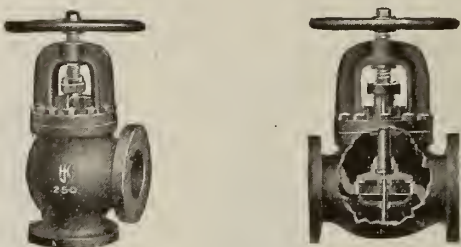
These extra heavy valves are of the latest and most improved design and are admirably adapted for high pressure power plant service. The body is very heavy and its barrel shape permits of large and free openings.

The extra heavy, hard metal seat in the body has a bridge of improved design to guide the swivel disc. This disc will not rattle even when the valve is partly opened, as the combination of the guide on the disc and the bridge on the seat insures a perfectly tight seating of the disc at all times. Seats are made of a special hard metal to resist wear.

The valve is provided with a disc nut of improved design which facilitates packing while under pressure by opening the valve to the point where the disc nut comes in contact with the lower face of the bonnet flange and forms a joint.

The valve is made with steel stem and malleable iron stuffing box flange with brass follower, giving additional strength and durability to these parts. The over-size wheel gives maximum leverage to the operator in opening or closing the valve.

Designed for steam working pressures up to 250 lbs. Tested to 800 lbs. hydraulic pressure per sq. in. Regularly furnished with $\frac{1}{16}$ in. raised face.



EXTRA HEAVY IRON BODY VALVES

For 250 lbs. working pressure. With yoke, with or without by-pass
Also furnished in cast steel or bronze at special prices

Size, in.	2	2½	3	3½	4	4½
F. to F., figd., in.	10½	11½	12½	13¼	14	15
C. to F., angle, figd., in.	5½	5¾	6¼	6¾	7	7½
E. to E., serd., in.	9½	10¾	11¾	12¼	13	14
C. to F., angle, serd., in.	4½	5¾	5¾	6½	6½	7
Diam., wheel, in.	7½	9	10	10	14	14
Thickness, figs., in.	7½	1	1½	1½	1½	1½
Diam., figs., in.	6½	7½	8¼	9	10	10½

Size, in.	5	6	7	8	10	12	14	15
Size, by-pass, in.	15½	17½	19¼	21	24½	28	33	33
F. to F., figd., in.	7½	8¾	9¾	10½	12¼	14	16½	16½
C. to F., angle, figd., in.	15	16½	18¼	20	23¼	26	30	30
E. to E., serd., in.	7½	8¾	9¾	10	11½	13	15	15
Diam., wheel, in.	16	18	20	24	27	30	36	36
Thickness, figs., in.	13½	1½	1½	1½	1½	2	2½	2½
Diam., figs., in.	11	12½	14	15	17½	20½	23	24½

Jenkins Type, Standard Kelly & Jones Valves.

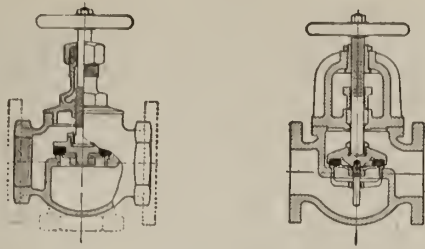
THE KELLY & JONES Co. manufacture a full line of Jenkins type, iron body, globe, angle, cross check and safety valves in both screwed and flanged patterns and in any size from 2 to 12 in., inclusive.

The brass mounted valves are made in sizes 2, 2½ and 3 in. All sizes are furnished with yoke unless otherwise specified. In placing orders it should be stated whether the brass mounted or the yoked pattern is desired. Also whether the valve is to be used for cold water service, as a soft disc is used for this kind of work.

Designed for 125 lbs. working pressure. Can be packed under full steam pressure but valve must be wide open while doing so.



Globe, with Yoke Globe, Flanged Angle
JENKINS TYPE, STANDARD KELLY & JONES IRON BODY VALVES
For 125 lbs. working pressure



JENKINS TYPE, STANDARD KELLY & JONES VALVES

Iron body. For 125 lbs. working pressure. Globe, angle, cross, check and safety valves, screwed or flanged, with or without yoke
Also furnished in cast steel or bronze at special prices

IRON BODY, INSIDE SCREW

Size, in.	2	2½	3	3½	4	5	6
F. to F., flgd., in.	7½	7½	9¼	10	11¾	13½	16
E. to E., serd., in.	6½	7¼	9½	10	12	13¼	16
C. to F., angle, flgd., in.	3½	4½	4½	5½	5½	6½	8
C. to F., angle, serd., in.	3½	3½	4½	5	6	6½	8
Diam., wheel, in.	5½	6½	7½	8	8¾	10	12
Thickness, flgs., in.	5/8	11/16	3/4	13/16	1	1	1
Diam., flgs., in.	6	7	7½	8½	9	10	11

IRON BODY, OUTSIDE SCREW AND YOKE

Size, in.	2	2½	3	3½	4	4½
F. to F., flgd., in.	7½	7½	9¼	10	11¾	12½
E. to E., serd., in.	6½	7¼	9½	10	12	12½
C. to F., angle, flgd., in.	3½	4½	4½	5½	5½	6¼
C. to F., angle, serd., in.	3½	3½	4½	5	6	6¼
Diam., wheel, in.	5½	6½	7½	8	8¾	9¼
Thickness, flgs., in.	5/8	11/16	3/4	13/16	1	1
Diam., flgs., in.	6	7	7½	8½	9	9¼

Size, in.	5	6	7	8	10	12
F. to F., flgd., in.	13½	16	16¼	18½	21¼	24½
E. to E., serd., in.	13¼	16	16½	18¾	21½	25¼
C. to F., angle, flgd., in.	6½	8	8	9¼	10½	12¼
C. to F., angle, serd., in.	6½	8	8¼	9½	10¾	12½
Diam., wheel, in.	10	12	12¾	14	16	18
Thickness, flgs., in.	11/16	1	1	1¼	1½	1¾
Diam., flgs., in.	10	11	12½	13½	16	19

Extra Heavy Automatic Stop Check Valves.

This type valve closes automatically and instantly, cutting out the boiler to which it is connected and in case a tube blows out or a joint in the boiler bursts, the valve will act immediately as a non-return valve and will prevent the back flow of steam from the main.

This valve will also prevent steam from entering or backing into a cold boiler while work is being done, and in this way acts as a safety stop valve. It will open automatically and promptly when the boiler to which it is connected reaches the full pressure in the main. But it will remain closed against a higher pressure in the main—a sure means of detecting a sluggish boiler.

To attain its greatest efficiency, this valve should be placed with wheel up and in such a manner as to allow the boiler pressure to come underneath the disc.



EXTRA HEAVY AUTOMATIC STOP CHECK VALVE

DIMENSIONS, EXTRA HEAVY AUTOMATIC STOP CHECK VALVES

Size, in.	2	2½	3	3½	4	4½	5
E. to E., serd., in.	9½	10¾	11¾	12¼	13	14	15
F. to F., flgd., in.	10½	11½	12½	13¼	14	15	15¾
C. to F., angle, serd., in.	4¾	5¾	5¾	6½	6½	7	7½
C. to F., angle, flgd., in.	5¼	5¾	6¼	6½	7	7½	7¾
Diam., flgs., in.	6½	7½	8¼	9	10	10½	11

Size, in.	6	7	8	10	12	14	15
E. to E., serd., in.	16½	18¼	20	23¼	28	33	33
F. to F., flgd., in.	17½	19¼	21	24½	28	33	33
C. to F., angle, serd., in.	8¾	9¾	10	11¾	12¼	14	16¾
C. to F., angle, flgd., in.	8¾	9¾	10½	12¼	14	16¾	16¾
Diam., flgs., in.	12½	14	15	17½	20¼	23	24½

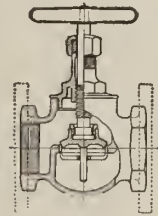
Standard Iron Body Valves.

Made in all sizes from 1 to 3 in., brass mounted, and 2 to 16 in., yoke pattern, screwed or flanged, and for 125 lbs. working pressure.

Made in all styles, globe, angle, cross, check, Y, safety and swing check, and correctly designed, with strength added where the greatest strain is caused. Material used in their construction is of high quality and each valve is carefully inspected and tested to pressure before shipment.



Globe



Inside Screw



Outside Screw and Yoke

STANDARD IRON BODY VALVES

Also furnished in cast steel or bronze at special prices

INSIDE SCREW, BRASS MOUNTED

Size, in.	1	1¼	1½	2	2½	3
F. to F., flgd., in.	3¾	4½	5	5¾	7½	7½
E. to E., serd., in.	3¾	4½	5	5¾	6½	7¾
C. to F., angle, flgd., in.	2¾	3	3¼	3¾	4½	4¾
C. to F., angle, serd., in.	1¾	2¼	2½	2¾	3½	3¾
Diam., wheel, in.	2¾	3¼	3¾	4½	5	5¾
Thickness, flgs., in.	1	1	1	1	1	1
Diam., flgs., in.	4	4½	5	6	7	7½

OUTSIDE SCREW AND YOKE

Size, in.	2	2½	3	3½	4	4½	5	6
F. to F., flgd., in.	8	8½	9½	10½	11	12	13	14
E. to E., serd., in.	5½	6½	7½	9½	10½	11½	12½	14
C. to F., angle, serd., in.	2½	3¾	4¼	4¾	5	5¾	6	6¾
C. to F., angle, flgd., in.	4	4¼	4¾	5¼	5½	6	6½	7
Diam., wheel, in.	7	7	8	8	9	9	11	12
Thickness, flgs., in.	5/8	11/16	3/4	13/16	1	1	1	1
Diam., flgs., in.	6	7	7½	8½	9	9½	10	11

Size, in.	7	8	9	10	12	14	16	...
F. to F., flgd., in.	16	17	18½	20	24	28	32	...
E. to E., serd., in.	14	16¼	18	20½	22½	25¾	...	...
C. to F., angle, serd., in.	7½	8¼	9	9¾	11¼	12¾	...	...
C. to F., angle, flgd., in.	8	8½	9¼	10	12	14	16	...
Diam., wheel, in.	12	14	14	16	18	20	24	...
Thickness, flgs., in.	1½	1¾	1¾	1¾	1¾	1¾	1¾	...
Diam., flgs., in.	12½	13½	15	16	19	21	23½	...

Standard Iron Body Safety Valves.



Angle



Globe

STANDARD IRON BODY SAFETY VALVES

Size, in.	2	2½	3	3½	4	4½	5	6	7	8
Diam., flgs., in.	6	7	7½	8½	9	9¼	10	11	12½	13½

Sizes from 1- to 3-in., inclusive, have swivel top; larger sizes have cast iron top and can be set at any 90° angle.
Levers are graduated from 30 to 100 lbs. Three-way are made same sizes

Foot Valves and Strainers.



Basket Pattern Western Pattern Long Pattern
IRON FOOT VALVES, FLANGED, WITH STRAINERS

Size, in.	2	2½	3	3½	4	4½	5	6	7	8	10
Diam., flgs., in.	6	7	7½	8½	9	9¼	10	11	12½	13½	16
Size, in.	12	14	15	16							
Diam., flgs., in.	19	21	22½	23½							

LEATHER DISC, LONG PATTERN

Size, in.	2	2½	3	3½	4	4½	5	6	7	8	10
Diam., flgs., in.	6	7	7½	8½	9	9¼	10	11	12½	13½	16

Beckwith Pipe Line Swing Check Valves.

Correct design and substantial construction. All-iron or iron with lead gasket.

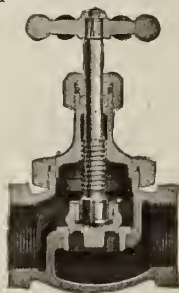
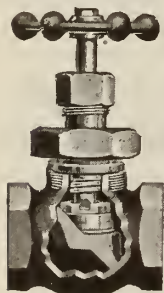
Extra Heavy Hydraulic Swing Check Valves.

Made for heavy service, with composition seats. For 800 lbs. water working pressure. Tested to 2000 lbs. hydraulic pressure per square inch.

"Excelsior" High Pressure Brass Valves.

Regrinding "Excelsior" valves are designed to meet the demand for valves suitable for working pressures from 200 to 300 lbs. of live or superheated steam, and are extensively used in modern steam plant construction. The stuffing boxes can be packed while under pressure and valve reground while in position, without disturbing the pipe connections, by making slight adjustments and rotating the stem backward and forward.

Made of the highest grade metal and furnished in globe, angle, cross or check patterns. The outside screw and yoke pattern is recommended for superheated steam. The nickel seat style is so constructed as to permit of easy removal of the seat for renewal purposes.



Globe Angle Nickel Seat
"EXCELSIOR" HIGH PRESSURE BRASS VALVES
MEDIUM PRESSURE FOR 200 LBS.

Size, in.	½	¾	1	1½	2	2½	3	3½	4
F. to F., globe and horiz. check, flgd., in.	2½	3	3½	4½	5½	6½	7½	8½	10½
E. to E., globe and horiz. check, serd., in.	1½	2½	2½	2½	2½	3½	4½	5½	6½
C. to F., angle, check or cross, flgd., in.	1½	1½	1½	2½	2½	2½	3½	4½	5½
C. to F., angle, check or cross, serd., in.	¾	1	1	1½	1½	1½	2½	3½	4½
Thickness, flgs., in.	2½	3	3½	4	4½	5	6	7	8
Diam., flgs., in.	6	7	7½	8½	9	10	11	12½	13½

EXTRA HEAVY FOR 300 LBS.

Size, in.	½	¾	1	1½	2	2½	3	3½	4
F. to F., globe and horiz. check, flgd., in.	3½	3½	4½	4½	5½	6½	7½	8½	10½
E. to E., globe and horiz. check, serd., in.	2½	2½	2½	3½	3½	4½	5½	6½	7½
C. to F., angle, check or cross, flgd., in.	2½	2½	2½	2½	3½	3½	4½	5½	6½
C. to F., angle, check or cross, serd., in.	1	1½	1½	1½	2½	2½	2½	3½	4½
Thickness, flgs., in.	3	3½	4	4½	5	6	6½	7½	8½
Diam., flgs., in.	6	7	7½	8½	9	10	11	12½	13½

RENEWABLE NICKEL SEAT VALVES

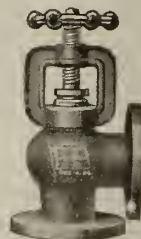
Size, in.	½	¾	1	1½	2	2½	3
F. to F., globe, flgd., in.	3	3½	4	4½	5½	6½	7½
E. to E., globe, serd., in.	2½	2½	2½	3½	3½	4½	5½
Thickness, flgs., in.	2½	3	3½	4	4½	5	6
Diam., flgs., in.	6	7	7½	8½	9	10	11



Horizontal Check



Cross



Angle

"EXCELSIOR" HIGH PRESSURE BRASS VALVES

Brass Straightway Valves, Solid Wedge, Gate.

These valves are of the latest improved design, well proportioned and of good weight. They are made special pattern for pressures up to 100 lbs.; standard for 125 lbs.; heavy for 150 lbs.; medium for 175 and 200 lbs.; extra heavy for 250 lbs.; and extra heavy hydraulic for 1000 lbs.

The guides on the discs and the ribs in the bodies of these valves are fitted accurately, insuring a true and easy movement, thus preventing wear of the faces. They also keep the disc from touching the seats in the bodies except at the closing point.



Standard



Outside Screw and Yoke



Extra Heavy



Solid Wedge

BRASS STRAIGHTWAY VALVES WITH SOLID WEDGES

Guides on discs and in bodies of these valves are fitted accurately, insuring a true and easy movement and preventing wear of the faces. Also keeps disc from touching seats in bodies except at closing point

Size, in.	½	¾	1	1½	2	2½	3
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SPECIAL, 100 LBS.

E. to E., serd., in.	1½	2	2½	2½	3	3½	4½
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STANDARD PATTERN, 125 LBS.

E. to E., serd., in.	1½	1½	1½	2½	2½	3	3½	4½	4½
F. to F., flgd., in.	3½	3½	3½	4½	4½	5½	6½	7½	7½

HEAVY STANDARD PATTERN, 150 LBS.

E. to E., serd., in.	1½	1½	2	2½	2½	3½	3½	4½	5½
F. to F., flgd., in.	3½	3½	3½	4½	4½	5½	6½	7½	7½

OUTSIDE SCREW AND YOKE PATTERN, 125 LBS.

E. to E., serd., in.	2½	2½	2½	3	3½	4½	4½
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OUTSIDE SCREW AND YOKE PATTERN, 150 LBS.

E. to E., serd., in.	2½	2½	2½	3½	3½	4½	4½
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Jenkins Type, Standard Kelly & Jones Brass Valves.

Made of high grade steam metal, correctly designed and carefully machined. Of standard weight and durable construction.

The Y or blow-off brass valve has a full opening very nearly in direct line with the pipe, which practically eliminates resistance to the free flow of steam or liquids. It is specially adapted for handling thick fluids in sugar refineries, paper mills, chemical works, etc.



Globe Y Angle Swing Check
JENKINS TYPE, STANDARD KELLY & JONES BRASS VALVES

Standard pattern for 125 lbs. pressure
Special pattern for 100 lbs. pressure

GLOBE, ANGLE AND CROSS VALVES

Size, in.	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Diam., flgs., in.	2 1/2	2 1/2	3	3 1/2	4	4 1/2	5	6	7	7 1/2
F. to F., globe, serd., in.	2 1/2	2 3/8	2 3/4	3 1/8	3 1/2	4 1/4	4 3/4	5 3/4	6 5/8	8 1/2
F. to F., globe, flgd., in.	2 1/2	3	3 1/8	3 3/8	4	4 3/4	4 3/4	6	6 3/4	7 1/2
C. to F., angle, serd., in.	1 1/8	1 1/8	1 3/8	1 1/2	1 3/4	2 1/8	2 1/4	2 7/8	3 1/4	4 1/4
C. to F., angle, flgd., in.	1 1/8	2 1/8	2 1/8	2 3/8	2 3/8	2 1/2	3 1/8	3 3/4	4 1/4	4 1/2

STANDARD "Y" OR BLOW-OFF VALVES—BRASS

Size, in.	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
F. to F., serd., in.	3 1/8	4 1/4	5 1/4	6 1/4	7 1/4	8 1/4	9 1/4	10 1/4	11 1/4
F. to F., flgd., in.	4 1/4	4 3/4	5 1/4	6 1/4	7 1/4	8 1/4	9 1/4	10 1/4	11 1/4
Flg. to end of hand wheel, open, in.	1 1/8	1 1/8	2 1/8	2 1/8	3 1/8	3 1/8	4 1/8	5 1/8	6 1/8
Hex. to end of hand wheel, open, in.	2 7/8	3	3 1/4	4 1/4	5 1/4	6 1/4	7 1/4	8 1/4	9 1/4
Diam., flgs., in.	3	3 1/2	4	4 1/2	5	6	7	7 1/2	8 1/2
C. to top, hand wheel, open, in.	4 1/4	5 1/4	6 1/8	7 3/8	8 3/8	9 1/2	10 3/8	11 3/8	12 1/2
Diam., wheel, in.	2 1/2	2 3/8	3	3 1/4	4 1/8	4 3/8	5	6	6 1/2

BRASS SWING CHECK VALVES

Size, in.	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
E. to E., serd., in.	2 1/8	2 3/4	3 3/8	3 1/2	4 1/4	4 3/4	5 3/4	6 3/4	7 3/4	8 3/4
F. to F., flgd., in.	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8	9
Diam., flgs., in.	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8	9
Thickness, flgs., in.	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8



Horizontal Check



Angle Check

JENKINS TYPE, HORIZONTAL AND ANGLE CHECK VALVES

Regrinding Straightway Swinging Brass Check Valves.

May be used in a horizontal or vertical position. The plug in the body provides for regrinding the valve without removing from line.



REGRINDING STRAIGHTWAY SWINGING BRASS CHECK VALVES

MEDIUM REGRINDING STRAIGHTWAY SWINGING CHECK VALVES
For 150 lbs. working pressure

Size, in.	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Diam., flgs., in.	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8	9

EXTRA HEAVY REGRINDING STRAIGHTWAY SWINGING CHECK VALVES
For 250 lbs. working pressure

Size, in.	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Diam., flgs., in.	4 1/2	5	6	6 1/2	7 1/2	8 1/2	9 1/2	10 1/2
Thickness, flgs., in.	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2

May be used in a horizontal or vertical position. Plug in body provides for regrinding without removing from line.

DIMENSIONS AND DRILLING TEMPLATES BRASS PLANGED VALVES, FITTINGS AND FLANGES
STANDARD

Size, in.	Face to face, in.	Center to face, in.	Center to face 45° ell., in.	Diam., flgs., in.	Thickness, flgs., in.	No. of bolts	Size, bolts, in.	Bolt circle, in.
1	7	3 1/2	1 3/4	4	3/8	4	7/8	3
1 1/4	7 1/2	3 3/4	2	4 1/2	3/8	4	1 1/8	3 3/8
1 1/2	8	4	2 1/4	5	1/2	4	1 1/8	3 3/8
2	9	4 1/2	2 3/4	6	1/2	4	1 1/8	4 3/4
2 1/2	10	5	3	7	1/2	4	1 1/8	5 1/2
3	11	5 1/2	3 1/2	7 1/2	1/2	4	1 1/8	6
3 1/2	12	6	3 3/4	8 1/2	1 1/4	8	1 1/8	7
4	13	6 1/2	4	9	1 1/4	8	1 1/8	7 1/2
4 1/2	14	7	4 1/4	9 1/4	1 1/4	8	1 1/8	7 3/4
5	15	7 1/2	4 1/2	10	1 1/4	8	1 1/8	8 1/2
6	16	8	5	11	1 1/4	8	1 1/8	9 1/2
7	17	8 1/2	5 1/2	12 1/2	1 1/4	8	1 1/8	10 3/4
8	18	9	5 3/4	13 1/2	1 1/4	8	1 1/8	11 3/4
9	20	10	6	15	1 1/4	12	1 1/8	13 1/4
10	22	11	6 1/2	16	1 1/4	12	1 1/8	14 1/4
12	24	12	7 1/2	19	1 1/4	12	1 1/8	17

EXTRA HEAVY

Size, in.	Face to face, in.	Center to face, in.	Center to face 45° ell., in.	Diam., flgs., in.	Thickness, flgs., in.	No. of bolts	Size, bolts, in.	Bolt circle, in.
1	8	4	2	4 1/2	1 1/2	4	1 1/8	3 1/4
1 1/4	8 1/2	4 1/4	2 1/4	5	1 1/2	4	1 1/8	3 3/4
1 1/2	9	4 1/2	2 3/4	6	1 1/2	4	1 1/8	4 1/2
2	10	5	3	7	1 1/2	4	1 1/8	5
2 1/2	11	5 1/2	3 1/2	7 1/2	1 1/2	4	1 1/8	5 1/2
3	12	6	3 3/4	8 1/2	1 1/2	8	1 1/8	6 1/2
3 1/2	13	6 1/2	4	9	1 1/2	8	1 1/8	7 1/4
4	14	7	4 1/4	10	1 1/2	8	1 1/8	7 3/4
4 1/2	15	7 1/2	4 1/2	10 1/2	1 1/2	8	1 1/8	8 1/2
5	16	8	5	11	1 1/2	8	1 1/8	9 1/2
6	17	8 1/2	5 1/2	12 1/2	1 1/2	12	1 1/8	10 3/4
7	18	9	6	14	1 1/2	12	1 1/8	11 3/4
8	20	10	6 1/2	15	1 1/2	12	1 1/8	13
9	21	10 1/2	6 3/4	16 1/2	1 1/2	12	1 1/8	14
10	23	11 1/2	7	17 1/2	1 1/2	16	1 1/8	15 1/4
12	26	13	8	20 1/2	1 1/2	16	1 1/8	17 3/4

Indicator Posts.

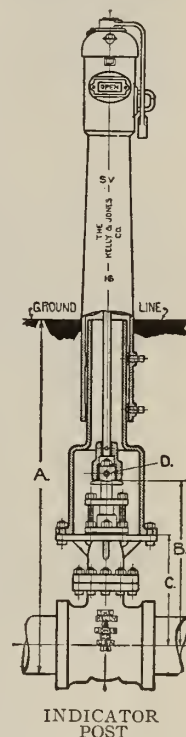
This post indicates whether the valve in the main is open or shut, and can be used in connection with any make of valve.

The wrench attached to top serves as a lock and prevents tampering with the post when the valve has been opened or closed to the position desired, and provision has been made on this indicator post for sealing.

In ordering indicator posts for the Kelly & Jones make of valves, the only information required is the "A" dimension, or bury of valve. In ordering indicator posts for valves other than Kelly & Jones make, it is important that the following information be received: The size of the valves the posts are to cover, whether the valves open to the right or the left, and the number of turns required to open the valve. Also furnish dimensions for the following: A—bury of valve; B—center of valve to bottom of square; C—center of valve to bottom of post; D—size of square on spindle or top nut.

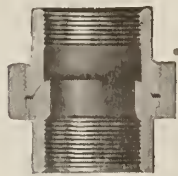
The indicator is adjustable, and is provided with removable metal frames which carry extra thick glass. The letters are aluminum on a black background.

The price of indicator posts does not include the valves. This indicator post has been especially designed to meet the specifications and requirements of the underwriters.

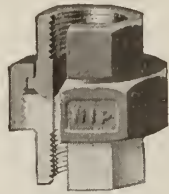


INDICATOR POST

Unions.



"Norustocta" Union
All parts completely covered with copper electrically applied



Nip Union
No inserted parts. The ring and bottom made of malleable iron, thread end of brass



Brass Seat Union
Round or octagon ends, iron or brass nut

MALLEABLE IRON UNIONS

Sizes, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, $3\frac{1}{2}$ and 4 in.

Van Stone Joints.

Van Stone joints are made with either round or square shoulder on lap, are absolutely squarable, and require no attention or renewing, excepting an occasional gasket. They are made by rolling over the end of the pipe in front of the flange until at right angles to axis of pipe. The lap is then faced on front and edge, and acts as bearing for gasket in making the joint.

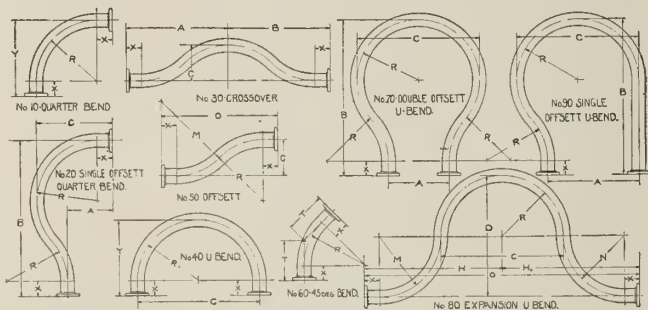
This joint can be used in connection with a flange of a valve or fitting, as well as two pieces of pipe. The flanges act merely as two swiveling collars to hold the pipes together, and permit turning for matching fittings, valve, or other flanges in any position.

Designed for any pressure, and can be furnished male or female.



VAN STONE JOINTS

Pipe Bends.



DIMENSION DIAGRAMS, PIPE BENDS MADE FROM LAP-WELDED STEEL PIPE

Size pipe	R-M-N. Advisable radius of bends	T. Center to end or face of flgs.	X. Length of tangents or straight pipe on each bend	Y. Center of bends to face of flanges or ends of pipe	Lin. ft. of pipe in each quarter bend	Lin. ft. of pipe in each U-bend	Lin. ft. of pipe in each 45° bend	Min. radius to which bends can be made from extra strong pipe only
in.	in.	ft. in.	in.	ft. in.	ft. in.	ft. in.	ft. in.	in.
$2\frac{1}{2}$	12 $\frac{1}{2}$	0	9 $\frac{1}{8}$	4	1	4 $\frac{1}{2}$	2	3 $\frac{3}{4}$
3	15	0	10 $\frac{1}{4}$	4	1	7	2	7 $\frac{1}{8}$
$3\frac{1}{2}$	17 $\frac{1}{2}$	0	11 $\frac{1}{4}$	5	1	10 $\frac{1}{2}$	3	11 $\frac{1}{2}$
4	20	1	1 $\frac{1}{4}$	5	2	1	3	5 $\frac{1}{2}$
$4\frac{1}{2}$	22 $\frac{1}{2}$	1	3 $\frac{1}{8}$	6	2	4 $\frac{1}{2}$	3	11 $\frac{1}{2}$
5	25	1	4 $\frac{3}{8}$	7	2	7	4	3 $\frac{1}{4}$
6	30	1	7 $\frac{1}{8}$	7	3	1	5	1 $\frac{1}{8}$
7	35	1	10 $\frac{1}{2}$	8	3	7	5	11
8	40	2	1 $\frac{1}{8}$	9	4	1	6	9
9	45	2	5 $\frac{5}{8}$	11	4	8	7	8 $\frac{3}{4}$
10	50	2	8 $\frac{3}{4}$	12	5	2	8	6 $\frac{1}{2}$
12	60	3	2 $\frac{1}{8}$	14	6	2	10	7 $\frac{1}{4}$
14	70	3	9	16	7	2	11	10
15	75	3	11 $\frac{1}{8}$	16	7	7	12	6
16	80	4	3 $\frac{1}{8}$	18	8	2	13	5 $\frac{3}{4}$
18	108	5	2 $\frac{3}{4}$	18	10	6	17	1 $\frac{1}{4}$
20	120	5	7 $\frac{3}{4}$	18	11	6	18	8 $\frac{1}{2}$
22	132	6	5 $\frac{5}{8}$	18	12	6	20	3
24	144	6	5 $\frac{5}{8}$	18	13	6	21	10

When submitting specifications for bends, always give the various dimensions indicated on cuts. Prices on application

Standard Cast Iron Flanged Fittings.



CAST IRON STANDARD FLANGED FITTINGS
For 125 lbs. working pressure. Made in all styles and sizes, straight and reducing
Also furnished in cast steel or bronze at special prices

DIMENSIONS IN INCHES

Size, in.	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	6	7	8
F. to F., tees and crosses	7 $\frac{1}{2}$	8	9	10	11	12	13	14	15	16	17	18	19
C. to F., tees, crosses	3 $\frac{1}{2}$	4	4 $\frac{1}{2}$	5	5 $\frac{1}{2}$	6	6 $\frac{1}{2}$	7	7 $\frac{1}{2}$	8	8 $\frac{1}{2}$	9	9 $\frac{1}{2}$
C. to F. of 45° ells.	1 $\frac{1}{4}$	2	2 $\frac{1}{4}$	3	3 $\frac{1}{4}$	4	4 $\frac{1}{4}$	5	5 $\frac{1}{4}$	6	6 $\frac{1}{4}$	7	7 $\frac{1}{4}$
Diam. base, base ells.	4	4	4	4	4	4	4	4	4	4	4	4	4
Thickness base flg., base ells.	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
C. to B. of base ells.	4 $\frac{1}{2}$	5	5 $\frac{1}{2}$	6	6 $\frac{1}{2}$	7	7 $\frac{1}{2}$	8	8 $\frac{1}{2}$	9	9 $\frac{1}{2}$	10	10 $\frac{1}{2}$
C. to F. of long radius ells.	5	5 $\frac{1}{2}$	6	6 $\frac{1}{2}$	7	7 $\frac{1}{2}$	8	8 $\frac{1}{2}$	9	9 $\frac{1}{2}$	10	10 $\frac{1}{2}$	11
Radius of long radius ells.	5	5 $\frac{1}{2}$	6	6 $\frac{1}{2}$	7	7 $\frac{1}{2}$	8	8 $\frac{1}{2}$	9	9 $\frac{1}{2}$	10	10 $\frac{1}{2}$	11
F. to F. of laterals	7 $\frac{1}{2}$	8	9	10	11	12	13	14	15	16	17	18	19
Long C. to F. of laterals	5 $\frac{1}{2}$	6	7	8	9	10	11	12	13	14	15	16	17
Short C. to F. of laterals	1 $\frac{1}{4}$	2	2 $\frac{1}{4}$	3	3 $\frac{1}{4}$	4	4 $\frac{1}{4}$	5	5 $\frac{1}{4}$	6	6 $\frac{1}{4}$	7	7 $\frac{1}{4}$
F. to F. of reducers	4	4	4	4	4	4	4	4	4	4	4	4	4
Diam., flgs.	4	4	4	4	4	4	4	4	4	4	4	4	4
Thickness, flgs.	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
No. of bolts	4	4	4	4	4	4	4	4	4	4	4	4	4
Size, bolts	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Length, bolts	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$
Bolt circle	3	3 $\frac{1}{4}$	3 $\frac{1}{2}$	4	4 $\frac{1}{4}$	4 $\frac{1}{2}$	5	5 $\frac{1}{4}$	5 $\frac{1}{2}$	6	6 $\frac{1}{4}$	6 $\frac{1}{2}$	7
Min. thickness of body	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$

Size, in.	9	10	12	14	15	16	18	20	22	24	26	28	30
F. to F., tees and crosses	20	22	24	28	29	30	33	36	40	44	46	48	50
C. to F., tees, crosses	10	11	12	14	14 $\frac{1}{2}$	15	16 $\frac{1}{2}$	18	20	22	23	24	25
C. to F. of 45° ells.	6	6 $\frac{1}{2}$	7 $\frac{1}{2}$	8	8	8	8 $\frac{1}{2}$	9 $\frac{1}{2}$	10	11	11	13	14
Diam. base, base ells.	9	9	11	11	11	11	13 $\frac{1}{2}$	13 $\frac{1}{2}$	13 $\frac{1}{2}$	13 $\frac{1}{2}$	13 $\frac{1}{2}$	13 $\frac{1}{2}$	13 $\frac{1}{2}$
Thickness base flg., base ells.	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
C. to B. of base ells.	9 $\frac{1}{2}$	10	10 $\frac{1}{2}$	13 $\frac{1}{2}$	14	14 $\frac{1}{2}$	16 $\frac{1}{2}$	18 $\frac{1}{2}$	20	22	23	24	25
C. to F. of long radius ells.	15 $\frac{1}{2}$	16 $\frac{1}{2}$	19	21 $\frac{1}{2}$	22 $\frac{1}{2}$	24	26 $\frac{1}{2}$	29	31 $\frac{1}{2}$	34	36 $\frac{1}{2}$	39	41 $\frac{1}{2}$
Radius of long radius ells.	13	14 $\frac{1}{2}$	16 $\frac{1}{2}$	18 $\frac{1}{2}$	20	21 $\frac{1}{2}$	23 $\frac{1}{2}$	26	28 $\frac{1}{2}$	30	32 $\frac{1}{2}$	35	37 $\frac{1}{2}$
F. to F. of laterals	24	25 $\frac{1}{2}$	30	33	34 $\frac{1}{2}$	36 $\frac{1}{2}$	39	43	46	49 $\frac{1}{2}$	53	56	59
Long C. to F. of laterals	19 $\frac{1}{2}$	20 $\frac{1}{2}$	24 $\frac{1}{2}$	27	28 $\frac{1}{2}$	30	32 $\frac{1}{2}$	35	37 $\frac{1}{2}$	40 $\frac{1}{2}$	43	46 $\frac{1}{2}$	49
Short C. to F. of laterals	4 $\frac{1}{2}$	5	5 $\frac{1}{2}$	6	6	6	6 $\frac{1}{2}$	7	7	7	7 $\frac{1}{2}$	8	8 $\frac{1}{2}$
F. to F. of reducers	11 $\frac{1}{2}$	12	14	16	17	18	19	20	22	24	26	28	30
Diam., flgs.	15	16	19	21	22 $\frac{1}{2}$	23 $\frac{1}{2}$	25	27 $\frac{1}{2}$	29 $\frac{1}{2}$	32	34 $\frac{1}{2}$	36 $\frac{1}{2}$	38 $\frac{1}{2}$
Thickness, flgs.	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$
No. of bolts	12	12	12	12	12	12	12	12	12	12	12	12	12
Size, bolts	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Length, bolts	3 $\frac{1}{4}$	3 $\frac{1}{4}$	3 $\frac{1}{4}$	4 $\frac{1}{4}$	4 $\frac{1}{4}$	4 $\frac{1}{4}$	4 $\frac{1}{4}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$
Bolt circle	13 $\frac{1}{2}$	14 $\frac{1}{2}$	17	18 $\frac{1}{2}$	19	20 $\frac{1}{2}$	21 $\frac{1}{2}$	23	25	27 $\frac{1}{2}$	29 $\frac{1}{2}$	31 $\frac{1}{2}$	34
Min. thickness of body	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$

Size, in.	32	34	36	38	40	42	44	46	48	50	52	54	56
F. to F., tees and crosses	52	54	56	58	60	62	64	66	68	70	74	78	82
C. to F., tees, crosses	26	27	28	29	30	31	32	33	34	35	37	39	41
C. to F. of 45° ells.	16	17	18	19	20	21	22	23	24	25	26	27	28
C. to F. of long radius ells.	44	46 $\frac{1}{2}$	49	51 $\frac{1}{2}$	54	56 $\frac{1}{2}$	59	61 $\frac{1}{2}$	64	66 $\frac{1}{2}$	69	71 $\frac{1}{2}$	74
F. to F. of reducers	32	34	36	38	40	42	44	46	48	50	52	54	56
Diam., flgs.	41 $\frac{1}{2}$	43 $\frac{1}{2}$	46	48 $\frac{1}{2}$	50 $\frac{1}{2}$	53	55 $\frac{1}{2}$	57 $\frac{1}{2}$	59 $\frac{1}{2}$	61 $\frac{1}{2}$	64	66 $\frac{1}{2}$	68 $\frac{1}{2}$
Thickness, flgs.	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$
No. of bolts	28	32	32	32	36	36	40	40	44	44	44	44	44
Size, bolts	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$
Length, bolts	6 $\frac{1}{2}$	6 $\frac{1}{2}$	7	7	7	7	7 $\frac{1}{2}$	7 $\frac{1}{2}$	8	8	8	8 $\frac{1}{2}$	8 $\frac{1}{2}$
Bolt circle	38 $\frac{1}{2}$	40 $\frac{1}{2}$	42 $\frac{1}{2}$	45 $\frac{1}{2}$	47 $\frac{1}{2}$	49 $\frac{1}{2}$	51 $\frac{1}{2}$	53 $\frac{1}{2}$	56	58 $\frac{1}{2}$	60 $\frac{1}{2}$	62 $\frac{1}{2}$	65
Min. thickness of body	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$

Size, in.	58	60	62	64	66	68	70	72	74	76	78	80
F. to F., tees and crosses. . .	84	88	90	94	96	100	102	106	108	112	116	118
C. to F., ells, tees, crosses. . .	42	44	45	47	48	50	51	53	54	56	58	59
C. to F. of 45° ells.	29	30	31	32	33	34	35	36	37	38	39	40
C. to F. of long radius ells. . .	76 ¹ / ₂	79	81 ¹ / ₂	84	86 ¹ / ₂	89	91 ¹ / ₂	94	96 ¹ / ₂	99	101 ¹ / ₂	104
F. to F. of reducers.	58	60	62	64	66	68	70	72	74	76	78	80
Diam., figs.	71	73	75 ¹ / ₂	78	80	82 ¹ / ₂	84	86 ¹ / ₂	88	90 ¹ / ₂	93	95 ¹ / ₂
Thickness, figs.	31 ¹ / ₂	31 ¹ / ₂	31 ¹ / ₂	32 ¹ / ₂	33 ¹ / ₂	33 ¹ / ₂	3 ¹ / ₂	3 ¹ / ₂	3 ¹ / ₂	3 ¹ / ₂	3 ¹ / ₂	3 ¹ / ₂
No. of bolts.	48	52	52	52	52	56	56	60	60	60	60	64
Size, bolts.	1 ³ / ₄	1 ³ / ₄	1 ³ / ₄	1 ³ / ₄	1 ³ / ₄	1 ³ / ₄	1 ³ / ₄	1 ³ / ₄	1 ³ / ₄	1 ³ / ₄	1 ³ / ₄	2
Length, bolts.	9	9	9	9	9	9 ¹ / ₂	9 ¹ / ₂	10	10	10	10 ¹ / ₂	10 ¹ / ₂
Bolt circle.	67 ¹ / ₂	69 ¹ / ₂	71 ¹ / ₂	74	76	78 ¹ / ₂	80 ¹ / ₂	82 ¹ / ₂	84 ¹ / ₂	86 ¹ / ₂	88 ¹ / ₂	91
Min. thickness of body.	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	2 ¹ / ₂	3

Extra Heavy Cast Iron Flanged Fittings.



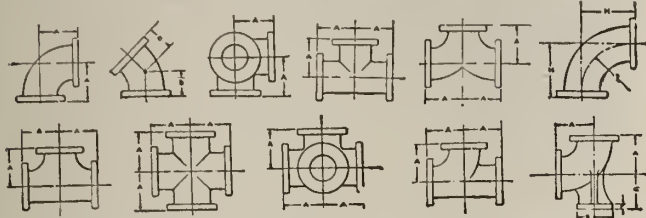
Elbow

Tee

Lateral

EXTRA HEAVY CAST IRON FLANGED FITTINGS

For 250 lbs. working pressure. Made in all styles and sizes, straight and reducing
Also furnished in cast steel or bronze at special prices



DIMENSION DIAGRAMS, CAST IRON FLANGED FITTINGS

Size, in.	1	1½	2	2½	3	3½	4	4½	5	6	7
F. to F., tees and crosses, in.	8	8½	9	10	11	12	13	14	15	16	17
C. to F., tees, crosses, in.	4	4½	4½	5	5½	6	6½	7	7½	8	8½
C. to F., 45° ells, in.	2	2½	2½	3	3½	3½	4	4½	4½	5	5½
Diam. base, base ells, in.	4½	4½	5	5	5	6	6	6½	6½	7½	7½
Thickness base flg., base ells, in.	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½
C. to B. of base ells, in.	4½	5	5½	6	6½	6½	7	7½	7½	8	8½
C. to F. of long radius ells, in.	5	5½	6	6½	7	7½	8½	9	9½	10½	11½
Radius of long radius ells, in.	6½	7½	8½	9½	10½	11½	12½	13½	14½	15½	16½
F. to F. of laterals, in.	8½	9½	11	11½	13	14	15½	16½	18	18½	21½
Long C. to F. of laterals, in.	6½	7½	8½	9	10½	11	12½	13½	14½	15	17½
Short C. to F. of laterals, in.	2	2½	2½	2½	2½	3	3	3	3½	3½	4
F. to F. of reducers, in.	4½	5	6	6½	7½	8½	9	10	10½	11	12½
Diam., flgs., in.	4½	5	6	6½	7½	8½	9	10	10½	11	12½
Thickness, flgs., in.	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½
No. of bolts, in.	4	4	4	4	4	8	8	8	8	12	12
Size, bolts, in.	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½
Length, bolts, in.	2	2½	2½	2½	3	3½	3½	3½	3½	3½	4
Bolt circle, in.	3½	3½	4½	5	5½	6½	7½	8½	9½	10½	11½
Min. thickness of body, in.	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½

Size, in.	8	9	10	12	14	15	16	18	20	22	24	26
F. to F., tees and crosses, in.	20	21	23	26	30	31	33	36	39	41	45	48
C. to F., tees, crosses, in.	10	10½	11½	13	15	15½	16½	18	19½	20½	22½	24
C. to F., 45° ells, in.	6	6½	7	8	8½	9	9½	10	10½	11	12	13
Diam. base, base ells, in.	10	10	10	12½	12½	12½	12½	15	15	17½	17½	18
Thickness base flg., base ells, in.	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½
C. to B. of base ells, in.	9½	10	10½	11	14	14½	15½	16½	17½	18½	19½	20½
C. to F. of long radius ells, in.	14	15½	16½	19	21½	22½	24	26½	29	31½	34	36½
Radius of long radius ells, in.	12	13	14½	16½	18½	20	21½	23½	26	28½	30½	32½
F. to F. of laterals, in.	25½	27½	29½	33½	37½	39½	42	45½	49	53	57½	61½
Long C. to F. of laterals, in.	20½	22½	24	27½	31	33	34½	37½	40½	43½	47½	51½
Short C. to F. of laterals, in.	5	5	5½	6	6½	6½	7½	8	8½	9½	10	10½
F. to F. of reducers, in.	11	11½	12	14	16	17	18	19	20	22	24	26
Diam., flgs., in.	15	16½	17½	20½	23	24½	25½	28	30½	33	36	38½
Thickness, flgs., in.	1½	1½	1½	2	2½	2½	2½	2½	2½	2½	2½	2½
No. of bolts, in.	12	12	16	16	20	20	20	24	24	24	28	28
Size, bolts, in.	7½	1	1	1½	1½	1½	1½	1½	1½	1½	1½	1½
Length, bolts, in.	4½	4½	5	5½	5½	6	6	6½	6½	7	7½	8
Bolt circle, in.	13	14	15½	17½	20½	21½	22½	24½	27	29½	32	34½
Min. thickness of body, in.	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½

Size, in.	28	30	32	34	36	38	40	42	44	46	48
F. to F., tees and crosses, in.	52	55	58	61	65	68	71	74	78	81	84
C. to F., tees, crosses, in.	26	27½	29	30½	32½	34	35½	37	39	40½	42
C. to F., 45° ells, in.	14	15	16	17	18	19	20	21	22	23	24
C. to F. of long radius ells, in.	39	41½	44	46½	49	51½	54	56½	59	61½	64
F. to F. of reducers, in.	28	30	32	34	36	38	40	42	44	46	48
Diam., flgs., in.	40½	43	45½	47½	50	52½	54½	57	59½	61½	65
Thickness, flgs., in.	2½	3	3½	3½	3½	3½	3½	3½	3½	3½	4
No. of bolts, in.	28	28	28	28	32	32	36	36	36	40	40
Size, bolts, in.	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½
Length, bolts, in.	8	8½	9	9	9½	9½	10	10	10½	10½	11
Bolt circle, in.	37	39½	41½	43½	46	48	50½	52½	55	57½	60½
Min. thickness of body, in.	1½	2	2½	2½	2½	2½	2½	2½	2½	2½	3

DIMENSIONS, EXTRA HEAVY HYDRAULIC FLANGED FITTINGS (SEMI-STEEL)

For 800 lbs. water working pressure

Size, in.	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12
Diam., flgs. in.	6½	7½	8½	10	10½	11½	12½	13½	15	16	17	18½	21	23½
Straight or reducing tees and crosses, in.	5½	6	6½	7½	8	8½	9½	10	11	11½	12½	13½	15	16½
C. to F. of elbows, in.	7½	8	8½	9½	10	10½	11½	12½	13½	15	16½	17½	20½	22½
Rad. of sweep of elbows, in.	5½	6½	7½	8½	9½	10½	11½	12½	13½	15	16½	17½	20½	22½
C. to F. of 45° elbows, in.	3½	3½	4	4½	5	5½	5½	6	6½	7	7½	8½	9½	10½

Special Flanged Fittings.

For special purposes flanged fittings are made in different designs and the illustrations show a few patterns designed and made by THE KELLY & JONES CO. They can be furnished as shown or in any other design, for all pressures and temperatures.

In ordering, sketch should be submitted showing design wanted and complete dimensions. Prices on application.

FIG. 68P
Elbow with
Clean-out
FlangeFIG. 68Q
Flanged YFIG. 68R
Special Angle
Elbow
5½°, 11½°,
22½°, 30°,
60°FIG. 68S
Elbow showing
location of
Tapped Drain
BossesFIG. 68T
Tee showing loca-
tion of Tapped
Drain Bosses

FIG. 68U. Offset

FIG. 68V
Beveled
Filling
Ring for
closing up
between

FIG. 68W. Return Bend

FIG. 68X. Return Bend
with Back Outlet

FIG. 68Y. Saddle Nozzle

FIG. 68Z. Double Lateral

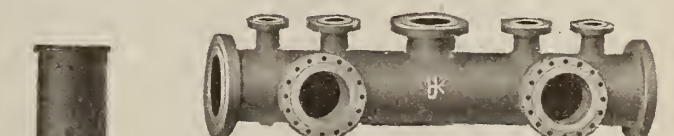


FIG. 68½A. Distributing Header

FIG. 68½.
Cast Iron
Pipe with
Flange and
SpigotFIG. 68½B. Ring Closing Piece
faced both sides
6 in. or less in length

SPECIAL FLANGED FITTINGS

Also furnished in cast steel or bronze at special prices

THE KENNEDY VALVE MFG. CO.

GENERAL OFFICES AND WORKS
ELMIRA, N. Y.

BRANCH OFFICES AND WAREHOUSES

NEW YORK, N. Y., 81 John Street—Telephone, Beekman 1430
BOSTON, MASS., 47 India Street

SAN FRANCISCO, CAL., 443 Rialto Building
CHICAGO, ILL., 204-8 North Jefferson Street

PHILADELPHIA, PA.
EL PASO, TEX.

SALES OFFICES
SEATTLE, WASH.
SALT LAKE CITY, UTAH

PORTLAND, ORE.
WINNIPEG, MAN.

Products.

GATE, CHECK, GLOBE and ANGLE VALVES, for power, heating, fire protection, water supply, plumbing, etc.

Radiator and other Valves, and Fire Hydrants.



Guarantee.

All Kennedy goods are thoroughly tested before leaving the works. Should any defects develop in proper use of goods in the service for which they are manufactured and sold, such goods will be replaced.

Catalogues.

Complete catalogues in either large or pocket size will be sent on application.

Types of Gate Valves.

Bronze valves 3 ins. and smaller, and iron valves 2 ins. and smaller are made with solid wedge disks.

In the larger sizes it is necessary to have a feature of flexibility that will take up and automatically follow slight variations. This is provided by the double disk feature, operated by wedging mechanism.

Outside rising stem and yoke gate valves, for all pressures, and inside stationary stem gate valves, for medium and extra heavy pressures, can be repacked while under pressure and open.

The wedging mechanisms used for operating Kennedy double disk gate valves are the "Cam," "Newtype" and "Lenticular" types.

The "Cam" type is simple—with the least possible number of working parts—and is for light and standard pressures, in sizes 2 to 12 ins. inclusive, for which it is found to give the best service.

The "Newtype" water gate type meets the requirements of water works.

The "Lenticular" type combines the flexible double disk principle with the wedge feature and center spreading control. This type is best for pressures greater than the ordinary, particularly for steam.

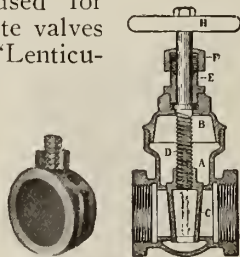


FIG. 1
FIG. 2
KENNEDY SOLID WEDGE DISK AND SECTIONAL VIEW OF SOLID WEDGE DISK GATE VALVE

Disk is in one piece, with double taper or wedge shaped faces.

Guided by ribs, cast on inside of body, working on channels in the disk.

A, body; B, cap or bonnet; C, disk; D, stem; E, stuffing box; F, packing nut; H, cast iron hand wheel

"Cam" Type Double Disk Parallel Seat Gate Valves.

These valves have a direct passage, the full size of internal diameter of the pipe, double disks with parallel faces, operated by cams revolving on trunnions fitting into bearings in the disks, a very simple and efficient mechanism.



FIG. 6



FIG. 7
BACKS OF DISKS

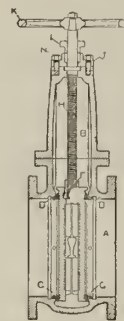


FIG. 8

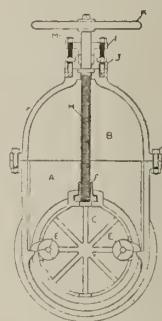


FIG. 9

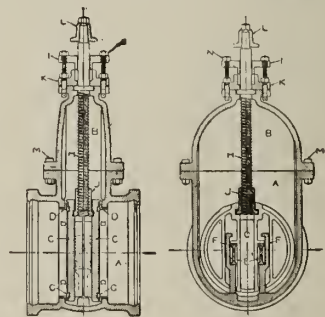
SECTIONAL VIEWS OF KENNEDY "CAM" TYPE DOUBLE DISK PARALLEL SEAT GATE VALVE

A, body; B, cap or bonnet; C, disk; D, seat ring; E, cams; F, stem nut; G, disk rings

"Newtype" Double Disk Parallel Seat Gate Valves.

Especially efficient for water works purposes. Wedges, of solid bronze, act on both disks equally

and independently of stem; stem always, therefore, being unimpaired and in perfect alignment. Wedging surfaces of wedges are of same angle and interchangeable. Disks can not stick, because bronze stem nut is thicker on one side than on the other; therefore, in opening valve, one disk lifts ahead of the other. Valves operate in any position.



SECTIONAL VIEWS OF SMALLER SIZES "NEWTYP" WATER GATE VALVE

Double wedging mechanism, parallel seats and independent stem nut



DISKS WITH WEDGING MECHANISM OF "NEWTYP" WATER GATE VALVE

"Lenticular" Double Disk Taper Seat Gate Valves.

Only five parts, which are moved by action of the screw—the two disks, lenticular bearing pieces, and the stem nut. The disks are provided with recesses or pockets to admit the shoulders or projections cast on

stem nut and from which the disks are suspended, and on the back of each disk is a projection having its face concaved and fitting the convex faces of the center pieces, thus making a true center bearing.

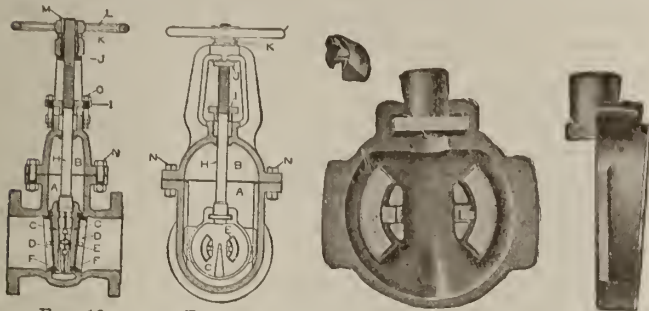


Fig. 12 Sectional Views
Fig. 13 Back of Disk with Stem Nut and Center Pieces in Place
Side View of Disk with Stem Nut
A, B, C, I, L, of cast iron; D, E, F, J, K, of bronze; H, bronze or steel according to size; M, steel; N, O, mild steel
KENNEDY "LENTICULAR" DOUBLE DISK GATE VALVE

"Standard" Bronze Gate Valves.

Solid wedge disks are used in sizes up to 3 ins., and double disk parallel seats 3½ ins. and larger. Stem is stationary.

Sizes ¼ to 3 ins. are for working pressures up to 150 lbs. water, or 125 lbs. steam; 3½ ins. to 6 ins. for working pressures up to 125 lbs. water, or 100 lbs. steam, and made with bolted bonnet. With or without gland in stuffing box.



Fig. 27
"STANDARD" BRONZE GATE VALVE, SCREWED

"STANDARD" BRONZE GATE VALVES (SCREWED), FIG. 27

Size, ins.	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4
End to end....	2	2	2	2¼	2¾	3⅜	3⅝	3¾	4¾	4½	5¾	6
Center to top of wheel....	3¾	3⅝	3¾	4¾	5⅝	5½	6¾	7⅝	9	10⅝	11½	13

"STANDARD" BRONZE GATE VALVES (FLANGED)

Size, ins.	2	2¾	3	3½	4	5	6
F. to F., flgd.....	4¾	5½	6	6½	7	8	9
Diam. flgs.....	6	7	7½	8½	9	10	11



Fig. 31. "STANDARD" BRONZE HOSE GATE VALVES
For working water pressures up to 150 lbs. Solid wedge disk and stationary stem. Unless otherwise specified, without cap and chain

Fig. 36. "STANDARD" QUICK OPERATING LEVER VALVE
Disk can be securely locked in any position by wheel screw. For working pressure of 150 lbs. water and 125 lbs. steam.
Sizes, ½, ¾, 1, 1¼, 1½, 2, 2½ and 3 ins.

Medium and Extra Heavy Gate Valves.

Made with iron wheel, solid wedge disk, and stationary stem. Gland follower in stuffing box. Fig. 37, medium pressure for water 250 lbs., steam 200 lbs. Fig. 40, extra heavy for working steam pressures up to 250 lbs.



Fig. 40 Sectional View
Fig. 37 Water, 250 lbs., and steam, 200 lbs.
Fig. 40 Steam, 250 lbs.

MEDIUM AND EXTRA HEAVY GATE VALVES
MEDIUM PRESSURE GATE VALVE (FIG. 37)

Size, ins.	½	¾	1	1¼	1½	2	2½	3
End to end.....	2 ⅞	2 ½	2 ⅝	3 ¼	3 ⅞	4	4 ⅝	5 ½
Center to top of wheel...	4 ½	5 ¼	5 ¾	6 ¾	7 ¾	8 ½	10 ¾	12 ½

EXTRA HEAVY BRONZE SCREWED GATE VALVE (FIG. 40)

Size, ins.	¾	½	¾	1	1¼	1½	2	2½	3
End to end.....	2 ⅞	3 ⅝	3 ½	3 ¾	4 ¾	5 ¾	6 ¾	6 ¾	6 ¾
Center of opening to top of stem.....	5	6	7	7 ¾	8 ¾	10 ½	12 ¾	14	14

"Low Pressure" Gate Valves.

These are iron body, bronze mounted, or all-iron valves with steel stems. Equipped with "Newtype" disks, and are for lighter pressures than the "Standard" line. Those without ribs are tested to 30 lbs. and those for heavier service are more heavily ribbed.

Furnished with flanges of any practicable diameter and drilling.

Stems on inside screw valves are of manganese bronze of at least 50,000 lbs. tensile strength. On outside rising stem and yoke valves they are of steel, unless otherwise specified.



Fig. 48
"LOW PRESSURE" GATE VALVE
Outside rising stem and yoke. 30 lbs. test pressure. Iron, bronze mounted, all-iron

Valves can be furnished to operate with chain instead of hand wheel. Sizes, 14, 16, 18, 20, 24, 30, 36, 42 and 48 ins. Other dimensions on application.



Fig. 57. Screwed "STANDARD" IRON BODY, BRONZE MOUNTED GATE VALVE
Fig. 58. Flanged "STANDARD" IRON BODY, BRONZE MOUNTED GATE VALVE
Fig. 59. Dimension Diagram MOUNTED GATE VALVE
With double disks, parallel seats, inside stationary stem of bronze of 50,000 lbs. tensile strength

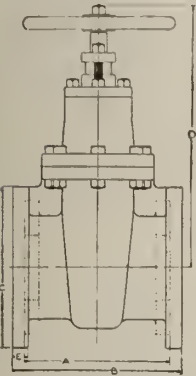
WORKING PRESSURES IN POUNDS PER SQUARE INCH, FOR "STANDARD" IRON BODY, BRONZE MOUNTED GATE VALVES

Sizes	Figs. 57 and 58		Fig. 59
	Water	Steam	Water
8 ins. and smaller.....	150	125	125
9, 10 and 12 ins.....	125	100	125
14 ins. and larger.....	100	...	100
Ribbed, 14 ins. and larger.....	150	...	150

Figs. 57 and 58, 12 ins. and smaller, "Cam" type; 14 ins. and larger, "Newtype," as described on preceding page.

Medium Heavy Iron Body, Bronze Mounted "Lenticular" Gate Valves.

Description on second preceding page. These valves are suitable for working steam pressures up to 175 lbs. The outside rising stem makes a positive indicator as to position of valve (Fig. 75).



Dimension Diagram



FIG. 74

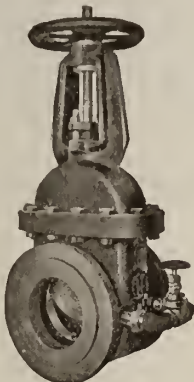


FIG. 75

MEDIUM HEAVY FLANGED "LENTICULAR" GATE VALVES

Stems of all sizes of Fig. 74, and 5 ins. and smaller, of Fig. 75, made of bronze of at least 50,000 lbs. tensile strength; and of steel, 6 ins. and larger, of Fig. 75, although they can be furnished of bronze at a reasonable extra price.

Attention is called to the self-packing feature, both in the inside screw and outside screw and yoke styles

MEDIUM HEAVY IRON BODY, BRONZE MOUNTED "LENTICULAR" GATE VALVES												
Size, ins.	2½	3	3½	4	4½	5	6	7	8	10	12	
A, serd.	6¾	7½	8¾	9¾	9¾	10¾	11¾	12	12¾	13¾	14¾	
B, flgd., with by-pass.	9½	9½	10½	10¾	11¾	12¾	13¾	13¾	13¾	14¾	15¾	
Size of by-pass.	7½	8½	9	10	10½	11½	12½	13½	13½	14½	15½	
C.	7½	8½	9	10	10½	11½	12½	13½	13½	14½	15½	
D, open H.	11¼	12¼	13¼	14¼	16¼	18¼	21¼	23¼	25¼	30¼	35	
O. R. S. & Y.	15¾	17¾	20¼	22¼	25¾	29¼	34¼	38	42	51¼	59	
Shut D.												
O. R. S. & Y.	12¼	14	15¾	17¼	19¾	22¾	26¾	29¼	32	39	44½	

Extra Heavy Iron Body, Bronze Mounted "Lenticular" Gate Valves.



FIG. 76. Inside Stationary Stem
Can be repacked under pressure

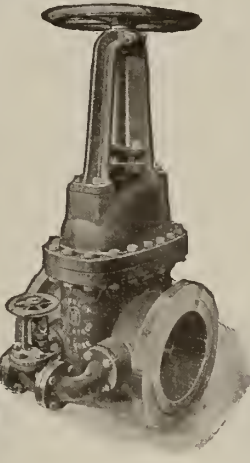
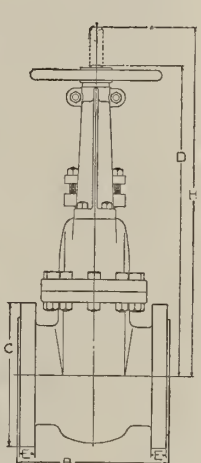


FIG. 77. Outside Rising Stem and Yoke with By-pass



Dimension Diagram

EXTRA HEAVY IRON BODY, BRONZE MOUNTED "LENTICULAR" GATE VALVES							
Size, ins.	2½	3	3½	4	5	6	7
A, serd.	9	10	10¾	10¾	13¼	13¾	14½
B.	10	11¾	11¾	12¼	15	15¾	16½
B with by-pass.					15	15¾	16½
Size of by-pass.	7½	8½	9	10	11	12½	14
C.	7½	8½	9	10	11	12½	14
D, Fig. 76.	12¾	14	16¼	16¾	19¾	22	24¼
H, open.	16¾	18¾	22¼	23¼	29¼	33¼	38¼
D, shut.	13¼	15¼	18¼	19¼	23¾	26¼	30½

EXTRA HEAVY IRON BODY, BRONZE MOUNTED "LENTICULAR" GATE VALVES—(Continued)							
Size, ins.	8	10	12	14	16	18	20
A, serd.	15¾						
B.	16½	18	19½	21½	21½	22	25
B with by-pass.	21	22½	23¾	25½	29	32	35¼
Size of by-pass.	1½	1½	2	2	2½	3	4
C.	15	17½	20½	23	25½	28	30½
D, Fig. 76.	26¾	30¼	36½	37¾	41½	47½	49¾
H, open.	41¼	50	62¼	67¼	75	83	93
D, shut.	32¼	39	49	52½	58	64	72



FIG. 91. Globe



FIG. 92. Angle

BRONZE GLOBE AND ANGLE VALVES
Renewable elastic disks and raised seats, insuring perfectly tight joint. Can be repacked under pressure. For working steam pressures, 150 lbs.; water, 175 lbs. Sizes, ¼, ¾, 1½, 2, 2½ and 3 ins.

Heavy Iron Body, Bronze Mounted Globe and Angle Valves.

For working pressures up to 125 lbs. steam and 150 lbs. water. Renewable elastic disks and raised seats, insuring tight joint.

Can be repacked under pressure. Of heavy design, with full size disk and area.

Sizes, 2, 2½, 3, 3½, 4, 4½, 5, 6, 7, 8 and 10 ins. Complete dimension on request.



FIG. 100. Screwed HEAVY IRON BODY, BRONZE MOUNTED GLOBE VALVE

Swing Check Valves.

Fig. 103 shows a heavy valve for 125 lbs. steam and 150 lbs. water pressure. Screwed ends. Sizes, ¾, 1½, 2, 2½ and 3 ins.



FIG. 103. BRONZE SWING CHECK VALVE

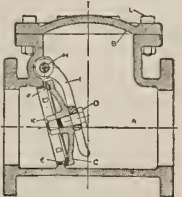


FIG. 106. SECTIONAL VIEW OF FLANGED IRON BODY, BRONZE MOUNTED SWING CHECK VALVES

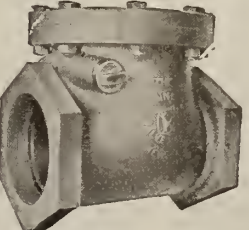


FIG. 105. SCREWED IRON BODY, BRONZE MOUNTED SWING CHECK VALVES

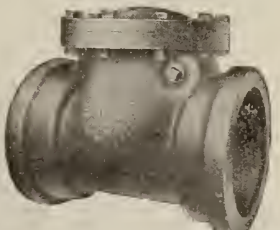


FIG. 107. BELL END, IRON BODY SWING CHECK VALVE WITH LEATHER FACED DISK

For working pressures up to 150 lbs. water or 100 lbs. steam. These valves are straightway, having a direct passageway of full area of pipe; disks revolve and are self-adjustable. Sizes, 2¼, 3, 3½, 4, 5, 6, 7, 8, 10 and 12 ins.

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VALVES: IRON, BRONZE and STEEL; STEAM, WATER, AIR, NATURAL GAS, OIL, AMMONIA; ANGLE and GATE; HORIZONTAL and VERTICAL CHECK; for either high, low or medium pressure.

FOOT VALVES; FIRE HYDRANTS.

For Sluice Gates, Shear Gates and Flap Valves, see page 504.

Ludlow Double Gate Straightway Valves.

Internal mechanism of valve consists of stem, two gates and two bevel faced wedges, the wedges being entirely independent of gates (or disks) and working between them, as shown in illustrations (Figs. 70 and 84).

CLOSING AND WEDGING—By action of stem, gates descend parallel with their seats until lower wedge strikes stop (or boss) in bottom of the case, gates and upper wedge continuing downward movement until face of upper wedge comes in contact with face of lower wedge. Face of upper wedge moves across face of lower wedge, exerting pressure on backs of both gates, forcing them apart and squarely against their seats (Figs. 70 and 84).

OPENING—First turn of stem releases upper wedge, thereby releasing both gates from their seats *before they commence to rise*, thus eliminating all grinding and reducing to a minimum the wear on the faces of both gates and seats. *No other valve possesses this advantage.*

CONSTRUCTION—Metal used, both iron and bronze, is of highest grade. Gates can not, under Ludlow construction, be wedged or locked until they are directly opposite valve opening; stem can not bind in wedge; no stripping of thread from stem by canting of gates to either side.

GROUND SEATS—All Ludlow valves have gates ground to their seats, to secure best joints possible.

STANDARD FLANGES AND DRILLING—The diameter and drilling of end flanges on our iron body valves, tested at 1000 lbs. or less, now conform to the "American" Standard effective January 1, 1914.

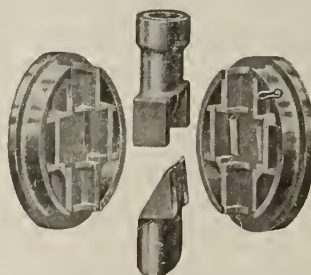


FIG. 84. STYLE OF GATES AND WEDGES FOR DOUBLE GATE VALVES

A, case; B, cover or bonnet; C, stem or spindle; D, packing plate or stuffing box; E, stuffing box gland or follower; F, stem nut; G, gates; H, gate rings; I, case rings; J, top wedge; K, bottom wedge; L, throat flange bolts; M, stuffing box or follower bolts

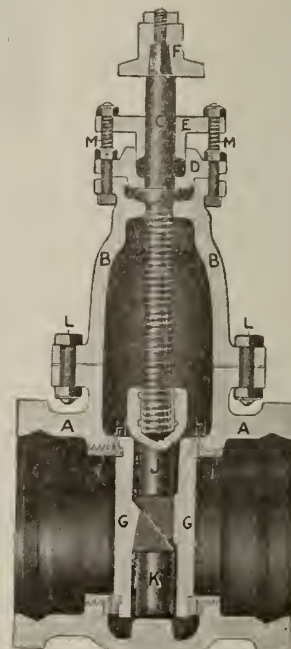
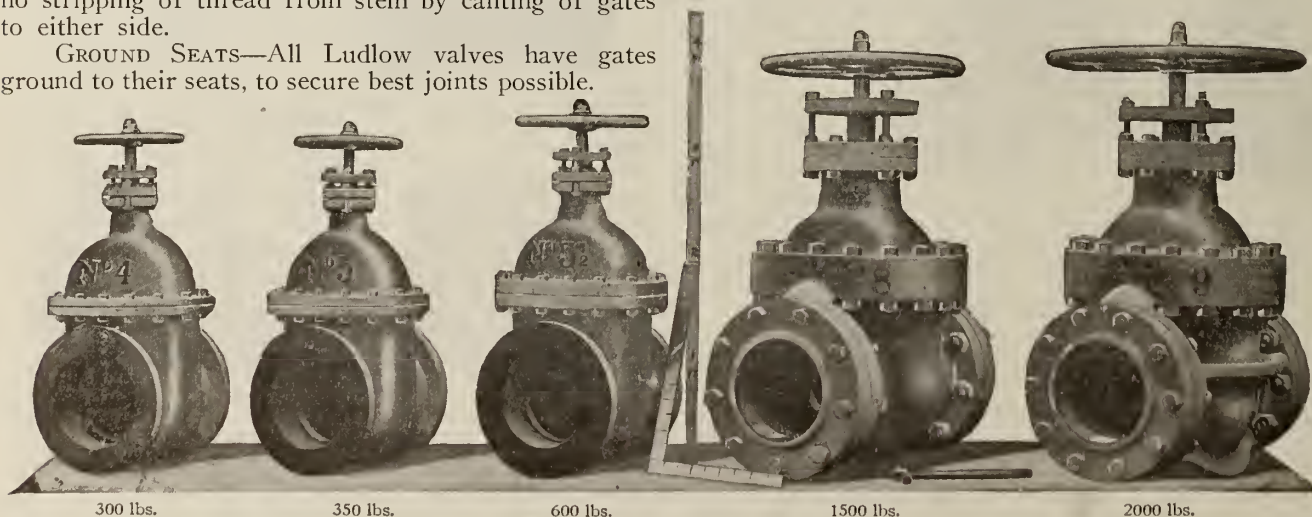


FIG. 70. LUDLOW BRONZE MOUNTED DOUBLE GATE VALVE

List No. 4, Double Gate Valves.

For heavy pressures on either side of gate. Used for water, steam, gas, oil, ammonia, etc. Valves tested at 300 lbs. water pressure. Gates are adjustable with center bearings which absolutely prevent gates becoming wedged in case. Although shorter than other



A FEW SAMPLES OF LUDLOW VALVES IN VARIOUS SIZES
Tested to above pressures



FIG. 96. Screwed End Valve, with Bronze Screwed Packing Box. Style 6-in. and under



FIG. 97. Screwed End Valve, with Bolted Packing Plate. Style above 6-in.



FIG. 98. Flanged End Valve, with Bronze Screwed Packing Box. Style 6-in. and under



FIG. 5. Flanged End Valve, with Bolted Packing Plate. Style above 6-in.



FIG. 3. Hub or Bell End Water or Gas Valve. Style of all sizes

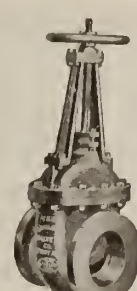


FIG. 99. Showing Outside Screw and Yoke For screwed or flanged end valves

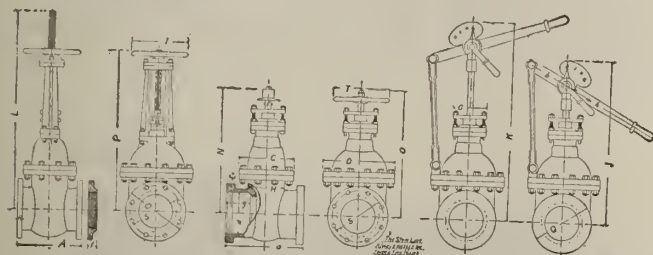


FIG. 11. Showing Sliding Stem and Lever

VALVES OF LISTS NOS. 1, 4, 5, 5½

valves, metal is thicker and will stand heavier pressures. Valves made with flanged or screwed ends for steam, and with hub or spigot ends for water.

Recommended working pressures not exceeding, steam, 75 lbs.; water, 150 lbs.



DIMENSION DIAGRAM, LIST NO. 4, IRON BODY BRONZE MOUNTED GATE VALVES

Size, ins.	A	Q	T	O	N	a	A-scr.	P	L	I	J	K
1	5	4	3 3/8	7 3/8	...	...	3 3/4	...	...	...	...	...
1 1/4	5 1/4	4 1/2	3 3/8	8	...	...	3 3/4	...	...	...	...	...
1 1/2	5 1/4	5	3 3/8	8 1/2	...	...	4	...	...	...	...	...
2	5 5/8	6	4 1/2	8 3/4	...	...	4 1/2	...	...	...	...	...
2 1/2	6 1/8	7	5	9 3/8	...	...	5	...	...	...	...	...
3	6 3/4	7 1/2	6	11 1/2	...	...	5 3/8	...	...	...	...	...
3 1/2	8 1/8	8 1/2	7 1/2	15 3/4	...	...	5 1/2	...	...	...	...	...
4	8 1/4	9	7 1/2	15 3/4	...	...	7 1/4	...	...	...	...	...
4 1/2	9 3/4	9 1/4	9 1/2	19 1/2	...	...	7 1/4	...	...	...	...	...
5	10 3/4	10	9	20	...	...	9 1/2	...	...	...	...	...
6	11 1/4	11	10	21	...	...	11	...	...	...	...	...
7	11 1/4	12 1/2	10	25 1/4	...	...	11 1/4	...	...	...	...	...
8	11	13 1/2	10	26 1/4	...	...	12	...	...	...	...	...
9	13	15	12	31 1/4	...	...	12 3/8	...	...	...	...	...
BM10	13 3/4	16	12	31 1/4	...	...	13 3/8	...	...	...	...	...
AI10	12 3/4	16	12	31 1/4	...	...	12 3/8	...	...	...	...	...
BM12	14 3/4	19	15	34 3/4	...	...	13 3/8	...	...	...	...	...
AI12	12 3/4	19	12	34 3/4	...	...	13 3/4	...	...	...	...	...

List No. 5, Double Gate Valves.

Valves have iron bodies and bronze mountings. Tested at 350 lbs. water pressure. Test *guaranteed*. For extra heavy working pressures either side of gate. All hub valves and all-iron valves have bolted stuffing box. These valves are also made with one end hub and other end spigot, or any other combination desired.

Recommended working pressures not exceeding, steam, 85 lbs.; water, 185 lbs.

DIMENSIONS, LIST NO. 5, DOUBLE GATE VALVES

Size, ins.	A	Q	T	O	N	a	A-scr.	P	L	I	J	K
2	5 3/8	6	4 1/2	8 3/4	9 3/8	7	4 7/8	12	15 1/2	6	11 1/4	13 1/2
2 1/2	6 1/8	7 1/2	5 1/2	11	11	7 3/4	5 3/8	13 1/4	17	6	14 1/4	17 1/4
3	8	8 1/2	7 1/2	15 3/4	15 1/2	10	7 3/4	16 1/8	20	9	...	...
3 1/2	8 1/4	9 1/2	7 1/2	16 3/4	17 1/4	10 1/2	7 7/8	21	26 1/4	9	...	...
4	9 3/8	9 1/4	9	19 3/8	19	11	9 1/2	25	30 1/4	10	...	...
4 1/2	10 3/4	10	9	20	19 3/4	12	11	28 1/4	34	10	...	...
5	11 1/4	11	10	24	22 1/2	13 1/4	11 3/4	28 1/2	36	12	...	...
6	13 1/4	13 1/2	12	25 1/4	24	13 3/8	12	31 1/4	39 1/4	12	...	...
7	13 1/4	15	12	26 1/4	24 3/4	14	13 1/2	34	43	12	...	...
8	15	16	12	31 1/4	29 3/4	15 1/2	13	38	48 1/4	14	...	...
9	15	16	12	30 3/4	29 3/4	14 3/4	14 1/4	41 1/2	53 1/2	14	...	...
10	15 1/2	19	15	35 3/4	33	15 3/4	14 3/4	47	61	15	...	...

For dimension diagrams, see List No. 4.

SWEET'S CATALOGUE

List No. 5½, Double Gate Valves.

Iron body with bronze mountings and all-iron. A first class steam gate valve made to withstand easily and safely a heavy working pressure up to 250 lbs. Tested at 600 lbs. water pressure. Test *guaranteed*. All parts, both iron and bronze, exceptionally heavy. Stuffing box can be repacked with gates fully open. Made in following styles: With inside screw, outside screw and yoke, bevel or spur gear, with by-pass, with loose flanges, flanges plain or grooved, and with screwed, flanged and hub ends.

Recommended working pressures not exceeding, steam, 250 lbs.; water, 400 lbs.

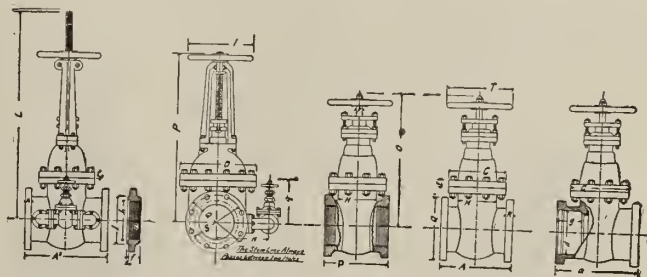


FIG. 101. Inside Screw Valve. Can be repacked with pressure on



FIG. 102. Outside Screw and Yoke Valve

VALVES OF LIST NO. 5½



DIMENSION DIAGRAM, LIST NO. 5½, DOUBLE GATE VALVES

Size, ins.	A	A2	Q	T	O	a	p	P	L	I	q
1 1/2	6	...	6	4 1/2	7 1/2	...	6 3/8	8 3/8	10	6	...
2	7 1/4	...	6 1/2	4 1/2	9 1/4	...	6 1/4	10 1/4	12 1/2	6	...
2 1/2	8	...	7 1/2	6	11	...	6 1/2	13	16 1/2	6	...
3	9 1/4	...	8 1/4	9	18 1/4	...	8 3/8	20	25	10	...
3 1/2	9 1/2	...	9	9	18 1/4	...	8 3/8	20	25	10	...
4	9 1/2	...	10	9	19 3/4	...	8 3/4	23	28 1/2	10	...
4 1/2	11	...	10 1/2	9	19 3/4	...	10	23 1/4	30 1/2	10	...
5	12 1/8	...	11	10	24 3/4	...	10 1/2	29	35 1/2	12	...
6	13	...	12 1/2	12	25 3/4	...	14	32	39 1/2	12	...
7	13 3/4	...	14	12	26 3/4	...	12	34	41 1/2	12	...
8	14 1/4	...	15 1/2	14	29 3/4	...	15	39	48 1/2	14	...
9	16 3/4	...	16 1/4	16	31	...	...	38	49	16	...
10	16 3/4	...	17 1/2	16	33 1/4	...	...	42 1/2	54	16	...
12	17 1/2	...	20 1/2	18	39 1/4	...	...	47	61	18	...
14	19	...	23	20	39	...	...	52 3/4	68 1/4	20	...
16	23	...	25 1/2	20	43	...	...	57	74 3/4	20	...
18	25	...	28	24	47 1/2	...	...	66 1/2	86	24	...
20	26 1/2	...	30 1/2	30	54	...	...	70 1/2	92	30	...
24	29 1/2	...	36	36	61 1/2	...	...	80	109	36	...

Continued on next page

List No. 30, Double Gate Valves.

For water, steam, oil, natural gas. Similar in style and construction to valves in List No. 5½, except that these valves are made heavier by means of ribs to withstand greater pressure. Iron body with bronze mountings, and all-iron. Tested at 1000 lbs. water pressure. Test *guaranteed*. Can be furnished with Dresser, Custer, Hammon or Dayton couplings.

Recommended working pressures not exceeding, steam, 275 lbs.; water, gas, 500 lbs.



FIG. 221. Screwed End Valve



FIG. 222. Flanged End Valve with Loose Flanges Bolted On



FIG. 223. Flanged End Valve

LIST NO. 30 DOUBLE GATE VALVES
Dimensions same as List No. 5½

List No. 8, Double Gate Valves.

Iron body with bronze mountings and all-iron. These valves have been on the market during many years. Thousands in use in this and other countries.

All parts extremely heavy. Tested at 1500 lbs. water pressure. All bolts are extra large. Stuffing box and follower are triple bolted, and the former is packed with special packing.

For extreme working pressures either side of gate. Recommended for working pressure not exceeding 750 lbs.

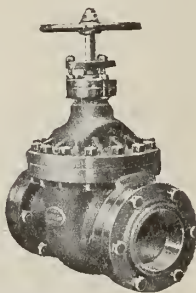


FIG. 12. LIST NO. 8 DOUBLE GATE VALVE
6-in. No. 8 valve with loose flanges bolted on

List No. 9, Double Gate Valves.

For hydraulic work, natural gas, oil, etc. Iron body with bronze mountings, and all-iron. Similar in design to valves in List No. 8, but heavier in every way for heavier working pressures. Used extensively on oil and natural gas lines; many still giving satisfaction after 35 years continuous service. Tested at 2000 lbs. water pressure. Gates and seats have ground faces, securing perfectly tight joints.

For extreme working pressures. Recommended for working pressure not exceeding 1200 lbs.



FIG. 14. LIST NO. 9 DOUBLE GATE VALVE
6-in. valve with loose flanges bolted on

is less water on the face of the gates and seats in operation, they work easier under heavy pressure, last longer and require fewer repairs.

The gates are adjustable, with center bearings and can not become stuck in the case. Gates and seats have ground faces, thus insuring watertight and steamtight joints. They work equally well with pressure either side of the gate.

By-passes of any size furnished. Valves made with hub or spigot ends for water, with flanged ends for steam. Tested at 300 lbs. water pressure.

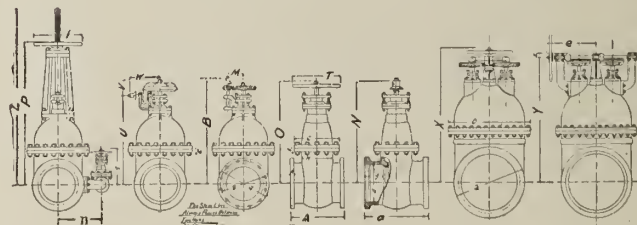
Recommended working pressure not exceeding, steam, 75 lbs.; water, 150 lbs.



FIG. 108. DOUBLE GATE HUB OR BELL END VALVE
With spur gearing



FIG. 184. SINGLE STEM HEAVY PRESSURE GATE VALVE
For electric and hand operation



DIMENSION DIAGRAM, LIST NO. 6, DOUBLE GATE VALVE

Size, ins.	A	Q	T	O	N	a	P	L	I	n	q	B	M	U	V	W	X	Y	e
14	15 3/4	21	15	43	40	15 3/4	55	71	15	15 1/2	83 1/2	43	81 1/2	33	71 1/2	14 3/4	...	...	...
15	15 3/4	22 1/4	18	43	41	15 3/4	58	76	18	16 3/4	83 1/2	46	81 1/2	36	71 1/2	14 3/4	...	...	...
16	16	23 1/2	18	44 1/4	42 1/2	15 3/4	58	76	18	16 3/4	83 1/2	47	81 1/2	35 1/2	71 1/2	14 3/4	...	...	...
18	17	25	21	48 1/4	47	18	...	...	...	21	17 1/2	111 1/2	81 1/2	38 1/2	71 1/2	14 3/4	...	...	...
20	17 3/4	27 1/2	24	51	50 1/2	19 1/2	...	...	...	24	18 1/2	111 1/2	81 1/2	38 1/2	71 1/2	14 3/4	...	...	...
22	20 1/4	29 1/2	24	57	56 1/2	19 1/2	...	...	...	24	19 3/4	111 1/2	81 1/2	38 1/2	71 1/2	17 3/4	...	...	...
24	21	32	24	60 1/2	60	22 1/4	...	...	...	24	22 1/2	116	81 1/2	38 1/2	71 1/2	17 3/4	...	...	...
28	26 1/2	36 1/2	...	...	...	24 1/2	...	...	...	26	25 1/2	116	73	14	63 1/2	121 1/2	21 1/4	...	...
30	26 1/2	38 1/2	...	...	...	26	...	...	...	26	16	79	14	67 3/4	14	21 1/4	...	...	...
36	28	46	...	...	...	26 7/8	...	...	...	30 1/2	21	92 1/2	181 1/2	78 1/2	163 1/2	30	90	92	34
42	34 1/2	53	...	...	...	33	...	...	...	33 1/2	21	96 3/4	181 1/2	84	163 1/2	30	106 1/2	99 1/2	40
48	42 1/2	59 1/2	...	...	...	39	...	...	...	41 1/2	26 1/2	...	231 1/2	98 1/2	173 1/2	33	...	...	...

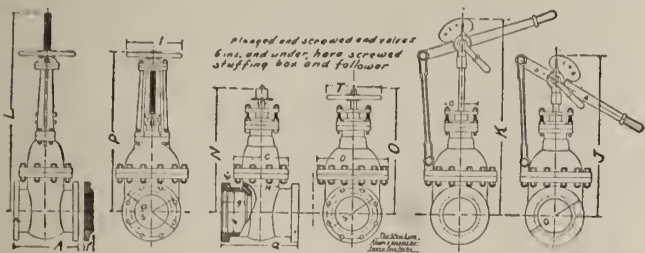
List No. 6, Double Gate Valves.

For heavy working pressures on either side of gate. Iron body with bronze mountings, and all-iron. Designed for water, steam, gas, etc. More of these valves are in use in water works systems than any other valve on the market (Figs. 108 and 184). Superior to all other water works valves, for the reason that there

List No. 1, Single Gate Valves.

Iron body with bronze mountings, and all-iron. For water, gas, etc. Used where double gate valves are unnecessary, and pressure is not excessive. Gate and seat have ground faces, therefore watertight joints are assured. Tested at 200 lbs. water pressure.

Recommended working pressures not exceeding, water, 100 lbs.



DIMENSION DIAGRAM, LIST NO. 1, SINGLE GATE VALVE

Size, ins.	A	Q	T	O	N	a	A-ser.	P	L	I	J	K
1	1 1/4											
1 1/2	5 1/2	5	3 1/2	8 1/2	8 1/2	8 1/2	4	12	15 1/2	6	11 1/4	13 1/2
2	5 5/8	6	4 1/2	8 3/4	9 3/8	7	4 7/8	13 1/4	17	6	14 1/4	17
2 1/2	6 1/8	7	5 1/2	11	11	7 3/4	5 3/8	13 3/4	17 1/2	6	15 1/2	19
3	6 5/8	7 1/2	6	11 1/2	11	8 3/4	5 3/2	13 1/2	17 1/2	9		
3 1/2	8 1/4	8 1/2	7 1/2	15 3/4	15 3/4	9 3/8	7 1/4	21	26 1/2	10	18 1/4	22 3/4
4	8 3/4	9	7 3/2	16	16 3/8	9 3/8	7 1/4	21	26 1/2	10		
4 1/2	9 3/4	9 1/4	9	19 1/2	19	11	9 1/2	25	30 1/4	10		
5	10 3/4	10	9	20	19 3/4	12	11	28 1/4	34	10		
6	11 3/8	11	10	21	22	12 1/2	11 1/4	29 3/8	36 1/2	12	23	29 3/4
7	11 1/4	12 1/2	10	25 1/4	24	13 1/2	12	31 1/4	39 1/4	12	26 1/2	34 1/2
8	11	13 1/2	10	26 1/2	25	14 1/2	12 3/8	33 1/2	42 1/2	12	30 3/8	39
9	13	15	12	31 1/4	29 3/4	15 1/2	13	38	48 1/4	14		
10	12 3/8	16	12	31 1/2	30	14 3/4	12 3/8	40	52	14	35 3/8	46 3/4
12	12 3/8	19	12	34 3/4	32 1/2	14 3/4	13 1/4	45	58	15	39 1/2	52 1/2

List Nos. 2 and 3, Gate Valves.

List No. 2 is single gate and List No. 3 is a double gate valve. Construction and method of wedging single gate valves are same as the double gate valves, except that one gate and one seat only have ground faces. For light working pressure steam, or medium pressure water or gas. Tested at 80 lbs. water pressure. Intended for use where double gate valves are not desirable.

Recommended working pressures not exceeding, steam, 30 lbs.; water, 40 and 50 lbs.

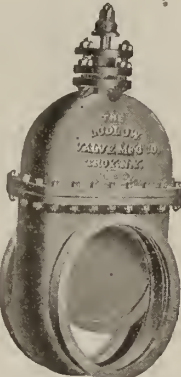
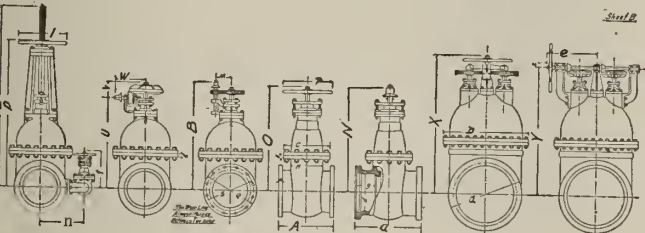


FIG. 104. HUB OR BELL END VALVE Without gearing



DIMENSION DIAGRAM, LIST NOS. 2 AND 3, SINGLE AND DOUBLE GATE VALVES

Size, ins.	A	Q	T	O	N	a	P	L	I	n	q	B	M	U	V	W	X	Y
1 1/2	13 3/4	21	15	40 1/4	40 1/4	15 1/4	5 1/8	68	15	15	8 3/4	42 1/2	8 1/4	32 1/2	7 1/2	14 3/8		
1 3/4	15 13/16	22 1/4	15	40	40	15 1/4	5 1/8	77	15	15 1/2	8 3/4	43	8 1/4	33	7 1/2	14 3/8		
1 7/8	16 13/16	23 1/4	15	43 1/2	42 1/2	15 1/4	5 1/8	86	15	15 1/2	8 3/4	44	8 1/4	33 1/2	7 1/2	14 3/8		
2	18 1/4	25	18	47	46	15 1/4	5 1/8	95	18	17 1/2	11 1/2	45	8 1/4	34 1/2	7 1/2	14 3/8		
2 1/8	20 1/2	27 1/4	18	50	49	17	65	89	18	18 1/2	11 1/2	48	8 1/4	38 1/2	7 1/2	14 3/8		
2 1/4	22 1/2	29 1/4	18	55	54	19		105	24	22 1/2	11 1/2	58	8 1/4	42 1/4	7 1/2	14 3/8		
2 3/8	24 1/2	32	24	57 1/2	55 1/2	17 1/4	76	105	24	22 1/2	11 1/2	58	8 1/4	48 1/4	7 1/2	14 3/8		
2 7/8	28 22/25	36 1/4	24	63 1/2	61 1/2	18		124	25	25	16	64 1/2	9 1/2	56 3/8	7 1/2	17 3/4		
3	30 22/25	38 3/4	30	69	67	19		130	26	26 1/2	16	71	11 1/2	60	9	19 1/2		
3 1/8	36 23	46				20 1/4		150	30	30 1/2	21	83	11 1/2	71 1/2	9	19 1/2		
40 28	50 3/4							180	32	32 1/2	21	95 1/4	14	85 1/2	14	21 1/4		
42 28	53							180	33 1/2	33 1/2	21	95 1/4	14	85 1/2	14	21 1/4		
48 38	59 1/2							210	41 1/4	26 1/4	26 1/4	106	18 1/4	92	16 3/4	25 1/2		
60 48	73							260	46 1/2	26 1/4	26 1/4	106	18 1/4	92	16 3/4	25 1/2		
72 48	86 1/2							260									118 1/2	
																	147 1/8	

List No. 7, Bronze Double Gate Valves.

For steam or water. These valves have been tested at these pressures per square inch: Water pressure, 6 ins. and under, at 300 lbs.; 7 ins. and above, at 250 lbs.

The metal in Ludlow valves is equal to that called for in Government work, and, as to tensile and transverse strength, is superior to that used in other valves.

Valves made to bear a heavy working pressure.

Gates and seats have ground faces, thus insuring steamtight and watertight joints.

All sizes up to 6 ins. inclusive have the screwed stuffing box and follower nut, unless otherwise specified; and all sizes above 6 ins. have the bolted packing gland or follower.

Working pressures recommended should not exceed the following: Steam, 3 ins. and under, 125 lbs., 3 1/2 ins. to 6 ins., 100 lbs., 7 ins. to 12 ins., 75 lbs.; water, 6 ins. and under, 175 lbs., 7 ins. and above, 125 lbs.

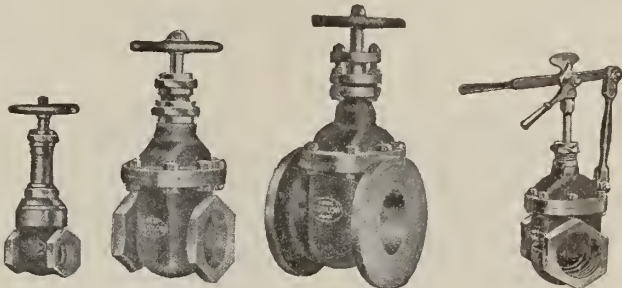


FIG. 85 Screwed Cover and Rising Stem 3/8, 1/2, 3/4, 1 in.

FIG. 87 Bolted Cover and Box 2 1/2 to 6 ins.

FIG. 91 Flanged End, with Bolted Cover and Stuffing Box 7 ins. and above

FIG. 21 Sliding Stem and Lock Lever Valve Gate held in any position

LIST NO. 7, BRONZE DOUBLE GATE VALVES

List No. 7 1/2, Extra Heavy Bronze Double Gate Valves.

Recommended working pressures: Water, 6 ins. and under, 400 lbs., and 7 ins. and above, 300 lbs.; steam, 6 ins. and under, 250 lbs., and 7 ins. and above, 200 lbs.

These valves are also made for heavy pressure hydraulic work, working water pressure not to exceed 1000 lbs.

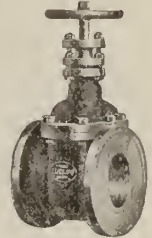


FIG. 153. LIST NO. 7 1/2 EXTRA HEAVY BRONZE DOUBLE GATE VALVE

List No. 10, Bronze Horizontal Swing Check Valves.

Made heavy and substantial, of highest grade of metal, for any desired working pressure. Gate and seat have ground faces.

Every valve is guaranteed. Tested at 300 lbs. water pressure.

Recommended working pressures not exceeding, steam, 100 lbs.; water, 175 lbs.



FIG. 35. SWING CHECK VALVE

List No. 10 1/2, Extra Heavy Bronze Horizontal Swing Check Valves.

Tested at 600 lbs. water pressure. Test guaranteed. Sizes, 1/2 to 4 ins.

Recommended working pressures not exceeding, steam, 250 lbs.; water, 400 lbs.

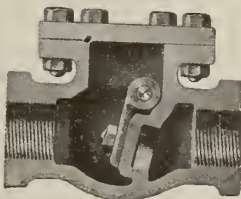


FIG. 154. EXTRA HEAVY BRONZE HORIZONTAL SWING CHECK VALVE

NOTE—The foregoing valves (Lists 10 and 10½) are not made to compete in price with light and inferior goods, but are made heavy and substantial, and the workmanship is unsurpassed. They are strong, and are not warped out of shape when screwed into a line pipe, as is often the case with inferior goods.

List Nos. 11 and 12, Horizontal Swing Check Valves, Iron Body with Bronze Mountings.

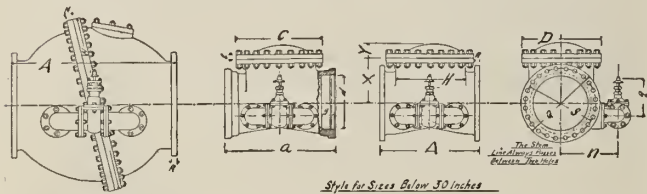
These valves are made with iron bodies, bronze mounted, are heavy and substantial. They are so constructed that bottom of the case is flattened and raised toward the seat, eliminating pockets or receptacles for stones or gravel. Gates in all sizes can be taken out by removing the cover or manhole plate.

Sizes 14 ins. and above are made with by-pass. Tested, 24 ins. and under at 300 lbs. per sq. in. water pressure; 30 ins. and above at 250 lbs. per sq. in. water pressure.

Recommended working pressures: Steam, 24 ins. and under, 75 lbs.; water, 24 ins. and under, 150 lbs.; 30 ins. and above, 125 lbs.



LIST No. 11 LIST No. 12
HORIZONTAL SWING CHECK VALVES, IRON BODY WITH BRONZE MOUNTINGS



DIMENSION DIAGRAM, LIST NOS. 11 AND 12, HORIZONTAL SWING CHECK VALVES

Size, ins.	A	Q	C	D	X	Y	a	n
2	7¾	6	6¼	6¼	2½	1½	9¼	.....
2½	8½	7	7¾	7¾	2¾	1¾	9½	.....
3	9½	7½	7¾	7¾	3¾	1½	11¾	.....
3½	9¾	8½	8½	8½	4½	1½	11¾	.....
4	11¾	9	11½	11	6	2	13¾	.....
4½	12½	9¼	11	10¾	6	1¾	16½	.....
5	13½	10	12½	11½	7	1¾	15	.....
6	14½	11	12¾	11¾	6½	1¾	16	.....
7	16	12½	14½	13½	7¾	2	18½	.....
8	17¾	13½	15½	14½	8	2½	19	.....
9	21½	15	21¾	19¼	11½	3½	24	.....
10	21½	16	21¾	19¼	11½	3½	24	.....
12	24½	19	23¼	21¾	11½	3½	26½	.....
14	26	21	25	23½	12¾	3¾	29	13¼
16	29	23½	26¾	25½	14¾	4	31	16
18	31¾	25	29¾	27½	15½	4½	34½	17¾
20	35¼	27½	31¾	29½	16½	5½	38	19
24	39¾	32	38	35½	20½	7½	44½	21½
30	54¾	38¾	.....	.....	.....	.....	54¾	33¾
36	61¾	46	.....	.....	.....	.....	61¾	37½
48	105	59½	.....	.....	.....	.....	115¾	.....

List No. 12½, Extra Heavy Horizontal Swing Check Valves.

For use under heavy pressure. Made with iron bodies and are bronze mounted. Similar in construction to the valves in List Nos. 11 and 12, but heavier throughout. All parts extra strong. Tested at 600 lbs. water pressure. Sizes 14 ins. and above made with by-pass; 12 ins. and under made without by-pass.

Recommended working pressures: Steam, 24 ins. and under, 200 lbs.; 30 ins. and above, 125 lbs.; water,

24 ins. and under, 400 lbs., 30 ins. and above, 200 lbs.

DIMENSIONS, LIST NO. 12½, HORIZONTAL SWING CHECK VALVES

Size, ins.	A	Q	X	Y	a	F. to F. screw
2	7¾	6½	2¾	1½	.....	6¾
2½	10¾	7½	2¾	1½	.....	9¼
3	12½	8¾	4	1½	.....	11¾
3½	13	9	5½	2	.....	.....
4	13	10	5¾	1¾	.....	12
4½	14	10½	.....	.....	.....	.....
5	14½	11	7¾	2	.....	13¾
6	18½	12½	6½	3¾	.....	15
7	19	14	.....	.....	.....	.....
8	19¼	15	8	2¾	.....	19
9	23½	16¼	.....	.....	.....	.....
10	23½	17½	11½	4½	.....	.....
12	26	20½	12¼	5½	.....	.....
14	28	23	14¾	5½	.....	.....
16	32	25½	.....	.....	.....	.....

For dimension diagram, see List Nos. 11 and 12

List No. 13, Vertical Check Valves.

Iron body, gates faced with solid rubber disks seating against iron plate. Bearings are of bronze. Rubber, of best quality.

Made in two styles: 9 ins. and under, with single gate; sizes above 9 ins. are made with gate plate and a nest of small gates varying in number according to size of valve, also with hand-holes for cleaning purposes.

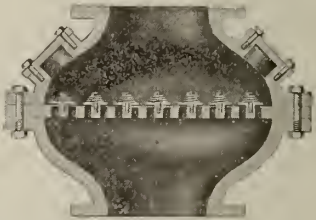
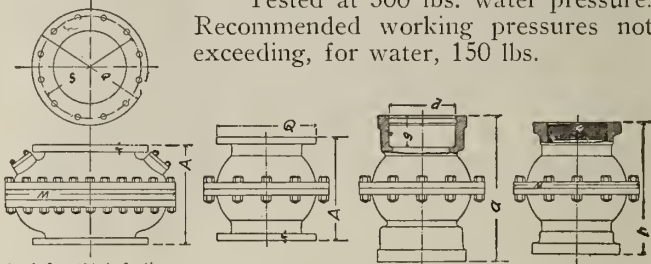


FIG. 127. VERTICAL CHECK VALVE
Screwed, flanged or hub ends

Tested at 300 lbs. water pressure. Recommended working pressures not exceeding, for water, 150 lbs.



DIMENSION DIAGRAM, LIST NO. 13, VERTICAL CHECK VALVES

Size, ins.	A	Q	p	a	M	Handhole.
2	4¾	6	7¾	9½	7	.....
2½	5¼	7	7¾	9¾	7½	.....
3	6¼	7½	8½	11	8½	.....
3½	7¼	8½	10½	11½	10½	.....
4	7¾	9	10¾	12½	11	.....
5	9¾	10	12¾	16¾	12	.....
6	9¾	11	13½	17¾	14	.....
7	9¾	12½	13½	19¾	16¼	.....
8	10¾	13½	14	19¾	16¾	.....
9	11¾	15	14¾	21¾	18½	.....
10	17¾	16	25¾	27½	23½ x 5½	.....
12	20½	19	29	30½	3 x 6	.....
14	18½	21	27¼	31	3½ x 6	.....
16	21¾	23½	30	34	3½ x 6	.....
18	23¼	25	31	36¾	3½ x 6	.....
20	23¼	27½	33½	39	3½ x 6	.....
24	29½	32	40½	53¾	3½ x 6	.....
30	29¾	38¾	.....	65¾	4 x 7	.....

List No. 14, Vertical Foot Valves.

Of similar construction to above vertical check valves. Iron body and iron gate plate. Gates faced with solid rubber. Sizes above 9 ins. have, in addition to nest of small gates, a plate screen or strainer bolted to bottom of valves and made of heavy brass wire, also handholes. Sizes under 9 ins. made with single gate, with basket screen or strainer. Tested

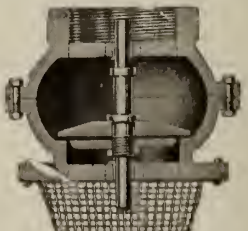


FIG. 128. VERTICAL FOOT VALVE
Screwed end

at 100 lbs. water pressure (Fig. 128). Smaller types, with screen omitted, are adapted for service as vertical check valves. Recommended working pressure not exceeding, for water, 50 lbs. Prices and dimensions sent upon application.

List No. 16, Bronze Hose Valves.

Light and heavy pattern double gate hose valves are intended for use in standpipes in public and office buildings, mills, etc. Single gate hose valves are to be carried on hose carriages for use with hydrants. Double gate patterns, recommended working water pressures, 150 and 125 lbs. Single gate pattern, recommended working water pressure, 100 lbs.



FIG. 71. BRONZE HOSE VALVES With cap and chain

List No. 75, Ludlow Slide Gate Fire Hydrant.

Gate type. A first class non-freezing hydrant, strong, simple in construction, tight under all pressures, with a positive drip that drains hydrant barrel completely. All working parts can be taken out without doing any digging or disturbing hydrant barrel.

CLOSING AND OPENING HYDRANT GATE AND DRIP VALVE—

In closing, gate is moved downward by action of stem through threaded bronze wedge nut in back of gate (Fig. 131), until it strikes the stop at bottom of projection in back of hydrant, when, by action of bronze wedge nut, moving along incline on back of gate, it is forced squarely against its seat without any grinding movement on either rubber gasket, with which gate is faced, or on bronze seat ring, against which it closes, the projections at top and bottom of gate keeping rubber gasket away from seat ring until it is forced squarely against it by action of wedge nut.

The final turn of stem, after gate is closed and wedged, opens drip valve.

In opening hydrant, first turn of stem closes drip valve, after which bronze wedge nut in back of gate is loosened, thus relieving gate from its seat.

GATE LOCKING DEVICE—Consists of 2 lock nuts on stem below gate, which lock gate after it is closed, preventing street from being flooded in case hydrant barrel or standpipe is broken by accident.

Device, fully covered by patent, operates the instant gate is closed and drip is open; and is released immediately upon starting to open hydrant.

DRIP VALVE—Bronze and faced with rubber, drip valve is screwed to lower end of hydrant stem and works in a bronze cup in extreme bottom of hydrant.

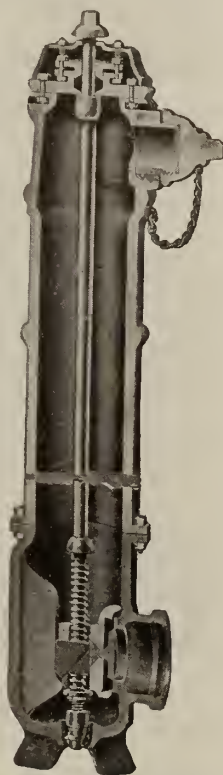


FIG. 131. LUDLOW SLIDE GATE FIRE HYDRANT

List No. 75, bronze mounted rubber faced gate. Sectional view showing gate closed and locked and drip valve in extreme bottom of hydrant open

Opens only *after* gate is closed and wedged; and closes *before* gate is released or any water enters barrel.

Fig. 131 shows location of drip valve which prevents freezing of hydrant. Valve does not open until after gate is closed and locked, shutting off water from hydrant barrel; and closes before gate is released from its seat, letting water into hydrant.

List No. 80, Ludlow Fire Hydrant with Balanced Valve.

Compression type. Built strong in every part, remains tight under all pressures, has positive drip and all parts can be removed without digging or disturbing hydrant barrel.

MATERIAL USED— Bronze : seats, sleeve, drip cylinder, drip valve, nozzles; all wearing surfaces are either bronze mounted or rubber faced (Fig. 179).

Other Ludlow Hydrants.

Slide gate flush hydrants; flush hydrants or street washers; slide gate fire hydrant, with water crane attachment; water crane, with automatic drip in main valve, for supplying sprinkling carts; underwriter hydrant, built in accordance with National Board of Fire Underwriters.

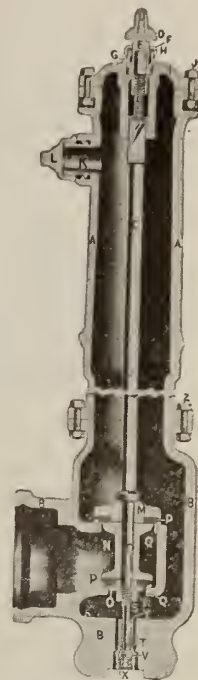


FIG. 179. LUDLOW FIRE HYDRANT WITH BALANCED VALVE Showing main valve and drip valve

List No. 29, Automatic Globe Air Valves.

Placed on mains at high points where air accumulates and obstructs flow of water.

When air takes the place of water about float in valve chamber, valve opens permitting air to escape. As water returns, valve is closed (Fig. 146).



FIG. 146. AUTOMATIC GLOBE AIR VALVES

List No. 23, Automatic Lever and Float Air Valves.

With bronze mountings and copper float. Placed on mains at high points where air accumulates and obstructs flow of water. When air takes the place of water about float, B, in valve chamber, float (attached to bronze lever A) drops, thus opening valve, D, allowing air to escape. As water returns it lifts float (relieved of the air pressure), thereby closing valve, D (Figs. 49 and 117).



FIG. 117

AUTOMATIC LEVER AND FLOAT AIR VALVES



FIG. 49

THE LUNKENHEIMER COMPANY

Manufacturers of High Grade Engineering Appliances

CABLE ADDRESS:
"LUNKEN" for—
Cincinnati, New
York and London

EXECUTIVE OFFICES AND FACTORIES
CINCINNATI, OHIO

NEW YORK, N. Y., 129-135 Lafayette Street
BOSTON, MASS., 136-138 High Street

CHICAGO, ILL., 188 North Dearborn Street
LONDON, ENG., 35 Great Dover Street, S.E.

CODES USED:
"Lunkenheimer,"
"ABC, fourth and
fifth editions,"
"Western Union,"
and "Liebers"

Products.

VALVES:

- Bronze Engine Throttle
- Iron Non-return Boiler Stop
- Cast steel Stop Check
- Anti-acid Needle
- Globe Radiator
- Angle Regulating Check
- Cross Blow-off
- Check Pop Safety
- Gate Relief

Oil and Grease Cups, Oil Pumps, Oiling Devices, Injectors and Ejectors, Water Columns and Gages, Gage Cocks, Whistles, Ground Key Work, Low Water Alarms, Fusible Plugs, Unions, Bronze Pipe Fittings.

Motors Accessories: Generator Valves, Carburetor Check Valves, Gasoline Engine Primers, Priming Cups, Gasoline Strainers, Unions, Cocks, etc.

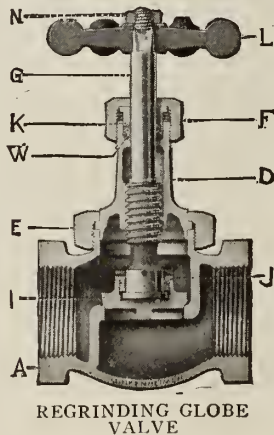
Lubricators for Steam, Gas, Gasoline and Diesel Engine and Compressor Cylinders.

Regrinding Globe, Angle and Cross Valves.

MATERIALS—Body and trimmings of "Valve-bronze"; hand wheel of iron.

PATTERNS—Medium with screw ends for 200 lbs. and "B-H" flange ends for 150 lbs. working steam pressure; extra heavy with screw ends for 300 lbs. and "B-X" flange ends for 250 lbs. working steam pressure. Also furnished in outside screw, bolted or screwed yoke patterns.

FEATURES—Seating surfaces regrindable; all parts renewable; stuffing box repackable under pressure when valve is wide open; flow areas in excess of pipe areas.



REGRINDING GLOBE VALVE

DATA, REGRINDING GLOBE, ANGLE AND CROSS VALVES

Size, in.	1/8	1/4	3/8	1/2	3/4	1	1 1/4
Face to face, flanged globe.	Medium, in. ... 2 7/8	3 5/8	4 1/8	4 7/8	5 1/2	6 1/4	7 1/4
Center to face, flanged angle or cross.	Ex. Hy., in. ... 3 3/8	4 1/2	5 1/8	6 1/4	7 1/4	8 1/4	9 1/4
Diam. of flanges.	Medium, in. ... 1 1/2	2	2 1/4	2 7/8	3 1/2	4 1/4	5 1/4
Thickness of flanges.	Ex. Hy., in. ... 2 1/8	2 3/4	3 1/4	4	4 3/4	5 1/2	6 1/4
Face to face, screw globe.	Medium, in. ... 1 5/8	2 1/8	2 3/4	3 1/4	3 3/4	4 1/4	5 1/4
Center of valve body to top of stem, wide open.	Ex. Hy., in. ... 2 1/4	2 3/4	3 1/4	3 3/4	4 1/4	5 1/4	6 1/4

DATA, REGRINDING GLOBE, ANGLE AND CROSS VALVES—Continued

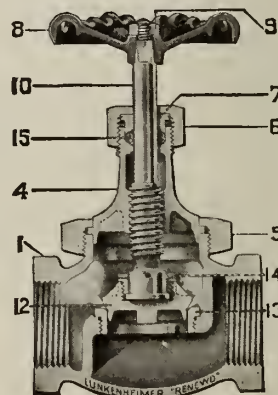
Size, in.	1 1/2	2	2 1/2	3	3 1/2	4
Face to face, flanged globe.	Medium, in. ... 5 7/8	6 7/8	7 1/2	8 1/8	9 1/8	10 1/8
Center to face, flanged angle or cross.	Ex. Hy., in. ... 6 3/8	7 3/8	8 1/4	9 1/4	10 1/4	11 1/4
Diam. of flanges.	Medium, in. ... 3 1/4	4	4 1/4	5 1/4	5 3/4	6 3/4
Thickness of flanges.	Ex. Hy., in. ... 5	6	7 1/2	8 1/4	9	10
Face to face, screw globe.	Medium, in. ... 4 1/8	5 1/8	6 1/8	7 1/8	8 1/8	9 1/8
Center of valve body to top of stem, wide open.	Ex. Hy., in. ... 4 3/4	5 3/4	6 3/4	7 3/4	8 3/4	9 3/4

"Renewo" Globe, Angle and Cross Valves.

MATERIALS—Seat and disc of "Valve-nickel"; hand wheel of malleable iron; other trimmings and body of "Valve-bronze."

PATTERNS—Medium with screw ends for 200 lbs. and "B-H" flange ends for 150 lbs. working steam pressure; extra heavy with screw ends for 300 lbs. and "B-X" flange ends for 250 lbs. working steam pressure. Also furnished in outside screw, bolted yoke patterns.

FEATURES—Seating surfaces regrindable; all parts renewable, including the nickel seat and disc, making these valves practically indestructible; seating surfaces self-cleansing; stuffing box repackable under pressure when valve is wide open; self-cooling hand wheel; flow areas in excess of pipe areas.



"RENEWO" GLOBE VALVE

DATA, "RENEWO" GLOBE, ANGLE AND CROSS VALVES

Size, in.	1/4	3/8	1/2	3/4	1
Face to face, flanged globe.	Medium, in. ... 3	3 1/8	4	4 1/2	5 1/4
Center to face, flanged angle or cross.	Ex. Hy., in. ... 3 1/2	3 3/4	4 1/4	5 1/4	6 1/4
Diam. of flanges.	Medium, in. ... 2 1/4	2 3/4	3 1/4	4 1/4	5 1/4
Thickness of flanges.	Ex. Hy., in. ... 3	3 1/4	4	4 1/4	5 1/4
Face to face, screw globe.	Medium, in. ... 2 1/8	2 3/8	3 1/8	3 3/4	4 1/4
Center of valve body to top of stem, wide open.	Ex. Hy., in. ... 2 3/4	3 1/4	4 1/4	5 1/4	6 1/4

Size, in.	1 1/4	1 1/2	2	2 1/2	3
Face to face, flanged globe.	Medium, in. ... 5 1/8	6 1/8	7 1/4	8	9
Center to face, flanged angle or cross.	Ex. Hy., in. ... 5 3/8	6 3/8	7 3/4	8 1/4	9 1/4
Diam. of flanges.	Medium, in. ... 3 1/4	4	4 1/4	5 1/4	6 1/4
Thickness of flanges.	Ex. Hy., in. ... 4 1/4	5 1/4	6 1/4	7 1/4	8 1/4
Face to face, screw globe.	Medium, in. ... 4 3/8	5 3/8	6 3/8	7 3/8	8 3/8
Center of valve body to top of stem, wide open.	Ex. Hy., in. ... 4 3/4	5 3/4	6 3/4	7 3/4	8 3/4

Regrinding Horizontal, Angle and Vertical Check Valves.

MATERIALS—Body and trimmings of "Valve-bronze."

PATTERNS—Medium with screw ends for 200 lbs. and "B-H" flange ends for 150 lbs. working steam pressure; extra heavy with screw ends for 300 lbs. and "B-X" flange ends for 250 lbs. working steam pressure. Also furnished with bolted instead of screwed cap.

FEATURES—Disc, properly guided at both top and bottom, insures perfect seating; seating surfaces regrindable; all parts renewable; flow areas in excess of pipe areas.



REGRINDING HORIZONTAL CHECK VALVE

DATA, REGRINDING HORIZONTAL, ANGLE AND VERTICAL CHECK VALVES

Size, in.	1/4	3/8	1/2	3/4	1	1 1/4
Face to face, flanged horizontal.	Medium, in. ... 27 3/8	3 3/8	4 1/8	4 3/8	4 7/8	4 7/8
Face to face, flanged vertical.	Ex. Hy., in. ... 2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
Center to face, flanged angle.	Medium, in. ... 1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8
Diam. of flanges.	Ex. Hy., in. ... 2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2
Thickness of flanges.	Medium, in. ... 3	3 1/2	4	4 1/2	5	5 1/2
Face to face, screw horizontal.	Ex. Hy., in. ... 2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
Face to face, screw vertical.	Medium, in. ... 1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2
Center to face, screw angle.	Ex. Hy., in. ... 1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8
Center of body to top of cap.	Medium, in. ... 1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8

Size, in.	1 1/2	2	2 1/2	3	3 1/2	4
Face to face, flanged horizontal.	Medium, in. ... 57 1/8	67 1/8	77 1/8	87 1/8	97 1/8	107 1/8
Face to face, flanged vertical.	Ex. Hy., in. ... 37 1/8	47 1/8	57 1/8	67 1/8	77 1/8	87 1/8
Center to face, flanged angle.	Medium, in. ... 3 1/8	3 1/8	3 1/8	3 1/8	3 1/8	3 1/8
Diam. of flanges.	Ex. Hy., in. ... 5	6	7	8	9	10
Thickness of flanges.	Medium, in. ... 1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8
Face to face, screw horizontal.	Ex. Hy., in. ... 4 1/8	5 1/8	6 1/8	7 1/8	8 1/8	9 1/8
Face to face, screw vertical.	Medium, in. ... 3 1/8	4 1/8	5 1/8	6 1/8	7 1/8	8 1/8
Center to face, screw angle.	Ex. Hy., in. ... 2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
Center of body to top of cap.	Medium, in. ... 2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8

"Renewo" Horizontal and Angle Check Valves.

MATERIALS—Body, cap and disc guide of "Valve-bronze"; seat and disc of "Valve-nickel."

PATTERNS—Medium with screw ends for 200 lbs. and "B-H" flange ends for 150 lbs. working steam pressure; extra heavy with screw ends for 300 lbs. and "B-X" flange ends for 250 lbs. working steam pressure.

FEATURES—Disc, properly guided at both top and bottom, insures perfect seating; seating surfaces regrindable; all parts renewable, including the nickel seat and disc, making these valves practically indestructible; flow areas in excess of pipe areas.



"RENEWO" HORIZONTAL CHECK VALVE

DATA, "RENEWO" HORIZONTAL AND ANGLE CHECK VALVES

Size, in.	1/4	3/8	1/2	3/4	1
Face to face, flanged horizontal.	Medium, in. ... 3 1/8	3 1/8	4 1/8	4 1/8	4 1/8
Center to face, flanged angle.	Ex. Hy., in. ... 1 1/8	1 1/8	1 1/8	1 1/8	1 1/8
Diam. of flanges.	Medium, in. ... 2 1/2	2 1/2	2 1/2	2 1/2	2 1/2
Thickness of flanges.	Ex. Hy., in. ... 3	3 1/2	4	4 1/2	5
Face to face, screw horizontal.	Medium, in. ... 2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
Center to face, screw angle.	Ex. Hy., in. ... 1 1/8	1 1/8	1 1/8	1 1/8	1 1/8
Center of body to top of cap.	Medium, in. ... 1 1/8	1 1/8	1 1/8	1 1/8	1 1/8

DATA, "RENEWO" HORIZONTAL AND ANGLE CHECK VALVES—Continued

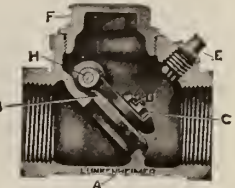
Size, in.	1 1/4	1 1/2	2	2 1/2	3
Face to face, flanged horizontal.	Medium, in. ... 5 1/8	6 1/8	7 1/8	8 1/8	9 1/8
Center to face, flanged angle.	Ex. Hy., in. ... 2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
Diam. of flanges.	Medium, in. ... 4 1/2	4 1/2	4 1/2	4 1/2	4 1/2
Thickness of flanges.	Ex. Hy., in. ... 5	5 1/2	6 1/2	7 1/2	8 1/2
Face to face, screw horizontal.	Medium, in. ... 4 1/8	4 1/8	4 1/8	4 1/8	4 1/8
Center to face, screw angle.	Ex. Hy., in. ... 2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
Center of body to top of cap.	Medium, in. ... 2 1/8	2 1/8	2 1/8	2 1/8	2 1/8

Regrinding Swing Check Valves.

MATERIALS—Body and trimmings of "Valve-bronze."

PATTERNS—Medium with screw ends for 200 lbs. and "B-H" flange ends for 150 lbs. working steam pressure; extra heavy with screw ends for 300 lbs. and "B-X" flange ends for 250 lbs. working steam pressure.

Also furnished with bolted instead of screwed cap. FEATURES—Practically straightway flow channel, with flow areas in excess of pipe areas; two renewable disc-carrier bearings, insuring constant alignment of disc; seating surfaces regrindable; all parts renewable.



REGRINDING SWING CHECK VALVE

DATA, REGRINDING SWING CHECK VALVES

Size, in.	1/4	3/8	1/2	3/4	1
Face to face, flanged.	Medium, in. ... 3 1/8	3 1/8	4 1/8	4 1/8	5 1/8
Diam. of flanges.	Ex. Hy., in. ... 2 1/2	2 1/2	2 1/2	2 1/2	2 1/2
Thickness of flanges.	Medium, in. ... 3	3 1/2	4	4 1/2	5
Face to face, screw.	Ex. Hy., in. ... 2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
Center of body to top of cap.	Medium, in. ... 1 1/8	1 1/8	1 1/8	1 1/8	1 1/8

Size, in.	1 1/4	1 1/2	2	2 1/2	3
Face to face, flanged.	Medium, in. ... 5 1/8	6 1/8	7 1/8	8 1/8	9 1/8
Diam. of flanges.	Ex. Hy., in. ... 4 1/2	4 1/2	4 1/2	4 1/2	4 1/2
Thickness of flanges.	Medium, in. ... 5	5 1/2	6 1/2	7 1/2	8 1/2
Face to face, screw.	Ex. Hy., in. ... 4 1/8	4 1/8	4 1/8	4 1/8	4 1/8
Center of body to top of cap.	Medium, in. ... 2 1/8	2 1/8	2 1/8	2 1/8	2 1/8

Double Disc Gate Valves.

MATERIALS—Body and trimmings of "Valve-bronze"; hand wheel of iron.

PATTERNS—Medium with screw or flange ends for 150 lbs. working steam pressure.

FEATURES—Ball and socket bearing between the discs provides greatest degree of flexibility in seating engagement; all parts renewable; stuffing box repackable under pressure when valve is wide open; pressure can be taken from either end.



DOUBLE DISC GATE VALVE

DATA, DOUBLE DISC GATE VALVES

Size, in.	1/4	3/8	1/2	3/4	1
Face to face, flanged, in.	Medium, in. ... 2 1/8	2 1/8	3 1/8	3 1/8	4 1/8
Diam. of flanges, in.	Ex. Hy., in. ... 2 1/2	2 1/2	2 1/2	2 1/2	2 1/2
Thickness of flanges, in.	Medium, in. ... 3	3 1/2	4	4 1/2	5
Face to face, screw, in.	Ex. Hy., in. ... 1 1/8	1 1/8	1 1/8	1 1/8	1 1/8
Center of body to top of stem, open, in.	Medium, in. ... 4 1/8	4 1/8	4 1/8	4 1/8	4 1/8

Size, in.	1 1/4	1 1/2	2	2 1/2	3
Face to face, flanged, in.	Medium, in. ... 4 1/8	4 1/8	5 1/8	6 1/8	7 1/8
Diam. of flanges, in.	Ex. Hy., in. ... 4 1/2	4 1/2	4 1/2	4 1/2	4 1/2
Thickness of flanges, in.	Medium, in. ... 5	5 1/2	6 1/2	7 1/2	8 1/2
Face to face, screw, in.	Ex. Hy., in. ... 2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
Center of body to top of stem, open, in.	Medium, in. ... 8 1/8	8 1/8	11 1/4	14 1/4	16 1/8

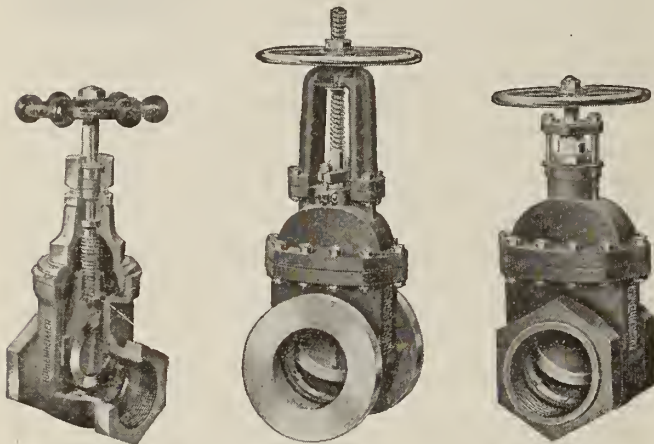
Wedge Disc Gate Valves.

MATERIALS—Body and trimmings of "Valve-bronze"; hand wheel of iron.

PATTERNS—Screwed bonnet, inside screw, or screwed yoke, outside screw; medium pattern with screw ends for 200 lbs. and with "B-H" flanged ends for 150 lbs. working steam pressure; extra heavy with screw ends for 300 lbs. and with "B-X" flange ends for 250 lbs. working steam pressure.

Bolted bonnet, inside screw, or bolted yoke, outside screw; medium pattern with screw or flanged ends for 125 lbs. and extra heavy pattern for 250 lbs. working steam pressure.

FEATURES—Double seated, permitting pressure to be taken from either end; stuffing box repackable under pressure when valve is full open; all parts renewable, including the seats on all sizes with exception of $\frac{1}{4}$ to $\frac{3}{4}$ in., inclusive.



SCREWED BONNET, INSIDE SCREW

BOLTED YOKE, OUTSIDE SCREW

BOLTED BONNET, INSIDE SCREW

DATA, SCREWED BONNET, INSIDE SCREW, AND SCREWED YOKE, OUTSIDE SCREW, WEDGE DISC GATE VALVES

Size, in.....	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	1
Face to face, flanged.....	Medium, in. ... 2 $\frac{7}{8}$	3 $\frac{1}{8}$	3 $\frac{1}{2}$	4 $\frac{1}{8}$	4 $\frac{3}{4}$
	Ex. Hy., in. ... 3 $\frac{1}{2}$	4 $\frac{1}{8}$	4 $\frac{3}{4}$	5 $\frac{1}{8}$	6 $\frac{1}{4}$
Diam. of flanges.....	Medium, in. ... 2 $\frac{1}{2}$	3 $\frac{1}{2}$	4	4 $\frac{1}{2}$	5
	Ex. Hy., in. ... 3	4	4 $\frac{1}{2}$	5	6
Thickness of flanges.....	Medium, in. ... $\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
	Ex. Hy., in. ... $\frac{1}{2}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
Face to face, screw.....	Medium, in. ... 2 $\frac{1}{8}$	2 $\frac{1}{8}$	2 $\frac{1}{8}$	2 $\frac{1}{8}$	2 $\frac{1}{8}$
	Ex. Hy., in. ... 2 $\frac{1}{8}$	2 $\frac{1}{8}$	2 $\frac{1}{8}$	2 $\frac{1}{8}$	2 $\frac{1}{8}$
Center of body to top of stem, open.....	Inside screw... Medium, in. ... 4 $\frac{3}{8}$	4 $\frac{3}{8}$	4 $\frac{3}{8}$	4 $\frac{3}{8}$	4 $\frac{3}{8}$
	Ex. Hy., in. ... 5 $\frac{1}{4}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$
	Outside screw and yoke... Medium, in. ... 4 $\frac{3}{8}$	4 $\frac{3}{8}$	4 $\frac{3}{8}$	4 $\frac{3}{8}$	4 $\frac{3}{8}$
	Ex. Hy., in. ... 5 $\frac{1}{4}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$

Size, in.....	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3
Face to face, flanged.....	Medium, in. ... 4 $\frac{1}{2}$	4 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$
	Ex. Hy., in. ... 5 $\frac{1}{4}$	5 $\frac{1}{4}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$	8 $\frac{1}{2}$
Diam. of flanges.....	Medium, in. ... 4 $\frac{1}{2}$	5	6	7	8
	Ex. Hy., in. ... 5	6	7	8	9
Thickness of flanges.....	Medium, in. ... $\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
	Ex. Hy., in. ... $\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Face to face, screw.....	Medium, in. ... 3 $\frac{1}{8}$	3 $\frac{1}{8}$	3 $\frac{1}{8}$	3 $\frac{1}{8}$	3 $\frac{1}{8}$
	Ex. Hy., in. ... 3 $\frac{1}{8}$	3 $\frac{1}{8}$	3 $\frac{1}{8}$	3 $\frac{1}{8}$	3 $\frac{1}{8}$
Center of body to top of stem, open.....	Inside screw... Medium, in. ... 7 $\frac{1}{4}$	8 $\frac{1}{4}$	9 $\frac{1}{4}$	10 $\frac{1}{4}$	11 $\frac{1}{4}$
	Ex. Hy., in. ... 8 $\frac{1}{2}$	9 $\frac{1}{2}$	10 $\frac{1}{2}$	11 $\frac{1}{2}$	12 $\frac{1}{2}$
	Outside screw and yoke... Medium, in. ... 7 $\frac{1}{4}$	8 $\frac{1}{4}$	9 $\frac{1}{4}$	10 $\frac{1}{4}$	11 $\frac{1}{4}$
	Ex. Hy., in. ... 8 $\frac{1}{2}$	9 $\frac{1}{2}$	10 $\frac{1}{2}$	11 $\frac{1}{2}$	12 $\frac{1}{2}$

DATA, BOLTED BONNET, INSIDE SCREW, AND BOLTED YOKE, OUTSIDE SCREW, WEDGE DISC GATE VALVES

Size, in.....	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4
Face to face, flanged.....	Medium, in. ... 4 $\frac{3}{8}$	5 $\frac{1}{4}$	5 $\frac{3}{8}$	6	6 $\frac{3}{8}$
	Ex. Hy., in. ... 6 $\frac{1}{8}$	7	7 $\frac{3}{8}$	8 $\frac{1}{4}$	9 $\frac{1}{8}$
Diam. of flanges.....	Medium, in. ... 6	7	7 $\frac{1}{2}$	8 $\frac{1}{2}$	9
	Ex. Hy., in. ... 6 $\frac{1}{2}$	7 $\frac{1}{2}$	8 $\frac{1}{2}$	9	10
Thickness of flanges.....	Medium, in. ... $\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
	Ex. Hy., in. ... $\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Face to face, screw.....	Medium, in. ... 4 $\frac{1}{8}$	4 $\frac{1}{8}$	4 $\frac{1}{8}$	4 $\frac{1}{8}$	4 $\frac{1}{8}$
	Ex. Hy., in. ... 4 $\frac{1}{8}$	4 $\frac{1}{8}$	4 $\frac{1}{8}$	4 $\frac{1}{8}$	4 $\frac{1}{8}$
Center to top of stem, open.....	Inside screw... Medium, in. ... 11 $\frac{1}{2}$	12 $\frac{1}{2}$	13 $\frac{1}{2}$	14 $\frac{1}{2}$	15 $\frac{1}{2}$
	Ex. Hy., in. ... 12 $\frac{1}{2}$	13 $\frac{1}{2}$	14 $\frac{1}{2}$	15 $\frac{1}{2}$	16 $\frac{1}{2}$
	Outside screw and yoke... Medium, in. ... 11 $\frac{1}{2}$	12 $\frac{1}{2}$	13 $\frac{1}{2}$	14 $\frac{1}{2}$	15 $\frac{1}{2}$
	Ex. Hy., in. ... 12 $\frac{1}{2}$	13 $\frac{1}{2}$	14 $\frac{1}{2}$	15 $\frac{1}{2}$	16 $\frac{1}{2}$

DATA, BOLTED BONNET, INSIDE SCREW, AND BOLTED YOKE, OUTSIDE SCREW, WEDGE DISC GATE VALVES—Continued

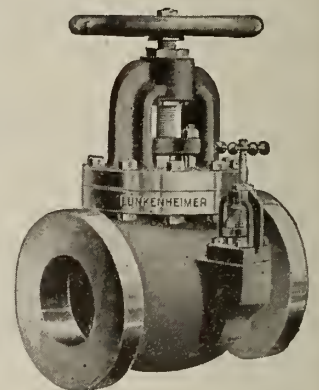
Size, in.....	$4\frac{1}{2}$	5	6	7	8
Face to face, flanged.....	Medium, in. ... 7 $\frac{3}{8}$	7 $\frac{3}{8}$	8 $\frac{1}{4}$	8 $\frac{3}{4}$	9 $\frac{3}{8}$
	Ex. Hy., in. ... 8 $\frac{3}{4}$	9 $\frac{3}{8}$	10	11 $\frac{1}{4}$	12 $\frac{1}{8}$
Diam. of flanges.....	Medium, in. ... 9 $\frac{1}{4}$	10	11	12 $\frac{1}{2}$	13 $\frac{1}{2}$
	Ex. Hy., in. ... 10 $\frac{1}{2}$	11	12 $\frac{1}{2}$	14	15
Thickness of flanges.....	Medium, in. ... $\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
	Ex. Hy., in. ... $\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Face to face, screw.....	Medium, in. ... 6 $\frac{1}{8}$	6 $\frac{1}{8}$	7 $\frac{1}{8}$	7 $\frac{1}{8}$	8 $\frac{1}{8}$
	Ex. Hy., in. ... 6 $\frac{1}{8}$	7 $\frac{1}{8}$	7 $\frac{1}{8}$	8 $\frac{1}{8}$	9 $\frac{1}{8}$
Center to top of stem open.....	Inside screw... Medium, in. ... 17 $\frac{1}{2}$	18 $\frac{1}{2}$	20 $\frac{1}{2}$	22 $\frac{1}{2}$	25 $\frac{1}{2}$
	Ex. Hy., in. ... 17 $\frac{1}{2}$	19 $\frac{1}{2}$	21	23 $\frac{1}{2}$	26
	Outside screw and yoke... Medium, in. ... 22 $\frac{3}{8}$	25 $\frac{3}{8}$	29 $\frac{3}{8}$	33 $\frac{3}{8}$	37 $\frac{3}{8}$
	Ex. Hy., in. ... 24 $\frac{3}{8}$	26 $\frac{3}{8}$	30 $\frac{3}{8}$	34 $\frac{3}{8}$	38 $\frac{3}{8}$

Bolted Yoke Globe, Angle and Cross Valves.

MATERIALS—Body and yoke of "Valve-iron"; bearing parts of "Valve-bronze." Also furnished with cast steel body, bonnet or yoke, and with seat and disc of "Valve-nickel."

PATTERNS—Standard pattern, sizes 2 to 12 in. inclusive, screw or flange ends for 125 lbs. working steam pressure; heavy pattern, sizes 2 to 8 in. inclusive, and with interior by-pass, $\frac{3}{2}$ to 12 in. inclusive, screw or flange ends for 175 lbs. working steam pressure; extra heavy pattern, sizes 2 to 8 in. inclusive, and with interior or exterior by-pass, $\frac{3}{2}$ to 12 in. inclusive, for 250 lbs. working steam pressure.

FEATURES—Seating surfaces regrindable; all parts renewable, including the seat and disc; self-cleansing seating surfaces; stuffing box repackable under pressure when valve is wide open; flow areas in excess of pipe areas.



IRON BODY BOLTED YOKE GLOBE VALVE WITH EXTERIOR BY-PASS

DATA, BOLTED YOKE GLOBE, ANGLE AND CROSS VALVES

Size, in.....	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$
*Face to face, flanged globe	Stand., in. ... 7 $\frac{3}{4}$	8 $\frac{3}{4}$	9 $\frac{1}{2}$	10 $\frac{1}{2}$	11 $\frac{3}{8}$	12 $\frac{3}{8}$
	Heavy, in. ... 9 $\frac{3}{4}$	11	12 $\frac{1}{4}$	13	13 $\frac{5}{8}$	14 $\frac{1}{2}$
	Ex. Hy., in. ... 9 $\frac{3}{4}$	11 $\frac{1}{2}$	12 $\frac{1}{2}$	13 $\frac{1}{2}$	14	15
*Center to face, flanged angle or cross.....	Stand., in. ... 3 $\frac{3}{8}$	4 $\frac{3}{8}$	4 $\frac{3}{8}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$	6 $\frac{1}{8}$
	Heavy, in. ... 4 $\frac{3}{8}$	5 $\frac{1}{2}$	6 $\frac{1}{8}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{4}$
	Ex. Hy., in. ... 4 $\frac{3}{8}$	5 $\frac{1}{2}$	6 $\frac{1}{8}$	6 $\frac{1}{2}$	7	7 $\frac{1}{2}$
Diam. of flanges.....	Stand., in. ... 6	7	7 $\frac{1}{2}$	8 $\frac{1}{2}$	9	9 $\frac{1}{2}$
	Hy. and Ex. Hy., in. ... 6 $\frac{1}{2}$	7 $\frac{1}{2}$	8 $\frac{1}{4}$	9	10	10 $\frac{1}{2}$
*Thickness of flanges.....	Stand., in. ... $\frac{5}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
	Hy. and Ex. Hy., in. ... $\frac{5}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Face to face, screw globe.....	Stand., in. ... 6 $\frac{3}{8}$	7 $\frac{3}{8}$	8 $\frac{3}{8}$	9	10	11 $\frac{3}{8}$
	Heavy, in. ... 7 $\frac{3}{8}$	8 $\frac{3}{8}$	9 $\frac{3}{8}$	10 $\frac{3}{8}$	11 $\frac{3}{8}$	12 $\frac{3}{8}$
	Ex. Hy., in. ... 8 $\frac{3}{8}$	10 $\frac{3}{8}$	11 $\frac{3}{8}$	12 $\frac{3}{8}$	13	14
Center to face, screw angle or cross.....	Stand., in. ... 3 $\frac{3}{8}$	4 $\frac{3}{8}$	4 $\frac{3}{8}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$	6 $\frac{1}{8}$
	Heavy, in. ... 4 $\frac{3}{8}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{4}$
	Ex. Hy., in. ... 4 $\frac{3}{8}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{4}$
Center to top of stem, open.....	Stand., in. ... 10 $\frac{1}{2}$	12 $\frac{1}{2}$	13 $\frac{1}{2}$	14 $\frac{1}{2}$	15 $\frac{1}{2}$	16 $\frac{1}{2}$
	Heavy, in. ... 11 $\frac{1}{2}$	13 $\frac{1}{2}$	14 $\frac{1}{2}$	16 $\frac{1}{2}$	17 $\frac{1}{2}$	18 $\frac{1}{2}$
	Ex. Hy., in. ... 13 $\frac{1}{2}$	14 $\frac{1}{2}$	16 $\frac{1}{2}$	17 $\frac{1}{2}$	19 $\frac{1}{2}$	20 $\frac{1}{2}$

Size, in.....	5	6	7	8	10	12
*Face to face, flanged globe	Stand., in. ... 12 $\frac{3}{4}$	14 $\frac{3}{8}$	16 $\frac{1}{8}$	19 $\frac{1}{4}$	24 $\frac{1}{4}$	27 $\frac{1}{4}$
	Heavy, in. ... 15 $\frac{3}{4}$	17 $\frac{1}{2}$	19 $\frac{1}{2}$	21 $\frac{3}{4}$	25 $\frac{3}{4}$	28 $\frac{3}{4}$
	Ex. Hy., in. ... 15 $\frac{3}{4}$	17 $\frac{1}{2}$	19 $\frac{1}{2}$	21 $\frac{3}{4}$	25 $\frac{3}{4}$	28 $\frac{3}{4}$
*Center to face, flanged angle or cross.....	Stand., in. ... 6 $\frac{3}{8}$	7 $\frac{3}{8}$	8 $\frac{3}{8}$	9 $\frac{1}{4}$	10 $\frac{1}{4}$	12
	Heavy, in. ... 7 $\frac{3}{8}$	8 $\frac{3}{8}$	9 $\frac{3}{8}$	10 $\frac{3}{8}$	12 $\frac{1}{4}$	14
	Ex. Hy., in. ... 7 $\frac{3}{8}$	8 $\frac{3}{8}$	9 $\frac{3}{8}$	10 $\frac{3}{8}$	12 $\frac{1}{4}$	14
Diam. of flanges.....	Stand., in. ... 10	11	12 $\frac{1}{2}$	13 $\frac{1}{2}$	16	19
	Hy. and Ex. Hy., in. ... 10 $\frac{1}{2}$	12 $\frac{1}{2}$	14	15	17 $\frac{1}{2}$	20 $\frac{1}{2}$
*Thickness of flanges.....	Stand., in. ... $\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
	Hy. and Ex. Hy., in. ... $\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Face to face, screw globe.....	Stand., in. ... 12	13 $\frac{1}{8}$	15 $\frac{1}{8}$	18	22 $\frac{1}{8}$	27
	Heavy, in. ... 14 $\frac{1}{8}$	16 $\frac{1}{8}$	17 $\frac{1}{8}$	20	23 $\frac{1}{8}$	26 $\frac{1}{8}$
	Ex. Hy., in. ... 14 $\frac{1}{8}$	16 $\frac{1}{8}$	18 $\frac{1}{8}$	20	23 $\frac{1}{8}$	27 $\frac{1}{8}$
Center to face, screw angle or cross.....	Stand., in. ... 6	6 $\frac{1}{8}$	7 $\frac{1}{8}$	8 $\frac{1}{8}$	10	11 $\frac{1}{8}$
	Heavy, in. ... 7 $\frac{1}{8}$	8 $\frac{1}{8}$	9 $\frac{1}{8}$	10	11 $\frac{1}{8}$	13 $\frac{1}{8}$
	Ex. Hy., in. ... 7 $\frac{1}{8}$	8 $\frac{1}{8}$	9 $\frac{1}{8}$	10	11 $\frac{1}{8}$	13 $\frac{1}{8}$
Center to top of stem, open.....	Stand., in. ... 17 $\frac{1}{8}$	19 $\frac{1}{8}$	21 $\frac{1}{8}$	23 $\frac{1}{8}$	27 $\frac{1}{8}$	31 $\frac{1}{8}$
	Heavy, in. ... 19 $\frac{1}{8}$	21 $\frac{1}{8}$	24 $\frac{1}{8}$	26 $\frac{1}{8}$	30 $\frac{1}{8}$	35 $\frac{1}{8}$
	Ex. Hy., in. ... 22	23 $\frac{1}{4}$	26 $\frac{1}{4}$	29 $\frac{1}{4}$	35 $\frac{1}{4}$	38 $\frac{1}{4}$

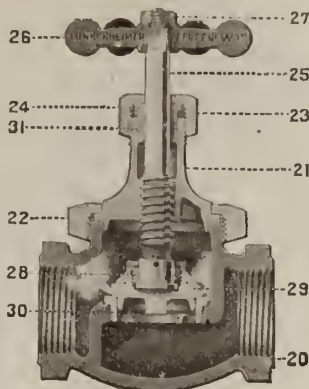
*Heavy and extra heavy valves have $\frac{1}{8}$ -in. raised face on flange ends, which is included in dimensions.

"Ferrenewo" Globe, Angle and Cross Valves.

MATERIALS—Body of "Valve-iron"; seat and disc of "Valve-nickel"; hand wheel of iron; other trimmings of "Valve-bronze."

PATTERNS—Screw ends only. For 150 lbs. working steam pressure.

FEATURES—Self-cleansing seating surfaces; regrindable seating surfaces; all parts renewable, including the nickel seat and disc; stuffing box re-packable under pressure when valve is wide open; flow areas in excess of pipe areas.



"FERRENEWO" GLOBE VALVE

DATA, "FERRENEWO" GLOBE, ANGLE AND CROSS VALVES

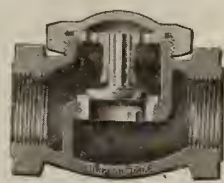
Size, in.	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2
Face to face, screw globe, in.	2 1/8	2 1/8	3	3 3/8	4 1/8	4 3/4	5 1/4	6 1/4
Center to face, screw angle or cross, in.	1 7/8	1 5/8	1 7/8	1 5/8	1 13/16	2 1/4	2 7/8	3 9/16
Center to top of stem, in.	4 1/8	4 1/8	4 1/8	6 3/8	7 1/8	8	8 1/4	9 1/8

"Ferrenewo" Horizontal and Angle Check Valves.

MATERIALS—Body of "Valve-iron"; seat and disc of "Valve-nickel"; disc guide and cap of "Valve-bronze."

PATTERNS—Screw ends only. For 150 lbs. working steam pressure.

FEATURES—Disc properly guided at both top and bottom insures perfect seating; seating surfaces regrindable; all parts renewable, including the nickel seat and disc; flow areas in excess of pipe areas.



"FERRENEWO" HORIZONTAL CHECK VALVE

DATA, "FERRENEWO" CHECK VALVES

Size, in.	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2
Face to face, screw horizontal, in.	2 3/8	2 1/8	3	3 1/8	4 1/8	4 3/4	5 1/4	6 1/4
Center to face, screw angle, in.	1 3/8	1 3/8	1 7/8	1 5/8	1 13/16	2 1/4	2 7/8	3
Center to top of cap, in.	1 3/8	1 1/8	1 7/8	1 13/16	1 13/16	2 1/4	2 7/8	3 1/8

Bolted Cap Horizontal and Angle Check Valves.

MATERIALS—Body and cap of "Valve-iron"; seat, disc and disc guide of "Valve-bronze." Also furnished with seat and disc of "Valve-nickel."

PATTERNS—Standard pattern, sizes 2 to 12 in. inclusive, screw or flange ends for 125 lbs. working steam pressure; heavy pattern, sizes 2 to 8 in. inclusive, for 175 lbs. working steam pressure.

FEATURES—Identical with those of the "Ferrenewo."

DATA, BOLTED CAP HORIZONTAL AND ANGLE CHECK VALVES

Size, in.	2	2 1/2	3	3 1/2	4	4 1/2
*Face to face, flanged horizontal.	Stand., in. 7 3/4	8 3/4	9 1/2	10 1/2	11 3/8	12 1/8
Heavy, in.	9 3/4	11	12 1/4	13	13 3/8	14 1/8
*Center to face, flanged angle	Stand., in. 3 3/8	4 3/8	4 3/4	5 1/4	5 13/16	6 1/8
Heavy, in.	4 3/8	5 1/8	6 1/8	6 1/2	6 13/16	7 1/4
Diam. of flanges.	Stand., in. 6	7	7 1/2	8 1/2	9	9 1/4
Heavy, in.	6 1/2	7 1/2	8 1/4	9	10	10 1/2
*Thickness of flanges.	Stand., in. 5/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8
Heavy, in.	7/8	1	1 1/8	1 1/8	1 1/8	1 1/8
Face to face, screw horizontal	Stand., in. 6 3/8	7 3/8	8 3/8	9	10	11 1/8
Heavy, in.	7 3/8	9	10 1/8	11 3/8	12 3/8	13 3/8
Center to face, screw angle.	Stand., in. 3 1/8	3 1/8	4 1/8	4 1/8	5	5 1/8
Heavy, in.	3 1/8	4 1/8	5 1/8	5 1/8	6 1/8	6 1/8
Center of body to top of cap	Stand., in. 4 1/8	4 1/8	5 1/8	6 1/8	6 3/4	7 1/8
Heavy, in.	5 1/8	5 3/4	6 3/8	7 1/8	7 1/8	8 1/4



HORIZONTAL CHECK VALVE

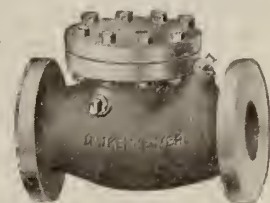
DATA, BOLTED CAP HORIZONTAL AND ANGLE CHECK VALVES—Continued

Size, in.	5	6	7	8	10	12
*Face to face, flanged horizontal.	Stand., in. 12 3/4	14 3/4	16 1/4	19 1/4	24 1/4	27 1/4
Heavy, in.	15 3/4	17 1/2	19 1/2	21 3/4	28 1/4	32 1/4
*Center to face, flanged angle	Stand., in. 6 3/8	7 3/8	8 3/8	10 1/8	12 1/8	14 1/8
Heavy, in.	7 3/8	8 3/8	9 3/8	11 1/8	13 1/8	15 1/8
Diam. of flanges.	Stand., in. 10	11	12 1/2	13 1/2	16	19
Heavy, in.	11	12 1/2	14	15	18	21
*Thickness of flanges.	Stand., in. 1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8
Heavy, in.	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8
Face to face, screw horizontal	Stand., in. 12	13 3/8	15 3/8	18	22 1/2	27
Heavy, in.	14 1/2	16 1/4	17 3/4	20	24 1/2	29
Center to face, screw angle.	Stand., in. 6	6 1/8	7 1/8	8 3/8	10	11 3/8
Heavy, in.	7 1/8	8 1/8	9 1/8	10 1/8	12 3/8	14 1/8
Center of body to top of cap	Stand., in. 9	10 3/8	11 3/8	12 3/8	15 1/8	18 1/8
Heavy, in.	10 3/8	11 3/8	12 3/8	14 1/8	17 1/8	20 1/8

*Heavy valves have 1/8-in. raised face on flange ends, which is included in dimensions.

Bolted Cap Swing Check Valves.

MATERIALS—Body and cap of "Valve-iron"; bearing parts of "Valve-bronze." Also procurable with steel body and cap. Seat and disc may be had of "Valve-nickel."



BOLTED CAP SWING CHECK VALVE

PATTERNS—Heavy pattern for 175 lbs. working steam pressure; extra heavy for 250 lbs. working steam pressure. Screw or flange ends.

FEATURES—Practically straightway flow channel. Two bronze side plugs provided as disc-carrier bearings which are renewable, as are all other parts; seating surfaces regrindable.

DATA, BOLTED CAP SWING CHECK VALVES

Size, in.	2	2 1/2	3	3 1/2	4
*Face to face, flanged.	Heavy, with stand. flanges, in. 8	9	10 1/4	10 1/8	11 3/4
Heavy, with ex. hy. flanges, in.	9 3/8	10 3/4	11 1/8	12 3/8	13 3/8
Extra Heavy, in.	10 3/8	11 3/8	12 3/8	13 3/8	14 3/8
Diam. of flanges.	Stand., in. 6	7	7 1/2	8 1/2	9
Ex. Hy., in.	6 1/2	7 1/2	8 1/4	9	10
*Thickness of flanges.	Stand., in. 5/8	1	1 1/8	1 1/8	1 1/8
Ex. Hy., in.	7/8	1	1 1/8	1 1/8	1 1/8
Face to face, screw.	Heavy, in. 5 1/8	7	7 7/8	9	9 3/8
Ex. Hy., in.	7	7 7/8	8 7/8	9 3/8	10 3/8
Center of body to top of cap.	Heavy, in. 4 3/8	5 1/8	5 3/8	6 3/8	6 1/2
Ex. Hy., in.	5 1/8	5 1/8	6 1/8	6 3/4	7 1/2

Size, in.	4 1/2	5	6	7	8
*Face to face, flanged.	Heavy, with stand. flanges, in. 12 3/4	13 3/4	14 3/8	15 1/8	17 1/4
Heavy, with ex. hy. flanges, in.	14 3/4	15 3/8	16 1/8	17 1/8	20 3/8
Extra Heavy, in.	15 3/8	16 3/8	18	20	21 3/8
Diam. of flanges.	Stand., in. 9 1/4	10	11	12 1/2	13 1/2
Ex. Hy., in.	10 1/4	11	12 1/2	14	15
*Thickness of flanges.	Stand., in. 1 1/8	1 1/8	1 1/8	1 1/8	1 1/8
Ex. Hy., in.	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8
Face to face, screw.	Heavy, in. 10 1/8	11 1/8	12 1/8	13 3/8	15 3/8
Ex. Hy., in.	11 1/8	12 1/8	13 3/8	16	17 3/8
Center of body to top of cap.	Heavy, in. 7 1/8	7 3/8	8 1/8	9 1/8	10 3/8
Ex. Hy., in.	7 3/8	8 3/8	9 1/8	10 1/4	11 3/8

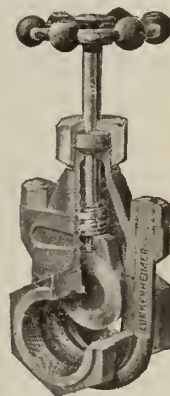
*Extra heavy flanges have 1/8-in. raised face, which is included in dimensions.

"Clip" Gate Valves.

MATERIALS—Body and bonnet of "Valve-iron"; bearing parts of "Valve-bronze."

PATTERNS—Screw or flange ends. Inside screw pattern for 100 lbs. working steam pressure; quick opening pattern, with lever, for 50 lbs. working steam pressure.

FEATURES—Wedge disc, double seated, permitting pressure to be taken from either side; steel clip, surrounding body, facilitates taking apart for cleaning or repairing and adds strength to the body; short face to face dimensions of body; few parts.



"CLIP" GATE VALVE

DATA, "CLIP" GATE VALVES

Size, in.	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2
Face to face, flanged, in.	...	...	3 3/8	3 1/2	3 3/4	4	4 1/8
Diam. of flanges, in.	...	...	4	4 1/2	5	6	7
Thickness of flanges, in.	...	...	1/2	1/2	3/8	5/8	1 1/8
Face to face, screw, in.	2	2 1/8	2 1/2	2 3/4	3 1/8	3 1/2	4
Center of body to top of stem, open, in.	4 1/8	5 1/8	6 1/2	7 3/8	8 1/8	9 3/8	12 3/4

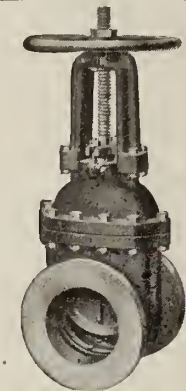
DATA, "CLIP" GATE VALVES—Continued

Size, in.	3	3½	4	4½	5	6
Face to face, flanged, in.	5½	5½	6¾	7¼	7¾	8½
Diam. of flanges, in.	7½	8½	9	9¾	10	11
Thickness of flanges, in.	¾	¾	1	1	1	1
Face to face, screw, in.	4¾	5	5½	6	6¾	7½
Center of body to top of stem, open, in.	15¼	17	18¾	20½	22½	25¾

"Victor" Gate Valves.

MATERIALS—Body, bonnet or yoke of "Valve-iron"; bearing parts of "Valve-bronze." Can be procured with seat and disc of "Valve-nickel," or body, yoke or bonnet of cast steel.

PATTERNS—Standard pattern, sizes 2 to 8 in. inclusive, for 125 lbs. working steam pressure, and sizes 10 to 24 in. inclusive, for 100 lbs. working steam pressure; medium pattern, sizes 2 to 24 in. inclusive, for 125 lbs. working steam pressure; heavy pattern, sizes 2 to 24 in. inclusive, for 175 lbs. working steam pressure; extra heavy pattern, sizes 1½ to 16 in. inclusive, for 250 lbs. working steam pressure. Furnished with screw ends up to 12 in. only. Flange ends in all sizes. Can be had with by-pass in 5-in. and larger sizes. Made with inside screw stationary stem and outside screw rising stem. Can be procured in sliding stem pattern for quick opening and closing; with angle outlet; stationary stem pattern with indicator to show degree of opening; with gear or hydraulic lift.



OUTSIDE SCREW AND YOKE



INSIDE SCREW STATIONARY STEM

FEATURES—Wedge disc, double seated, permitting pressure to be taken from either end; all parts renewable, including the seats and disc; stuffing box repackable under pressure when valve is wide open.

DATA, "VICTOR" GATE VALVES

Size, in.	1½	2	2½	3	3½	4	4½	5	6	7	8
*Face to face, flanged, in.	5	5½	5¾	6¼	7	7½	7¾	8½	9½	9¾	10¾
Stand., in.	5	5½	5¾	6¼	7	7½	7¾	8½	9½	9¾	10¾
Medium, in.	5¼	5½	5¾	6¼	7	7½	7¾	8½	9½	9¾	10¾
Heavy, in.	6½	7	7½	8½	9	9½	10½	12½	13½	14½	16½
Ex. Hy., in.	5¼	5½	5¾	6¼	7	7½	7¾	8½	9½	9¾	10¾
Diam. of flanges, in.	6	7	7½	8½	9	9½	10½	12½	13½	14½	16½
Stand. and Med., in.	6	7	7½	8½	9	9½	10½	12½	13½	14½	16½
Hy. and Ex. Hy., in.	6	7	7½	8½	9	9½	10½	12½	13½	14½	16½
*Thickness of flanges, in.	¾	¾	¾	1	1	1	1	1	1	1	1
Stand. and Med., in.	¾	¾	¾	1	1	1	1	1	1	1	1
Hy. and Ex. Hy., in.	¾	¾	¾	1	1	1	1	1	1	1	1
Face to face, screw, in.	4½	5	5½	6	6½	7	7½	8½	9½	10½	12½
Stand., in.	4½	5	5½	6	6½	7	7½	8½	9½	10½	12½
Medium, in.	4½	5	5½	6	6½	7	7½	8½	9½	10½	12½
Heavy, in.	4½	5	5½	6	6½	7	7½	8½	9½	10½	12½
Ex. Hy., in.	4½	5	5½	6	6½	7	7½	8½	9½	10½	12½
Center of body to top of stem, open, outside screw and yoke, in.	12¾	14½	16½	19	21	22½	25	29½	33½	37½	43½
Stand., in.	12¾	14½	16½	19	21	22½	25	29½	33½	37½	43½
Medium, in.	12¾	14½	16½	19	21	22½	25	29½	33½	37½	43½
Heavy, in.	12¾	14½	16½	19	21	22½	25	29½	33½	37½	43½
Ex. Hy., in.	12¾	14½	16½	19	21	22½	25	29½	33½	37½	43½
Center of body to top of stem, inside screw, in.	10½	12½	13½	14½	16½	17½	19½	21	22½	26	28
Stand., in.	10½	12½	13½	14½	16½	17½	19½	21	22½	26	28
Medium, in.	10½	12½	13½	14½	16½	17½	19½	21	22½	26	28
Heavy, in.	10½	12½	13½	14½	16½	17½	19½	21	22½	26	28
Ex. Hy., in.	10½	12½	13½	14½	16½	17½	19½	21	22½	26	28

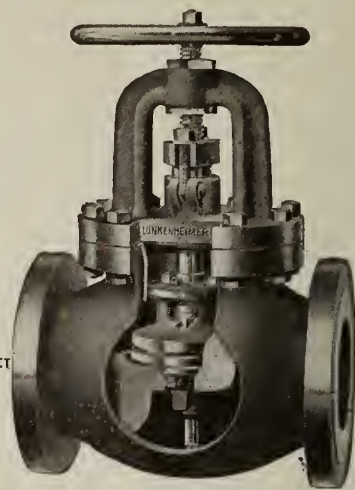
*Heavy and extra heavy valves have 1½-in. raised face on flange ends, which is included in dimensions.

Balanced Throttle Valves.

MATERIALS—Body and yoke of "Valve-iron"; bearing parts of "Valve-bronze." Can be procured with seat and disc of "Valve-nickel," or body and yoke can be had of cast steel.

PATTERNS—Globe or angle patterns with flange ends only, sizes 4 to 10 in., for 250 lbs. working steam pressure.

FEATURES—Simplicity of construction combined with efficiency make these valves particularly adapted for engine throttling purposes. Interior by-pass facilitates operation; spring seating surfaces accommodate themselves to any slight distortions caused by expansion and contraction; seating surfaces regrindable; all parts renewable, including seat and disc; can be connected with stem pointing vertically upward or horizontally.



BALANCED THROTTLE VALVE

DATA, BALANCED THROTTLE VALVE

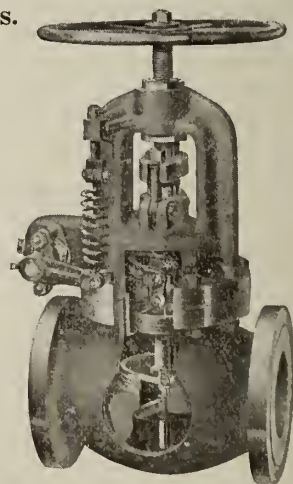
Size, in.	4	4½	5	6	7	8	10
Face to face, flanged globe, in.	14	15	15¾	17½	19¼	21¼	25¾
Center to face, flanged angle, in.	7	7½	7¾	8¾	9¾	10¾	12¾
Diam. of flanges, in.	10	10½	11	12½	14	15	17½
Thickness of flanges, in.	1¼	1½	1¾	1¾	1½	1½	1¾
Center of body to top of stem, open, in.	17½	18¾	19¾	21¾	23¾	26¾	31

Non-return Boiler Stop Valves.

MATERIALS—Body and yoke of "Valve-iron"; bearing parts of "Valve-bronze." Can be procured with seat and disc of "Valve-nickel," or body and yoke can be had of cast steel.

PATTERNS—Globe or angle patterns with screw or flange ends for 250 lbs. working steam pressure.

FEATURES—Will automatically close and instantly cut out the boiler in battery to which it is connected should the pressure within the boiler suddenly drop below that in the header; permits continued operation of other boilers in battery; will not open until pressure in boiler equals that in header; can be connected with stem pointing vertically upward or horizontally; self-cleansing seating surfaces; seating faces regrindable; all parts renewable, including seat and disc.



NON-RETURN BOILER STOP VALVE

DATA, NON-RETURN BOILER STOP VALVES

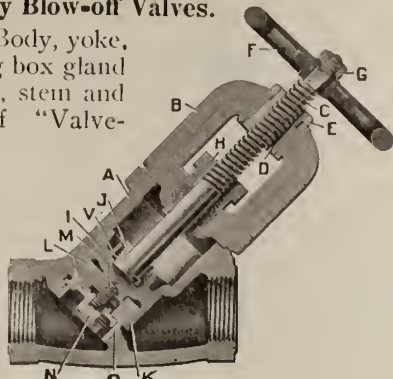
Size, in.	3	3½	4	4½	5	6	7	8	10
Face to face, flanged globe, in.	12½	13½	14	15	15¾	17½	19¼	21¼	25¾
Center to face, flanged angle, in.	6¼	6¾	7	7½	7¾	8¾	9¾	10¾	12¾
Diam. of flanges, in.	8¼	9	10	10½	11	12½	14	15	17½
Thickness of flanges, in.	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾	1¾
Face to face, screw globe, in.	11¾	12¾	13	14	14¾	16½	18¼	20	23¼
Center to face, screw angle, in.	5¾	6¾	6¾	7	7½	8¼	9¾	10	11¾
Center of body to top of stem, open, in.	18¾	20¼	22¼	23¾	25½	27½	31¼	33¼	40¼

Iron Body Straightway Blow-off Valves.

MATERIALS—Body, yoke, disc-guide and stuffing box gland of “Valve-iron”; seat, stem and stem bushings of “Valve-bronze”; iron disc with alloy faces.

PATTERNS—Standard for 125 lbs. and extra heavy for 250 lbs. working steam pressures. Screw or flange ends.

FEATURES—self-cleansing seating surfaces, reversible disc provided with two seating faces; disc face alloy can be renewed when worn; all parts including the seat are renewable.



IRON BODY STRAIGHTWAY BLOW-OFF VALVE

DATA, IRON BODY STRAIGHTWAY BLOW-OFF VALVES			
Size in.	2	2½	3
Face to face, flanged, standard, in.	10⅞	11⅞	13
Diam. of flanges, standard, in.	6	7	7½
Thickness of flanges, standard, in.	⅝	⅞	⅞
Face to face, screw, standard, in.	7⅞	9⅞	10½
Center of body to top of hand wheel, open, standard, in.	11⅞	13⅞	15⅞

“Renewo” Straightway Blow-off Valves.

MATERIALS — Seat and disc of “Valve-nickel”; hand wheel of iron; other trimmings and body of “Valve-bronze.”

PATTERNS — Medium with screw ends for 200 lbs. and “B-H” flange ends for 150 lbs. working steam pressure; extra heavy with screw ends for 300 lbs. and “B-X” flange ends for 250 lbs. working steam pressure.

FEATURES—Self-cleansing seating surfaces; re-grindable seating surfaces; all parts renewable, including nickel seat and disc; stuffing box repackable under pressure when valve is wide open.



“RENEWO” STRAIGHTWAY BLOW-OFF VALVE

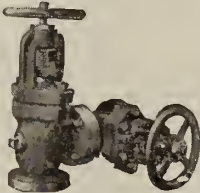
DATA, “RENEWO” STRAIGHTWAY BLOW-OFF VALVE							
Size, in.	¾	1	1¼	1½	2	2½	
Face to face, flanged.	Medium, in.	6¼	6⅞	7½	8¾	10	
	Ex. Hy., in.	7¼	7⅞	8½	9½	10⅞	
Diam. of flanges.	Medium, in.	4	4½	5	6	7	
	Ex. Hy., in.	4½	5	6	6½	7½	
Thickness of flanges.	Medium, in.	⅜	⅞	⅞	1	1½	
	Ex. Hy., in.	½	⅞	1	1½	1½	
Face to face, female, screw.	Medium, in.	3½	4½	5½	7	8½	
	Ex. Hy., in.	3½	4½	5½	7	8½	
Face of female, screw end to end of male.	Medium, in.	4½	4½	5½	6½	7½	
	Ex. Hy., in.	4½	5½	5½	6½	7½	
Center of body to top of stem, open.	Medium, in.	5¼	6¼	7½	8	9½	
	Ex. Hy., in.	5¼	6¼	7½	8¾	10½	

“Duro” Blow-off Valves.

MATERIALS—Body and yoke of “Valve-iron”; bearing parts of “Valve-bronze.”

PATTERNS—Screw or flange ends for 250 lbs. working steam pressure.

FEATURES—Self-cleansing seating surfaces; disc reversible and pro-



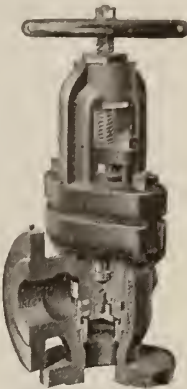
“DURO” BLOW-OFF AND “VICTOR” GATE VALVE COMBINATION

vided with two alloy faces, which can be melted out and new alloy inserted; all parts renewable, including seat.

A combination extensively used is that of the “Duro” with a “Victor” gate valve bolted between it and the boiler.

The gate valve serves as a safety device in event of accident to the blow-off valve and enables repairing of the latter while the boiler is under pressure.

DATA, “DURO” BLOW-OFF VALVES					
Size, in.	1½	2	2½	3	
Center to face, flanged, in.	3¾	4	4¾	5¼	5¾
Diam. of flanges, in.	5	6	6½	7½	8¼
Thickness of flanges, in.	¾	1	1	1	1½
Center to face, screw, in.	2¾	2¾	4¼	4¾	5¾
Center of body to top of stem, open, in.	12¼	13¾	16¼	18	20¾



“DURO” BLOW-OFF VALVE

“Vigilant” Safety Water Columns.

MATERIALS—Body and cap of “Valve-iron”; float of seamless copper, and trimmings of “Valve-bronze.”

PATTERNS—Made in various sizes to suit connections for all types of boilers. For 250 lbs. working steam pressure.

FEATURES—Will notify the attendant by automatically blowing a whistle when the water within the boiler approaches the low or high danger limits; aids in keeping the water level within the proper limits, thereby prolonging the life of the boiler and effecting an appreciable saving in fuel; simple in design and exceptionally durable; provided with a sediment chamber to trap scale or dirt, preventing same from being carried to water gage and gage cocks and interfering with their proper operation; only one float used, made of seamless copper and warranted to withstand a pressure greatly in excess of 250 lbs.; all parts renewable.



“VIGILANT” WATER COLUMN

DATA, “VIGILANT” SAFETY WATER COLUMNS							
Number.	4	5	6	7	8	9	11
Height over all, in.	30½	35 ⅞	35 ⅞	40½	51¾	49¾	43 ⅞
Center to center of water gage connections, in.	12	15	15	18	24	20	18
Center to center of gage cock connection, in.	3	4	4	5	7½	4	4
Steam and water connections, Nos. 4 to 8, in.	1	1¼	1¼	1¼	1½	.....	.....
Diam. of flanges, water and steam connections, Nos. 9 to 12, in. ....	.....	.....	.....	.....	.....	6	6
Water gage connections, in.	¾	¾	¾	¾	¾	¾	¾
Gage cock connections, in.	¾	¾	¾	¾	¾	½	½

McNAB & HARLIN MFG. CO.

Manufacturers of Valves and Fittings, Etc.

GENERAL OFFICE
N. E. Corner of John and William Streets
NEW YORK, N. Y.
WORKS AND SUPPLY HOUSE, PATERSON, N. J.

Products.

McNAB & HARLIN VALVES for all pressures and purposes, in Brass, Iron and Cast Steel.

PIPE and DRAINAGE FITTINGS.

BRASS and IRON BODY COCKS, etc.

Also, Wrought Pipe, Malleable Iron Fittings, Seamless Drawn Brass Pipe, Tools, Engine and Boiler Trimmings, Hose Goods and Plumbers' Brass Goods.

Quality of Materials.

The quality of the materials used in the manufacture of McNab & Harlin brass and iron valves and fittings is determined by daily chemical and physical analysis, and these tests furnish invaluable data for the production of a uniform product.

Steam metal, or hard brass, used in the manufacture of these valves, valve seats and disks, has a tensile strength of 33,000 lbs. per sq. in., and is particularly adapted for high pressure and unusually severe service.

Equipment and Facilities.

The installation of modern machinery and efficient methods enable this company to manufacture valves and fittings in the most satisfactory manner and with the least possible delay. A large and complete stock of all staple goods is carried at the factory at Paterson, N. J., insuring prompt shipments of all orders.

McNab & Harlin Patented Improved 1916 Type of Iron Body Gate Valve.

Furnished in sizes 2 to 14 in. inclusive, for 125 lbs. pressure, either inside screw or outside screw and yoke pattern.

For 250 lbs. pressure, outside screw and yoke pattern only.

These valves are of the double disk parallel seat type which has been designed and patented by this company after exhaustive research and experimental work.

Instead of having one central wedge to spread the disks against the seats at time of closing, they have two wedges, which more effectively transmit the lateral pressure exerted on the faces of the disks at the point of closing, thus insuring an absolutely tight valve. The design of the disk is such as to prevent warping or getting out of shape, due to temperature changes; they are equipped with lugs on the side, which operate in guides cast in the body of the valve, eliminating wear on the disks and seats due to friction in the operation of opening and closing, thus insuring a valve of longer life in service.

The disk rings and seat rings of these valves are made of Aterite metal, which is a patented non-corrosive alloy of great strength and density. This metal



TRADE-MARK

is approximately twice as strong as brass or bronze compositions at present used in the manufacture of disk rings and seat rings in gate valves. In addition to this, Aterite is proof against the corrosive action of most of the common acids and alkalis.

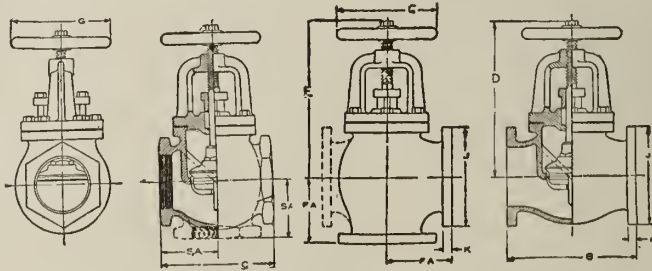
Valves equipped with disk rings and seat rings of this metal are particularly adapted for oil refinery work, as Aterite is proof against the corrosive action of sulphur and sulphurous compounds occurring in crude oil. Thousands of these valves are being furnished to different oil refining companies in this country and the valves are giving perfect satisfaction.

A special booklet, giving a detailed and complete description of these valves, as well as all Aterite valves, cocks and fittings, is issued by this company and will be sent on request.

Extra Heavy Iron Body Globe, Angle and Straightway Valves.

Constructed from a new line of patterns for 250 lbs. per sq. in. steam working pressure. Disk and seat rings are made of special hard metal faced true. All these valves are made to open by turning to the left. Wearing parts can be renewed, and seats can be easily and quickly reground. Valves can be packed when open without any escape of flow.

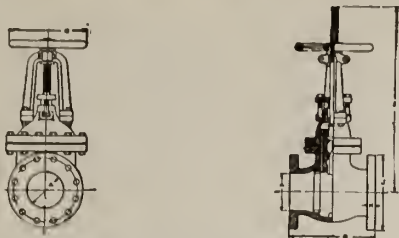
Diameters of flanges, thickness, bolt circle, size and number of bolts, of extra heavy valves and flanged fittings, are the standard adopted by all leading manufacturers on Jan. 1, 1915.



EXTRA HEAVY IRON BODY, GLOBE, ANGLE AND CROSS VALVES, BOLTED BONNET

Size, in.	B	C	FA	SA	D	E	G	J	K	Turns to open	Size by-pass
2	10 1/4	9 1/4	5 1/4	4 3/4	11 1/8	11 1/8	7 1/2	6 1/2	7/8	4	..
2 1/2	11 1/2	10 3/4	5 5/8	5 5/8	12 1/4	12 1/4	7 1/2	7 1/2	1	4 1/2	..
3	12 1/2	11 3/4	6 1/4	5 7/8	14 1/8	14 1/8	9	8 1/4	1 1/8	4	..
3 1/2	13 1/4	12 1/4	6 5/8	6 1/8	16	16	9	9	1 1/8	4 1/2	..
4	14	13	7	6 1/2	17 3/8	17 3/8	10	10	1 1/4	5	..
4 1/2	15	14	7 1/2	7	17 3/8	17 3/8	10	10 1/2	1 3/8	6	..
5	15 3/4	15	7 3/8	7 1/2	19	19	12	11	1 3/8	7	..
6	17 1/2	16 1/2	8 3/4	8 1/4	21 1/8	21 1/8	14	12 1/2	1 1/2	8	1 1/4
7	19 1/4	..	9 5/8	..	23 1/4	23 1/4	16	14	1 1/2	9	1 1/4
8	21	..	10 1/2	..	26 3/8	26 3/8	18	15	1 5/8	10 1/2	1 1/2
10	24 1/2	..	12 1/4	..	30	30	20	17 1/2	1 7/8	12	1 1/2
12	28	..	14	..	33 1/2	33 1/2	20	20 1/2	2	10 1/2	2

For steam working pressures up to 250 lbs. Valves 6 in. and larger made with by-pass to order at special prices.



EXTRA HEAVY IRON BODY STRAIGHTWAY VALVES, BOLTED BONNET, DOUBLE GATE

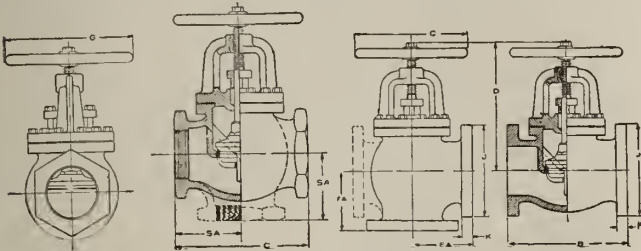
Size, in.—A	B	C	G	I	J	K	Turns to open	Size by-pass
2	8 1/2	7	6 1/2	14 1/2	6 1/2	3/8	15	....
2 1/2	9 1/2	8	7 1/2	16 3/4	7 1/2	1	15	....
3	11 1/8	9	9	19 3/8	8 1/4	1 1/8	13	....
3 1/2	11 7/8	10	11	21 1/8	9	1 1/8	16	....
4	12	11	12	24 3/4	10	1 1/4	17	....
4 1/2	13 1/4	12 1/4	12	26 1/8	10 1/2	1 3/8	20	....
5	15	13 1/2	14	28 1/8	11	1 3/8	22	....
6	15 7/8	15 7/8	16	32 1/8	12 1/2	1 7/8	25	1 1/4
7	16 1/4	16 1/4	18	35 3/4	14	1 7/8	30	1 1/4
8	16 1/2	16 1/2	20	41 1/8	15	1 7/8	33	1 1/2
10	18	18	22	50 1/8	17 1/2	1 7/8	36	1 1/2
12	19 3/4	....	24	57 1/8	20 1/4	2	44	2

C—end to end—screwed.

For steam working pressures up to 250 lbs. Valves 6 in. and larger made with by-pass to order at special prices.

Medium Iron Body Valves.

This new line takes the place of the old style throttle valve and is carefully designed to meet all requirements of 175 lbs. steam working pressure.



MEDIUM IRON BODY ENGINE THROTTLE VALVES, GLOBE OR ANGLE, BOLTED BONNET

Size, in.	B	C	FA	SA	D	G	J	K
2	9	7 3/4	4 1/2	3 7/8	10 3/4	7 1/2	6 1/2	3/8
2 1/2	10	8	5	4	11 5/8	7 1/2	7 1/2	1
3	11	8 1/4	5 1/2	4 1/8	12 7/8	7 1/2	8 1/4	1 1/8
3 1/2	12	9 1/2	6	4 3/4	14 1/8	9	9	1 1/8
4	13	10 1/2	6 1/2	5 1/4	15 5/8	9	10	1 1/4
4 1/2	13 1/2	11 1/4	6 3/4	5 3/8	16 3/4	9	10 1/2	1 1/8
5	14 1/2	12 1/4	7 1/4	6 1/8	17 5/8	10	11	1 3/8
6	16	14	8	7	19 1/2	12	12 1/2	1 7/8
7	17 1/2	17	8 3/4	8 1/2	22 1/8	14	14	1 7/8
8	20	18 1/2	10	9 1/4	24 1/2	16	15	1 7/8
10	22 1/2	21 1/4	11 1/4	11 1/4	27 1/2	18	17 1/2	1 7/8
12	25 1/2	25 1/2	12 3/4	12 3/4	31 1/4	20	20 1/2	2

For steam working pressures up to 175 lbs.

Standard Iron Body Brass Mounted Valves.

For steam working pressures up to 125 lbs. Construction is such that they can be packed when open without any escape of flow, a fact that all practical users can appreciate. To do so, the valve must be wide open.

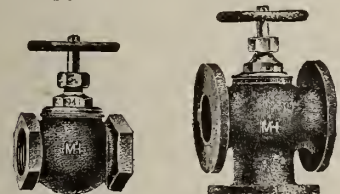


FIG. 270 Globe Valve

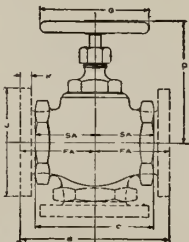
FIG. 275 Cross Valve



FIG. 276 3-way Valve



FIG. 302 Angle Check



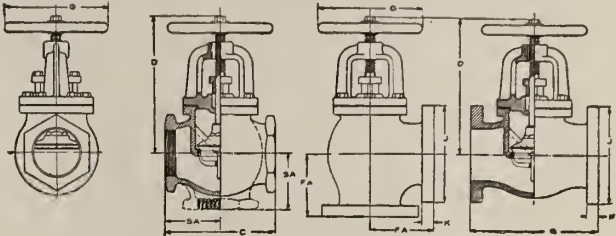
DIMENSION DIAGRAM

For standard iron body, brass mounted, screw bonnet, globe, angle, cross and check valves

STANDARD IRON BODY VALVES
For steam working pressures up to 125 lbs.

DIMENSIONS, STANDARD IRON BODY BRASS MOUNTED GLOBE, ANGLE, CROSS AND CHECK VALVES

Size, in.	B	C	FA	SA	D	G	J	K
1 1/4	4 9/8	4 5/8	3 1/4	2 5/8	5 5/8	3 1/4	4 1/2	1/2
1 1/2	5 5/8	5 5/8	3 3/4	2 3/4	6 1/4	3 3/4	5	5/8
2	8	6 1/2	4	3 1/4	7 1/4	4 1/4	6	3/4
2 1/2	8 1/2	7	4 1/4	3 1/2	8 1/4	6	7	1 1/4
3	9 1/2	8	4 3/4	4	9 1/4	7	7 1/2	1 3/4



STANDARD IRON BODY GLOBE, ANGLE AND CROSS VALVES, BOLTED BONNET

Size, in.	B	C	FA	SA	D	G	J	K	Turns to open
2	8	6 1/2	4	3 1/4	10 3/4	6 1/2	6	5 3/8	4
2 1/2	8 1/2	7	4 1/4	3 1/2	11	6 1/2	7	5 3/8	4 1/2
3	9 1/2	8	4 3/4	4	12 3/4	7 1/2	7 1/2	5 3/8	5
3 1/2	10 1/2	9	5 1/4	4 1/2	13 1/4	7 1/2	8 1/2	5 3/8	5
4	11 1/2	10	5 3/4	5	15 1/8	9	9	5 3/8	5
4 1/2	12	10 1/2	6	5 1/4	15 1/2	9	9 1/4	5 3/8	6
5	13	11 1/4	6 1/2	5 3/8	17	10	10	5 3/8	7
6	14	13	7	6 1/2	17 3/4	12	11	1	8
7	16	14 1/2	8	7 1/4	21 1/8	14	12 1/2	1 1/8	9
8	17	16	8 1/2	8	23	16	13 1/2	1 1/8	10 1/2
10	20	19 3/4	10	9 3/8	26 1/4	18	16	1 1/8	12
12	24	21 1/4	12	10 3/8	30	20	19	1 1/4	14

For steam working pressures up to 125 lbs. Valves 6 in. and larger made with by-pass to order at special price.

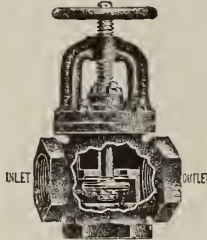


FIG. 287 3-way Valve
FIG. 288. Flanged

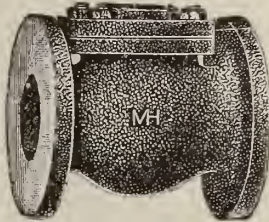


FIG. 305 Horizontal Check Valve

STANDARD IRON BODY VALVES, BOLTED BONNET

Size, in.	2	2 1/2	3	3 1/2	4	5	6	8	10
End to end, screwed.....	6 3/8	7	7 1/2	8 7/8	11	11	12 7/8	....	....
Center to bottom outlet, screwed.....	3 3/8	3 3/4	3 3/4	4 3/4	5 1/2	5 5/8	6 1/2	....	....

FIG. 287

Diam. of flgs.	6	7	7 1/2	8 1/2	9	....	10	11	....	13 1/2	1	....
Face to face, flgd.	6	7 1/2	8	9 1/2	11	....	12	13 3/8	....	16 1/2	20	....
Center to face, bottom outlet, flgd.	4 1/2	5	5 1/2	6 1/4	7	....	7 1/4	7 3/4	....	9 1/4	10	....

FIG. 288

Diam. of flgs.	6	7	7 1/2	8 1/2	9	9 1/4	10	11	12 1/2	13 1/2	16	19
Horiz. face to face.	8	8 1/2	9 1/2	10 1/2	11 1/2	12	13	14	16	17	20	24
Angle center to face.	4	4 1/4	4 3/4	5 1/4	5 3/4	6	6 1/2	7	8	8 1/2	10	12

FIG. 305

“Jenkins Type” Disk Valves.



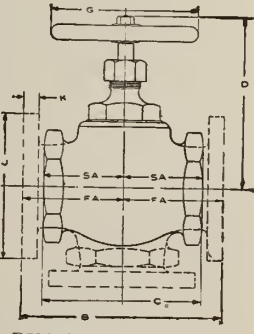
FIG. 277 “JENKINS TYPE” DISK GLOBE



FIG. 278 ANGLE VALVE

DIMENSIONS, STANDARD JENKINS TYPE DISK IRON BODY GLOBE, ANGLE AND CROSS VALVES

Size, in.	1 1/4	1 1/2	2	2 1/2	3
B	....	....	7 1/8	9 1/2	10
C	4 1/4	4 5/8	6 3/4	8	8 1/4
FA	....	....	3 7/8	4 3/4	5
SA	2 1/8	2 3/8	3 3/8	4	4 1/8
D	7 1/4	7 7/8	8 3/4	9 3/4	11
G	3 1/4	3 3/4	4 1/4	6	7
J	....	....	5 1/8	6	7 1/8
K	....	....	5 1/8	6 1/8	8 3/4



DIMENSION DIAGRAM

For “Jenkins Type” disk I. B. brass mounted, screwed bonnet globe, angle, cross and check valves

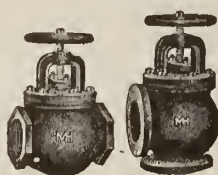
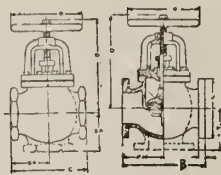


FIG. 289 FIG. 290
For steam pressures up to 125 lbs.



Dimension Diagram

"JENKINS TYPE" DISK IRON BODY VALVES

Size, in.—A	B	Flgd.	C	Serl.	FA	SA	D	G	J	K
2½	7½	7¾	4½	4	117⁄8	6½	7	7½	13	13
3	9¼	9¾	4¾	4 11⁄16	123⁄8	7½	7½	8½	13	13
3½	10	10	5¾	5¾	13	7½	8½	9	13	13
4	11¾	11¾	5¾	5¾	145⁄8	9	9	10	13	13
5	13¼	13¼	6½	6½	16½	10	10	11	13	13
6	16	16	7	7	18	12	12	13½	13	13
7	16¼	16¼	8½	8½	20½	14	14	15	13	13
8	18½	18½	9¼	9¾	223⁄8	16	16	17	13	13

Standard Straightway Valves.

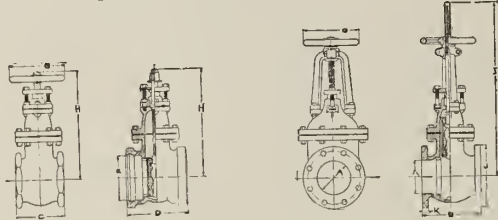


FIG. 325 FIG. 343 FIG. 328
For steam working pressures up to 125 lbs.

STANDARD IRON BODY STRAIGHTWAY VALVES

Size, in.—A	B	C	D	E	G	H	I	J	K
2	7	5 7⁄8	8¾	3¼	6½	11	13¾	6	5 5⁄8
2½	7½	5 7⁄8	9¾	4¾	6½	11 11⁄16	15 1⁄8	7	4 11⁄16
3	8	6 1⁄8	9¾	4¾	7½	12	18 11⁄16	7½	4 11⁄16
3½	8½	6 1⁄8	9¾	5 5⁄8	7½	12	20 1⁄8	8½	4 11⁄16
4	9	7 3⁄8	9¾	5 5⁄8	11	17	23 3⁄8	9	4 11⁄16
4½	9½	7 3⁄8	9¾	5 5⁄8	11	18 1⁄8	24 1⁄8	9½	4 11⁄16
5	10	7 1⁄8	11 1⁄8	6¾	12	19 3⁄8	27 1⁄8	10	4 11⁄16
6	10½	8½	11 1⁄8	7 7⁄8	12	21 3⁄8	30 1⁄8	11	4 11⁄16
7	11	9 3⁄8	11 1⁄8	8 1⁄8	14	23 1⁄8	34 1⁄8	12 1⁄2	4 11⁄16
8	11½	10 1⁄8	13 1⁄8	10	14	24 1⁄8	39 1⁄8	13 1⁄2	4 11⁄16
10	13	12 1⁄8	13 1⁄8	12 1⁄8	16	30 3⁄8	48 1⁄8	16	4 11⁄16
12	14	13¾	14 1⁄8	14 3⁄8	18	33	55 1⁄8	19	4 11⁄16
14	15	15	15	15	20	37 1⁄8	63 3⁄8	21	4 11⁄16

Standard Iron Body Swing Check Valves.

Iron body, brass seat. For steam working pressures up to 125 lbs. So constructed that by removing the bonnet, the disk can be taken out at same time. Thickness of body, metal and flanges correspond with other standard valves for 125 lbs. steam working pressures. Valves made to order with by-pass. Furnished with leather disk, when desired, at special price.

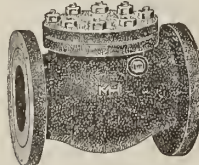


FIG. 297. STANDARD SWING CHECK VALVE, IRON BODY BRASS SEAT

DIMENSIONS, IRON BODY SWING CHECK VALVES

Size, in.	2½	3	3½	4	4½	5	6	8
Serl. end to end...	7	8	9	10	10½	11¼	13	16
Flgd. face to face...	8½	9¼	10½	11	12	13	14	17
Diam. of flgs.	7	7½	8½	9	9¼	10	11	13½
Hub, end to end...	7	8	9	10	10½	11¼	13	16
Hub end, depth hub	3	3	3	3	3	3	3	3½

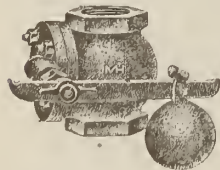


FIG. 317
IRON BODY BACK PRESSURE VALVE

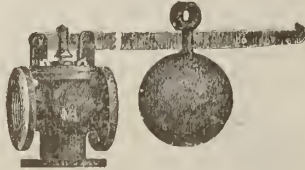


FIG. 320
IRON BODY SAFETY VALVE
Special graduations, extra

DIMENSIONS, IRON BODY BACK PRESSURE VALVES (FIG. 317)

Size, in.	2	2½	3	3½	4	4½	5	6	7	8	10	12
End to end	5¾	6½	7½	8¾	9½	10¾	11	12¾	14	16	18¾	22

Valves are weighted for back pressures up to 5 lbs.

DIMENSIONS, IRON BODY SAFETY VALVES (FIG. 320)

Size, in.	2	2½	3	3½	4	4½	5	6	8
Diam. of flgs.	6	7	7½	8½	9	9½	10	11	13½
Face to face, sides	6	7½	8	9½	11	11	12	13¾	16½
Center to bottom of flg.	4½	5	5½	6¼	7	7	7¼	7¾	9¼

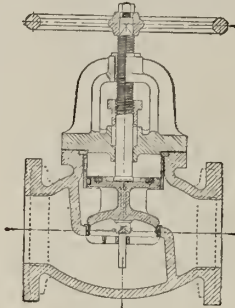


FIG. 426
EXTRA HEAVY AUTOMATIC STOP AND CHECK VALVE



FIG. 618
BRASS STANDARD STRAIGHTWAY VALVE

DIMENSIONS, STOP AND CHECK VALVES

Size, in.	2	2½	3	3½	4	4½	5	6	7	8	10	12
Face to face, in.	10¼	11½	12½	13¼	14	15	15¾	17½	19¼	21	24¼	28
Diam. of flgs., in.	6½	7½	8¼	9	10	10½	11	12½	14	15	17½	20½

DIMENSIONS, STANDARD BRASS STRAIGHTWAY VALVES

Size, in.	½	¾	1	1¼	1½	2	2½	3
Serl. end to end	2	2 1⁄8	2 5⁄8	2 7⁄8	3 1⁄8	3 5⁄8	4 1⁄8	4 7⁄8
Flgd. face to face	2 1⁄8	2 5⁄8	2 7⁄8	3 1⁄8	3 5⁄8	4 1⁄8	4 7⁄8	5 1⁄8
Diam. of flgs.	3½	4	4½	5	5½	6	7	7½

Screwed and flanged patterns, rising stem, steam metal double gate.



FIG. 526
Globe, Serd.

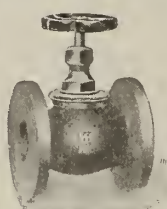


FIG. 529
Globe, Flgd.



FIG. 538
Swing Check
NEW STANDARD BRASS VALVES



FIG. 540
Horiz. Check

DIMENSIONS, GLOBE AND HORIZONTAL CHECK VALVES, SCREWED AND FLANGED

Size, in.	½	¾	1	1½	2	2½	3	3½	4
End to end, serd.	1 5⁄8	1 11⁄8	2 1⁄8	2 3⁄8	2 7⁄8	3 1⁄8	3 5⁄8	4 1⁄8	4 7⁄8
Face to face, flgd.	3	3½	4	4½	5	6	6½	7½	8½

DIMENSIONS, SWING CHECK VALVES, SCREWED

Size, in.	¼	¾	1	1¼	1½	2	2½	3
End to end	2¼	2 1⁄8	3 1⁄8	3 3⁄8	4 1⁄8	5 1⁄8	5 1⁄8	6 1⁄8

DIMENSIONS, MEDIUM BRASS GLOBE, ANGLE, CROSS AND CHECK VALVES

Size, in.	½	¾	1	1¼	1½	2	2½	3
Diam. of flgs.	3	3	3½	4	4½	5	6	6½
Face to face, flgd.	3½	4	4½	5	5½	6	7	7½
Center to out. let.	1¾	2	2½	2¾	3½	3¾	4	4
Center to in. let.	2½	3	3¼	3½	4	4½	5	5



564
MEDIUM FLANGED CROSS VALVE

DIMENSIONS, STANDARD SOLID WEDGE GATE VALVES

Size, in.	½	¾	1	1¼	1½	2	2½	3
End to end, serd.	2	2 1⁄8	2 5⁄8	2 7⁄8	3 1⁄8	3 5⁄8	4 1⁄8	4 7⁄8
Face to face, flgd.	3½	4	4½	5	5½	6	7	7½



FIGS. 622 AND 624
STANDARD SOLID OR SPLIT WEDGE GATE VALVE

DIMENSIONS, STANDARD SPLIT WEDGE GATE VALVES

Size, in.	½	¾	1	1¼	1½	2	2½	3
End to end, serd.	2	2 1⁄8	2 5⁄8	2 7⁄8	3 1⁄8	3 5⁄8	4 1⁄8	4 7⁄8
Face to face, flgd.	3½	4	4½	5	5½	6	7	7½



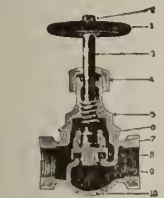
EXTRA HEAVY GLOBE VALVES (STEAM METAL)

Size, in.	1	1½	2	2½	3	3½	4	4½
Diam. of flgs.	4½	5	6	6½	7½	8¼	9	10
Face to face, flgd. .	4	4½	5	7	8½	9½	10½	12

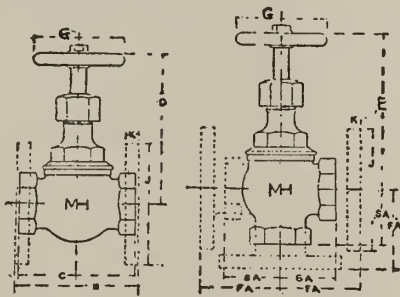
EXTRA HEAVY ANGLE CHECK VALVES (STEAM METAL)

Size, in.	1	1½	2	2½	3	3½	4	4½
Diam. of flgs.	4½	5	6	6½	7½	8¼	9	10
Center to outlet. .	2¾	3¼	3¾	4	4¼	4¾	5¼	5½
Center to inlet. .	2¾	3¼	3¾	4	4¼	4¾	5¼	5½

"Jenkins Type" Disk Brass Valve.



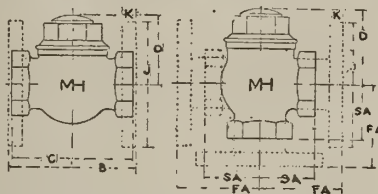
- (1) Wheel Nut
- (2) Wheel (3) Stem
- (4) Packing Nut
- (5) Bonnet
- (6) Lock Nut
- (7) Disk Holder
- (8) Disk (9) Disk Nut
- (10) Body



For steam working pressures up to 150 lbs.

DIMENSIONS, "JENKINS TYPE" DISK BRASS VALVES

Size, in.	B	C	FA	SA	D	E	G	J	K
1/8	...	1 1/8	...	1 1/8	2 5/8	2 3/4	1 1/2	...	...
1/4	...	2 1/8	...	1 1/8	3 3/8	3 1/8	2	2 1/2	3 1/2
3/8	2 1/8	2 3/8	1 7/8	1 1/8	4 1/8	4	2	2 1/2	3 1/2
1/2	3 1/8	2 3/4	2 1/8	1 3/8	5	5 1/4	2 1/2	3	3 1/2
3/4	3 3/8	2 3/4	2 1/8	1 1/2	5 1/2	5 1/2	2 3/4	3 1/2	3 1/2
1	4	3 1/4	2 3/8	1 3/4	6 1/8	6 1/8	3	4	4 1/2
1 1/4	4 3/8	4 1/4	2 1/2	2 1/8	7 1/8	7 1/8	3 1/4	4 1/2	5
1 1/2	4 7/8	4 7/8	3 1/8	2 1/4	7 1/2	7 1/2	4 1/8	5	6
2	6	5 3/4	3 3/4	2 3/8	9 1/8	9 1/8	5	6	7 1/2
2 1/2	6 3/4	6 3/4	4 1/4	3 1/4	10 1/8	10 1/8	5	7	8 1/4
3	7 1/2	8 1/2	4 3/4	4 1/4	11 1/8	11 1/8	6	7 1/2	9 1/8



"JENKINS TYPE" DISK BRASS HORIZONTAL AND ANGLE CHECK VALVES

Size, in.	B	C	FA	SA	D	J	K
1/8	...	1 1/8	...	1 1/8	1 3/8	2 1/2	...
1/4	2 1/8	2 1/8	1 7/8	1 1/8	1 3/8	2 1/2	...
3/8	2 3/8	2 3/8	2 1/8	1 3/8	1 3/8	3	3 1/2
1/2	3 1/8	2 3/4	2 1/8	1 1/2	2 1/4	3 1/2	4 1/2
3/4	3 3/8	3 1/4	2 3/8	1 3/4	2 1/2	4	5
1	4	3 1/4	2 3/8	1 3/4	2 1/2	4 1/2	5 1/2
1 1/4	4 3/8	4 1/4	3 1/8	2 1/4	2 3/4	5	6
1 1/2	4 7/8	4 7/8	3 3/4	2 3/8	3 1/2	6	7 1/2
2	6	5 3/4	4 1/4	3 1/4	4 1/4	7	8 1/4
2 1/2	6 3/4	6 3/4	4 3/4	4 1/4	4 3/4	7 1/2	9 1/8
3	7 1/2	8 1/2	4 3/4	4 1/4	4 3/4	8 1/4	10 1/8

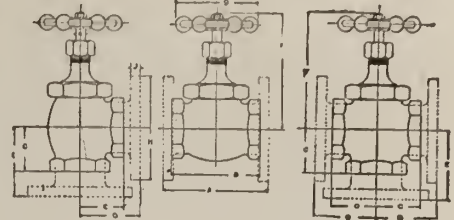
For steam working pressures up to 150 lbs.

Regrinding Valves.

McNab & Harlin regrinding valves are made of steam metal with screwed or flanged ends, in medium or extra heavy patterns, for working pressures of 200 lbs. and 300 lbs. respectively.



Fig. 566 Globe Valve



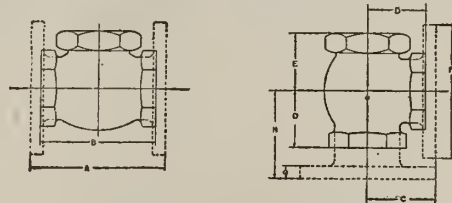
Dimension Diagrams

REGRINDING GLOBE, ANGLE AND CROSS VALVES WITH OR WITHOUT HARD BRONZE OR NICKEL RENEWABLE DISK AND SEAT
For 200 lbs. working pressure

Size, in.	A	B	C	D	E	F	G	H	J	K
1/4	...	1 1/8	...	...	...	3	2	...	...	1 1/8
3/8	...	2 1/8	...	...	...	3 3/8	2 1/2	...	...	1 3/8
1/2	...	2 3/8	...	...	...	3 1/2	2 1/2	...	...	1 3/8
3/4	3 1/2	2 3/8	1 1/2	1 3/4	2 1/2	3 1/2	3	3 1/2	...	1 3/8
1	4	3 1/8	1 1/2	2	3	4 1/8	3 3/8	4	...	1 3/8
1 1/4	4 1/2	3 3/4	2 1/4	2 1/2	3 1/4	5 3/8	3 3/4	4 1/2	...	1 3/8
1 1/2	5	4 1/8	2 1/4	2 3/4	3 1/2	6 1/8	4 5/8	5	...	1 3/8
2	6	5 1/8	2 3/4	3 1/2	4	7 1/8	5 1/2	6	...	1 3/8
2 1/2	6 1/2	6	3	3 3/4	4 1/2	8 1/8	6 1/2	7	...	1 3/8
3	7 1/2	7 1/8	3 1/8	4	5	9 1/8	7	8 1/4	...	1 3/8

EXTRA HEAVY TYPE
For 300 lbs. working pressure

Size, in.	A	B	C	D	E	F	G	H	J	K
1/4	...	2 5/8	1 5/8	...	...	5 1/8	3	3 1/2	3 1/2	2 5/8
3/8	...	3	2 1/8	...	...	5 3/8	3 3/8	4	3 1/2	2 5/8
1/2	4	3 3/8	2 1/8	2 1/2	2 1/2	6 1/8	3 3/4	4 1/2	4 1/2	3 1/4
3/4	4 3/4	4 1/2	2 3/4	2 3/4	2 3/4	7 1/8	4	5	5	3 1/4
1	5	4 5/8	2 3/4	3 1/4	3 1/4	8	4 5/8	6	6	3 1/4
1 1/4	5 1/2	5 1/8	2 3/4	3 1/2	3 1/2	9 1/8	5 1/2	6 1/2	6 1/2	3 1/4
1 1/2	6	5 3/8	3 1/8	3 1/2	3 1/2	10 1/8	6	7 1/2	7 1/2	3 1/4
2	6 1/2	6 3/8	3 1/8	4 1/8	4 1/8	11 1/8	7	8 1/4	8 1/4	3 1/4
2 1/2	7 1/2	7 3/8	3 1/8	4 1/2	4 1/2	12 1/8	8	9 1/4	9 1/4	3 1/4
3	8 1/2	8 3/8	3 1/8	4 1/2	4 1/2	13 1/8	9	10 1/4	10 1/4	3 1/4

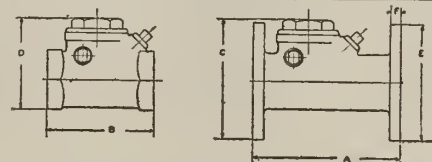


REGRINDING HORIZONTAL AND ANGLE CHECK VALVES
For 200 lbs. working pressure

Size, in.	A	B	C	D	E	F	G	H
1/4	...	1 1/8	...	...	...	...	...	...
3/8	...	2 1/8	...	...	...	...	...	...
1/2	...	2 3/8	...	...	...	...	...	...
3/4	3 1/2	2 3/8	1 1/2	1 3/4	2 1/2	3 1/2	3 1/2	2 1/2
1	4	3 1/8	1 1/2	2	3	4 1/8	4	3
1 1/4	4 1/2	3 3/4	2 1/4	2 1/2	3 1/4	5 3/8	4 1/2	3 1/4
1 1/2	5	4 1/8	2 1/4	2 3/4	3 1/2	6 1/8	5	3 1/4
2	6	5 1/8	2 3/4	3 1/2	4	7 1/8	6	4
2 1/2	6 1/2	6	3	3 3/4	4 1/2	8 1/8	7 1/2	4 1/2
3	7 1/2	7 1/8	3 1/8	4	5	9 1/8	8 1/4	5

EXTRA HEAVY PATTERN
For 300 lbs. working pressure

Size, in.	A	B	C	D	E	F	G	H
1/4	...	2 5/8	...	1 5/8	1 5/8	3 1/2	...	...
3/8	...	3	...	2 1/8	2 1/8	4	...	...
1/2	4	3 3/8	2 1/8	2 1/2	2 1/2	4 1/2	...	...
3/4	4 3/4	4 1/2	2 3/4	2 3/4	2 3/4	5 1/8	...	...
1	5	4 5/8	2 3/4	3 1/4	3 1/4	6	...	...
1 1/4	5 1/2	5 1/8	3 1/8	3 1/2	3 1/2	6 1/2	...	...
1 1/2	6	5 3/8	3 1/8	3 1/2	3 1/2	7 1/2	...	...
2	6 1/2	6 3/8	3 1/8	4 1/8	4 1/8	8 1/8	...	...
2 1/2	7 1/2	7 3/8	3 1/8	4 1/2	4 1/2	9 1/8	...	...
3	8 1/2	8 3/8	3 1/8	4 1/2	4 1/2	10 1/8	...	...



REGRINDING SWING CHECK VALVES
For 200 lbs. working pressure

Size, in.	A	B	C	D	E	F
1/4	...	2 5/8	...	2	...	...
3/8	...	3	...	2 1/8	...	...
1/2	...	3 3/8	...	2 1/2	...	...
3/4	3 1/2	3 3/8	1 1/2	2 3/4	3 1/2	...
1	4	4 1/8	1 1/2	3	4	...
1 1/4	4 1/2	4 5/8	2 1/4	3 1/2	4 1/2	...
1 1/2	5	5 1/8	2 1/4	3 3/4	5	...
2	6	6 1/8	2 3/4	4 1/2	6	...
2 1/2	6 1/2	6 3/8	3	5 1/2	7	...
3	7 1/2	7 3/8	3 1/8	6 1/2	8 1/4	...

DIMENSIONS, REGRINDING SWING CHECK VALVES (Continued)
EXTRA HEAVY PATTERN
For 300 lbs. working pressures

Size, in.	A	B	C	D	E	F
1/4	3 1/8	2 1/2	2 1/8	2 1/8	3	3 1/8
3/8	3 1/8	2 1/2	2 1/8	2 1/8	3 1/2	3 1/8
1/2	3 1/8	2 1/2	2 1/8	2 1/8	4	3 1/8
3/4	3 1/8	2 1/2	2 1/8	2 1/8	4 1/2	3 1/8
1	3 1/8	2 1/2	2 1/8	2 1/8	5	3 1/8
1 1/4	3 1/8	2 1/2	2 1/8	2 1/8	6 1/2	3 1/8
1 1/2	3 1/8	2 1/2	2 1/8	2 1/8	7 1/2	3 1/8
2	3 1/8	2 1/2	2 1/8	2 1/8	8 1/2	3 1/8
2 1/2	3 1/8	2 1/2	2 1/8	2 1/8	9 1/2	3 1/8
3	3 1/8	2 1/2	2 1/8	2 1/8	10 1/2	3 1/8

Semisteel Regrinding Valves.

Size, in.	1	1 1/4	1 1/2	2	2 1/2	3
Face to face, flgd.	4	4 5/8	5 5/8	8	8 1/2	9 1/2
End to end, serd.	4	4 5/8	5 5/8	6 1/2	7	8

For working pressures up to 200 lbs.
Made in globe, angle and cross types. Also horizontal and angle check valve.

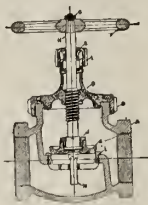


FIG. 309
REGRINDING VALVE
Semisteel body and bronze, nickel, bronze or monel metal trimming

Iron and Brass Cocks.



FIG. 375
STANDARD IRON COCK
Screwed
Sizes 3/8 to 6 in.

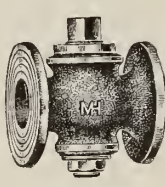


FIG. 678
FLANGED STEAM COCK
Steam metal



FIG. 683
PACKED PLUG COCK
Bolted gland
Sizes 3/8 to 4 in.



FIG. 674
SERVICE COCK
Flat head
Sizes 1/4 to 3 in.

DIMENSIONS, FLANGED STEAM COCKS (FIG. 678)

Size, in.	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6
Diam. of flgs.	4	4 1/2	5	6	7	7 1/2	8 1/2	9	10	11
Face to face, flgd, Standard	4	4 1/2	5	6	7	8	9	9 1/2	11	12
Face to face, flgd, Three-way	4 1/4	5	5 1/2	6 1/2	7 1/2	8 1/2	9 1/2	10 1/2	12	13
Center to side outlet, Three-way	2 3/4	3	3 1/2	4	4 1/2	5	5 1/2	6	7	8

Hydraulic Valves and Fittings.



FIG. 750
HYDRAULIC TEE
Sizes, 1/4, 3/8, 1/2, 3/4, 1, 1 1/4, 1 1/2, 2 in.



FIG. 757
HYDRAULIC UNION
Sizes, 1/4, 3/8, 1/2, 3/4, 1, 1 1/4, 1 1/2, 2 in.



FIG. 758
FLANGE UNION
Sizes, 1/2, 3/4, 1, 1 1/4, 1 1/2, 2, 2 1/2, 3 in.



FIG. 743
STOP VALVE
Sizes, 1/4, 3/8, 1/2, 3/4, 1, 1 1/4, 1 1/2, 2 in.

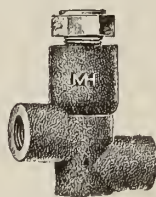


FIG. 744
CHECK VALVE
Sizes, 1/4, 3/8, 1/2, 3/4, 1, 1 1/4, 1 1/2, 2 in.

For pressures up to 10,000 lbs.



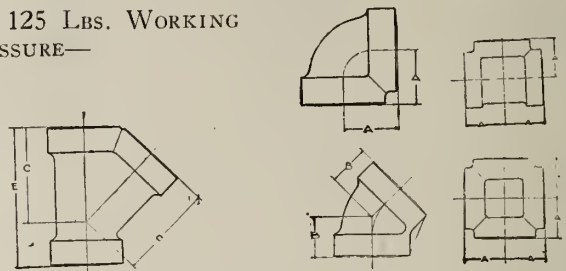
FIG. 746
HYDRAULIC VALVE
Size, 3/4-in.

Cast Iron Screwed Fittings.

This line of cast iron standard, medium and extra heavy screwed fittings is complete for 125 lbs., 175 lbs. and 250 lbs. working steam pressure. All fittings tapped to Briggs standard gage and carefully inspected before shipment.

The 175-lb. fittings are especially adapted for oil lines and car heating.

125 LBS. WORKING PRESSURE—



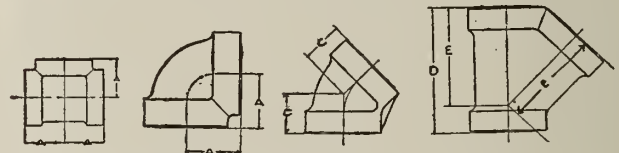
CAST IRON SCREWED FITTINGS

DIMENSIONS, MH STANDARD FITTINGS

Size, in.	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
A	1 1/8	3/4	7/8	1	1 1/8	1 3/8	1 1/2	1 1/2	2 3/8	2 5/8	3 1/8
B	1/2	3/8	1	3/4	1	1 1/8	1 1/8	1 1/8	1 5/8	1 1/2	1 3/8
C	...	...	...	2 1/8	2 1/8	2 3/8	3 1/8	3 1/8	4 1/8	5 1/8	6 1/8
E	...	...	...	2 1/8	3 1/8	4	4 5/8	5 1/8	5 1/8	7	8 1/8

Size, in.	3 1/2	4	4 1/2	5	6	7	8	9	10	12
A	3 3/8	3 5/8	4	4 3/8	5	5 1/8	6 3/8	6 3/8	8	9 1/8
B	2 1/8	2 1/4	2 1/8	2 1/8	2 1/8	3 1/8	3 1/8	4 1/8	4 1/8	5 1/8
C	6 1/8	7 1/8	8 3/8	9 1/8	10 1/8	12 3/8	13 3/8	...	17	...
E	9 1/8	10 1/8	11 1/8	12 1/8	14 1/8	16 3/8	18 3/8	...	22	...

175 LBS. WORKING PRESSURE—



MEDIUM CAST IRON SCREWED FITTINGS

DIMENSIONS, MH MEDIUM FITTINGS

Size, in.	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
A	1 1/8	3/4	7/8	1	1 1/8	1 3/8	1 1/2	1 1/2	2 3/8	2 5/8	3 1/8
C	1/2	3/8	1	3/4	1	1 1/8	1 1/8	1 1/8	1 5/8	1 1/2	1 3/8
D	...	...	...	...	...	...	...	...	6 1/8	7 1/8	8 1/8
E	...	...	...	...	...	...	...	...	4 1/8	5 1/8	6

Size, in.	3 1/2	4	4 1/2	5	6	7	8	9	10	12
A	4 1/8	4 1/8	5	5 1/8	6 1/8	6 7/8	7 1/2	8 1/8	9 1/4	11 1/8
C	2 1/8	2 3/8	2 1/8	2 1/8	3 1/8	3 1/8	4 1/8	4 1/8	5 1/8	5 1/2
D	9 1/4	10 1/4	11 3/8	12 1/8	13 1/8	15 3/8	17 1/4	18 1/8	...	...
E	6 3/8	7 1/8	8 1/2	9	10 3/8	11 3/8	13	...	...	...

250 LBS. WORKING PRESSURE—

DIMENSIONS, MH EXTRA HEAVY FITTINGS

Size, in.	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8	10	12
A	1 1/8	1 1/8	1 1/2	1 3/4	1 3/4	1 3/4	2 1/4	2 3/4	3 1/8	4 1/8	4 7/8	5 1/4	5 1/4	6 1/2	7 1/8	9 1/4	10 1/4
C	1	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/4	2 1/8	2 1/8	2 3/8	3 1/8	3 1/8	3 1/8	4 1/8	4 1/8	4 1/8	5 1/2
D	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
E	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Flanged Fittings.

We have a full line of patterns and up-to-date equipment for the manufacture of standard and extra heavy regular and long sweep flanged fittings, also special patterns for reducing sizes and special shapes used extensively on power plant work.

The dimensions and drilling of all flanged fittings conform with the American Standard adopted Jan. 1, 1915, by Committee on Standardization of Fittings and Valves.

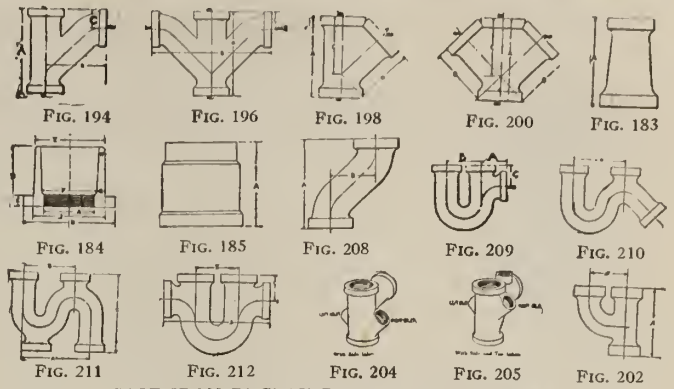
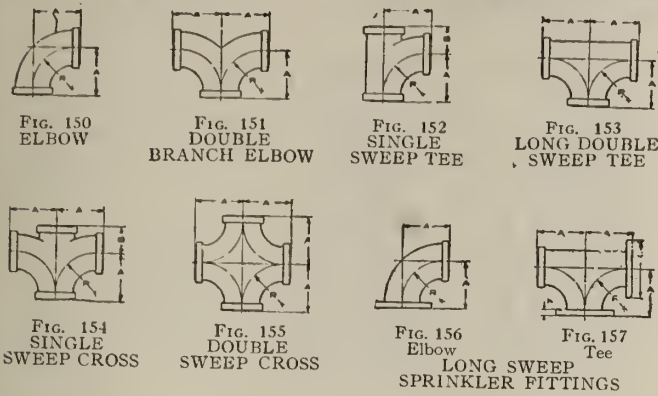


FIG. 217
FLANGED BASE ELBOWS



FIG. 219
REDUCING FLANGED TEE

Cast Iron Long Sweep Water and Sprinkler Fittings.



CAST IRON RECESSED DRAINAGE FITTINGS

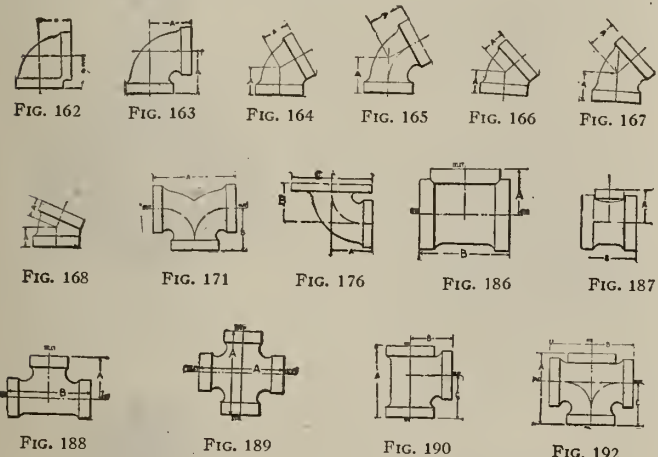
Fittings	dimension, in.	1 1/4	1 1/2	2	2 1/2	3	4	5	6	7	8	10
Fig. 162. 90° Short Turn Elbows.....	A	1 3/4	2 1/8	2 3/8	2 1/2	3 1/8	3 1/2	4 1/2	5 1/8	5 1/2	6 1/2	7 3/4
Fig. 163. 90° Long Turn Elbows.....	A	2 1/4	2 3/8	3 1/8	3 1/2	4 1/4	5 1/8	6 1/4	7 1/8	8 1/4	9	11
Fig. 164. 60° Short Turn Elbows.....	A	1 3/8	1 3/4	2	2 1/2	2 7/8	3 3/8	3 7/8	4 3/8	4 1/2	5 3/8	6 1/4
Fig. 165. 60° Long Turn Elbows.....	A	2	2 1/4	2 3/8	2 1/2	3 1/8	4					
Fig. 166. 45° Short Turn Elbows.....	A	1 3/8	1 7/8	1 3/4	2 1/8	2 3/8	2 3/4	3 3/8	3 3/2	3 7/8	4 3/8	4 7/8
Fig. 167. 45° Long Turn Elbows.....	A	1 3/4	1 7/8	2 1/4	2 3/8	2 7/8	3 1/8	4 1/8	4 3/4	5 1/2	6	7 1/2
Fig. 168. 22 1/2° Elbows	A	1 1/4	1 1/2	1 3/4	1 3/8	1 3/4	1 3/2	2 1/8	2 1/4	2 3/4	3 1/4	3 3/8
Fig. 169. 11 1/2° Elbows	A	1 1/4	1 1/2	1 3/4	1 3/8	1 3/4	1 3/2	2 1/8	2 1/4	2 3/4	3 1/4	3 3/8
Fig. 170. 5 1/2° Elbows	A	1 1/4	1 1/2	1 3/4	1 3/8	1 3/4	1 3/2	2 1/8	2 1/4	2 3/4	3 1/4	3 3/8
Fig. 171. Three-Way Elbow.....	A	4 1/2	5 1/4	6 1/4	7 3/8	8 3/8	10 3/8	12 3/4	14 3/4	16 3/4	20 3/4	2 3/4
Fig. 176. Closet Elbow.....	A	2 1/4	2 3/8	3 1/8	3 1/2	4 1/8	5 1/8	6 1/8	7 1/8	8 1/8	9 1/8	10 1/8
Fig. 186. Tee.....	A	1 3/4	2 1/8	2 3/8	2 1/2	3 1/8	3 1/2	4 1/8	5 1/8	5 1/2	6 1/2	7 3/4
Fig. 190. 90° Short Turn Y-Branch....	A	3 1/4	4 1/4	5 1/4	6 1/4	7 1/4	8 1/4	9 1/4	10 1/4	11 1/4	13 1/4	15 1/4
Fig. 192. Double 90° Short Turn Y-Branches.....	A	3 1/4	4 1/4	5 1/4	6 1/4	7 1/4	8 1/4	9 1/4	10 1/4	11 1/4	13 1/4	15 1/4
Fig. 194. 90° Long Turn Y-Branch....	A	3 1/4	4 1/4	5 1/4	6 1/4	7 1/4	8 1/4	9 1/4	10 1/4	11 1/4	13 1/4	15 1/4
Fig. 196. Double 90° Long Turn Y-Branches.....	A	3 1/4	4 1/4	5 1/4	6 1/4	7 1/4	8 1/4	9 1/4	10 1/4	11 1/4	13 1/4	15 1/4
Fig. 198. 45° Y-Branch.....	A	3 1/4	4 1/4	5 1/4	6 1/4	7 1/4	8 1/4	9 1/4	10 1/4	11 1/4	13 1/4	15 1/4
Fig. 200. 45° Double Y-Branches.....	A	3 1/4	4 1/4	5 1/4	6 1/4	7 1/4	8 1/4	9 1/4	10 1/4	11 1/4	13 1/4	15 1/4
Fig. 184. Roof Connection.....	A	1 1/4	1 1/2	1 3/4	1 3/8	1 3/4	1 3/2	2 1/8	2 1/4	2 3/4	3 1/4	3 3/8
Fig. 185. Tucker Connection.....	A	2 1/4	2 3/8	3 1/8	3 1/2	4 1/4	5 1/8	6 1/4	7 1/8	8 1/4	9	11
Fig. 209. 1/2" S Traps	A	2 1/4	2 3/8	3 1/8	3 1/2	4 1/4	5 1/8	6 1/4	7 1/8	8 1/4	9	11
Fig. 210. 3/4" S Traps	A	2 1/4	2 3/8	3 1/8	3 1/2	4 1/4	5 1/8	6 1/4	7 1/8	8 1/4	9	11
Fig. 211. Full S Traps	A	2 1/4	2 3/8	3 1/8	3 1/2	4 1/4	5 1/8	6 1/4	7 1/8	8 1/4	9	11
Fig. 212. Running Trap	A	2 1/4	2 3/8	3 1/8	3 1/2	4 1/4	5 1/8	6 1/4	7 1/8	8 1/4	9	11
Fig. 202. Upright Y-Branch.....	A	2 1/4	2 3/8	3 1/8	3 1/2	4 1/4	5 1/8	6 1/4	7 1/8	8 1/4	9	11

DIMENSIONS, CAST IRON LONG SWEEP WATER FITTINGS
For 150 lbs. water working pressure

Size, in.	A	B	R	Center to base, in. Tees and Ells	Diam. round or square base, in.	J	K	Diam. of bolt circle, in.	Number of bolts	Diam. of bolts, in.
1	2 1/2	1 3/8	1 7/8			4	1 1/2	3 3/8	4	7/8
1 1/4	3 1/2	1 1/2	2 1/8			4 1/2	1 1/2	3 3/8	4	7/8
1 1/2	3 3/2	1 1/2	2 1/8			5	1 1/2	3 3/8	4	7/8
2	4	2 3/8	3			6	1 1/2	4 3/4	4	7/8
2 1/2	4 3/4	2 1/4	3 1/8			7	1 1/2	5 1/2	4	7/8
3	5 1/2	2 3/8	4 1/8	5 3/4	5	7 1/2	1 3/4	6	4	7/8
3 1/2	6 1/4	3	5			8 1/2	1 3/4	7	4	7/8
4	7	3 1/2	5 1/8	6 1/2	6	9 1/2	1 3/4	7 1/2	4	7/8
4 1/2	7 3/4	3 3/8	6	6 3/4	6	10 1/2	1 3/4	8 1/2	4	7/8
5	8 1/2	3 3/4	7	7	7	11	1 3/4	9 1/2	4	7/8
6	9 1/2	4 1/4	8 1/8	7 1/2	7	12 1/2	1 3/4	10 1/2	4	7/8
7	10 1/2	5	9 1/8	8 1/4	8	13 1/2	1 3/4	11 1/2	4	7/8
8	11 1/4	5 1/2	10 1/4	8 3/4	9	14 1/2	1 3/4	12 1/2	4	7/8
9	12 1/4	6 1/8	11 1/4	9 1/2	9	15 1/2	1 3/4	13 1/2	4	7/8
10	13 1/4	6 3/4	12 1/4	10	10	16 1/2	1 3/4	14 1/2	4	7/8
12	15 1/4	7 3/4	14 1/4	10 1/2	11	18 1/2	1 3/4	16 1/2	4	7/8

Drainage Fittings.

These fittings are made with a shoulder, the same size inside diameter as the pipe. When the pipe is screwed up to the shoulder, the continuous passage thus formed leaves no opportunity for solid matter to collect and choke the pipe. A large stock enables prompt shipment.



CAST IRON RECESSED DRAINAGE FITTINGS

DIMENSIONS, REDUCING TEE (Fig. 187)

Size, in.	2x1 1/2	2 1/2x2	3x2	4x2	4x3	5x2	5x3
A	2 1/4	3	3 1/2	3 3/4	3 3/4	4 1/2	4 3/4
B	4 1/4	4 3/4	5 1/2	6	7	6	6 3/4

DIMENSIONS, BASIN TEES (Fig. 188)

Size, in.	1 1/4	1 1/2	1 1/2x1 1/4	2	2x1 1/4	2x1 1/2	2 1/2
A	2 3/4	2 1/4	2 1/4	3 1/2	3 1/4	3 1/4	4 1/4
B	4 3/4	5 3/8	5 3/8	7	6 1/4	6 1/2	8 1/2

DIMENSIONS, BASIN CROSSES (Fig. 189)

Size, in.	1 1/4	1 1/2	2	2x1 1/2
A	4 3/8	5 3/8	7	6 1/2

DIMENSIONS, INCREASERS (Fig. 183)

Size, in.	3x2	4x2	4x3	5x2	5x3	5x4	6x4	6x5	7x6	8x4	8x6	10x8
A	9	9	9	9	9	9	9	9	9	9	9	9

DIMENSIONS, OFFSETS (Fig. 208)

Size, in.	2	2	2	2	3	3	3	3	4	4	4	4
Offset B	4	6	8	10	4	6	8	10	4	6	8	10
Length A	7 1/2	9 1/2	11 1/2	13 1/2	8 3/4	10 3/4	12 3/4	14 3/4	9 3/4	11 3/4	13 3/4	15 3/4
Size, in.	4	4	5	5	5	5	6	6	6	6	6	6
Offset B	10	12	6	8	10	12	6	8	10	12	10	12
Length A	15 1/4	17 1/4	12 3/4	14 3/4	16 3/4	18 3/4	13 3/4	15 3/4	17 3/4	19 3/4	17 3/4	19 3/4

NELSON VALVE COMPANY

Manufacturers of Valves for Power Plant and General Industrial Service

CHESTNUT HILL, PHILADELPHIA, PA.

BRANCH OFFICES AND REPRESENTATIVES

NEW YORK, N. Y.
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BOSTON, MASS.
CLEVELAND, OHIO
SYRACUSE, N. Y.

NEW ORLEANS, LA.
WASHINGTON, D. C.
MONTREAL, CAN.

Products.

NELSON VALVES: Gate, Globe and Check in Bronze, Iron and Steel; Cushioned Non-return; Throttle; Large Gate, Electrically and Hydraulically Operated.

Scope.

These valves are made for standard, medium and extra heavy pressures, for saturated and superheated steam, water, air, oil and special service.

There is a Nelson valve for almost every purpose, ranging in sizes from $\frac{1}{4}$ in. to 42 in. The valves illustrated on these pages are a few representative types.

A catalogue of the complete Nelson line will be sent on request.

Nelson Quality.

An exceptionally high quality standard is maintained for Nelson valves. Materials are carefully selected, workmanship is of the skilled character produced by ideal shop conditions, and inspection and test are thorough.

As a result, 20 years' service of Nelson valves has firmly established them in the confidence and favor of engineers and valve users generally. Nelson valves are a *safe valve investment*.

Special Nelson Features.

Nelson valves are designed in accordance with the most advanced and approved engineering practice. They are of heavy construction, with metal distributed to give maximum strength and service. Their lines are carefully determined for clear openings and smooth flow. Each valve must stand test pressures two or three times its rated working pressure.

Nelson bronze valves have liberal weight of metal wherever strength is required. Screwed end valves have wide hexes and taper threads. All bronze valves

are fitted with the new Nelson non-heating hand wheel.

An important feature of Nelson gate valves is the double disk mechanism. This provides a simple flexible gate, insuring easy travel and perfect seating in spite of presence of dirt or possible distortion of valve body. The disks travel freely to their lowest point and then spread into position, eliminating scraping or scoring of seats.

Nelson Bronze Valves.

GATES—Nelson bronze gate valves include standard, medium and extra heavy patterns, screwed and flanged ends. They embody the Nelson double disk principle, insuring a tight valve under any line conditions.

Stems are tough manganese bronze, with generous acme threads. Medium and extra heavy valves are gland packed.

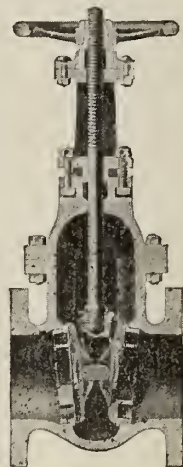
All valves have non-heating hand wheel.

In addition to regular inside screw valves, there are quick opening, rising stem and other patterns.

GLOBES—Nelson bronze globe and angle valves are made in both screwed and union bonnet patterns, screwed and flanged ends. They may be fitted with regrinding or *Nelsonite* renewable fiber disks, or copper disks, all interchangeable on the same stem. They have tapered seats to prevent scoring. Stems are tough manganese bronze.

All valves have non-heating hand wheel.

CHECKS—Nelson bronze check valves include standard swing checks with regrinding or leather disks; extra heavy regrinding swing checks; horizontal globe and angle type cup checks and vertical check valves.



Section
Disks travel freely, steadied by guides, and enter and leave seats without scraping or chattering. Stem makes a "pack" when open" joint when up

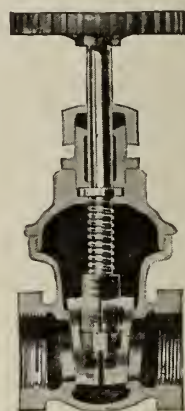


Parts
Only 3 parts—2 disks and 1 central wedge. Disks rock into position on the seats automatically, insuring perfect closing

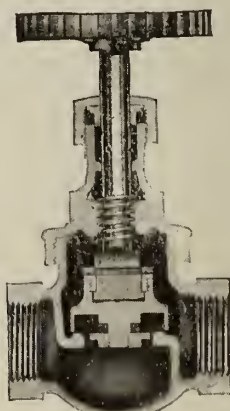


Disk Ring
Disk ring rolled into disk under hydraulic pressure, forming tongue and groove joint which can not be loosened

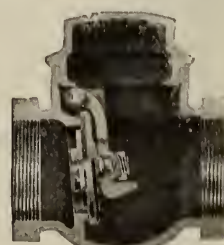
SPECIAL FEATURES OF NELSON VALVES



No. 101
STANDARD BRONZE GATE VALVE
Inside screw, screwed ends



No. 3
MEDIUM BRONZE GLOBE VALVE
Screwed ends, regrinding or hard rubber disk



No. 85
STANDARD BRONZE SWING CHECK VALVE, LEATHER DISK
Screwed ends, regrinding or leather disk

Nelson Iron Body Valves.

GATES—The Nelson iron gate line offers a valve for practically every condition. There are standard, medium and extra heavy patterns, with inside screw and outside screw and yoke types in each weight, and with screwed and flanged ends. Large, medium and extra heavy valves are also furnished with by-passes.

In addition to these regular types, there are quick opening types, hub end valves; compound thread; motor operated and hydraulically operated gates.

Nelson gate valves are mounted with screwed-in bronze seat rings and rolled-in bronze rings on the disks. The double disk and wedge construction insures positive closing and long satisfactory service. Medium and extra heavy valves have raised faces on end flanges.

Nelson gate valves may be ordered all-iron trimmed for acid and similar service.

GLOBES—Nelson iron globe and angle valves include standard, medium and extra heavy patterns.

The standard valves may be fitted with either regrinding or *Nelsonite* renewable fiber disks, interchangeable on the same stem. The bonnets have through bolts.

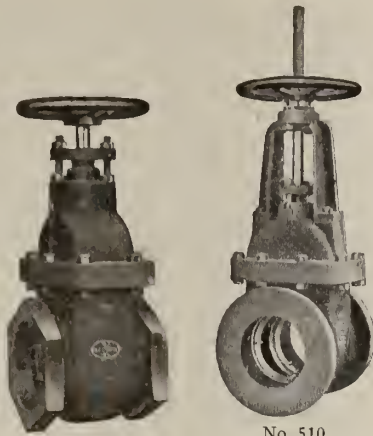
Cushioned non-return stop and check valves in globe and angle types are also included among Nelson iron body valves.

Extra heavy Nelson globe valves are made with either cast yoke or Navy type yoke.

CHECKS—Nelson iron body check valves include swing checks in standard and extra heavy pressures, and extra heavy globe and angle cushioned check valves.

The standard swing check valve may be equipped with a leather disk or bronze regrinding disk.

NELSON-ERWOOD—The Nelson-Erwood valve is a combina-



No. 501
STANDARD
IRON BODY GATE
VALVE

Inside screw, bronze
mounted, screwed
ends

No. 510
STANDARD
IRON BODY
GATE VALVE

Outside screw
and yoke, bronze
mounted, flanged
ends



No. 530
EXTRA HEAVY IRON
BODY GATE VALVE

Outside screw and yoke,
bronze mounted, flanged ends



No. 602
STANDARD IRON
BODY GLOBE VALVE

Bronze mounted,
flanged ends



No. 704
STANDARD IRON
BODY SWING CHECK
VALVE

Bronze mounted,
flanged ends

tion swing check and gate valve. The swing check disk is contained within the gate and is adjustable for the desired back pressure. They have numerous applications on exhaust and discharge lines.

Nelson Steel Valves.

GATES—Nelson steel gate valves represent the highest standard in steel valve construction. Close grained annealed castings of exceptionally heavy section are used in their manufacture and the trimmings are of monel metal throughout, adapting them to pressures of 350 lbs. and temperatures of 800°. Various specifications are supplied for different temperatures and working conditions.

They have extra high bonnet and stuffing box, with a long condensing chamber and test cock for packing under pressure. Swing bolts are used on the stuffing box. Cork grips are provided on the hand wheel. Motor operation is frequently furnished on the larger sizes.

GLOBES—Nelson steel globe and angle valves have the same quality and service features as the steel gates. They are distinctly high grade engineering products in the detail of design and in care of manufacture.

They are of heavy construction, monel mounted for superheated steam or composition mounted for other conditions. They are built with either cast yokes or Navy type yokes. Various specifications are supplied for different temperatures and working conditions.

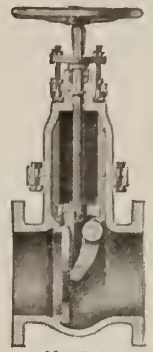
NON-RETURNS—Nelson steel cushioned non-return stop and check valves are similar in construction and types to the steel globes.

They are monel mounted for superheated steam or composition mounted for other conditions. Various specifications are supplied for different temperatures and working conditions.

Success of Nelson Valves.

Nelson valves are giving successful service in the best known power plants throughout the country, and are specified by leading engineers. They are a safe investment where first quality work is desired.

Reference book of Nelson valves giving details, specifications and dimensions will be mailed on request.



No. 708
NELSON-ERWOOD
SWING GATE VALVE

Iron body, bronze
mounted, flanged ends



No. 1554
EXTRA HEAVY CAST
STEEL GLOBE VALVE

With by-pass, outside
screw and yoke, monel
mounted



No. 1300
EXTRA HEAVY
CAST STEEL GLOBE
VALVE

Monel or composition
mounted



No. 1370
EXTRA HEAVY CAST
STEEL NON-RETURN
STOP AND CHECK
VALVE

Monel or composition
mounted

PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.

26th Street and Allegheny Valley R. R.

P. O. Box 1016

PITTSBURGH, PA.

BRANCH OFFICES

NEW YORK, N. Y., 30 Church Street
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DENVER, COLO., MOUNTAIN STATES MACHINERY Co.

TORONTO, CANADA, M. A. CAMPBELL, 32 Albany Street

SAN FRANCISCO, CAL., E. A. KEITHLEY, Rialto Building
DETROIT, MICH., DETROIT POWER PIPING Co., 82 Griswold
Street

Products.

VALVES: Accumulator, Aiken Hydraulic Operating, Aiken Stop, Atmospheric Relief, Back Pressure, Blow-off, Butterfly, Check, Chronometer, Crichtlow Hydraulic Operating, Exhaust Relief, Float, Foot, Gate, Globe, Angle and Cross, Hydraulic, Non-return, Plug, Register, Relief, Shock, Stuart Hydraulic Operating, Tanner Hydraulic Operating, Throttle, and Transfer, for high and low pressures, in all sizes, for all services.

VALVE FITTINGS and APPLIANCES.

Specialists in HYDRAULIC PIPING and OPERATING VALVES, and in PIPING SYSTEMS for high pressure superheated steam. PIPE, PIPE BENDS, PIPE FITTINGS and PIPING SUPPLIES.

STEAM SEPARATORS.

Also, Expansion Joints, Swivel Joints, Exhaust Heads, Cocks and Drip Pockets.

Services.

Complete piping contracts executed, designed by experienced engineers, manufactured by skilled workmen under competent supervision, and erected by expert fitters.

The engineering department makes a specialty of unusual conditions, and is prepared to design or estimate



TRADE-MARK

any piping layout or special valves upon receipt of specifications.

Engineers are invited to submit their piping and valve problems, and a satisfactory solution is assured.

Standard Specifications.

Our standard specifications have been adopted by the leading high pressure concerns in the United States, a copy of which will be furnished on request.

Guarantee.

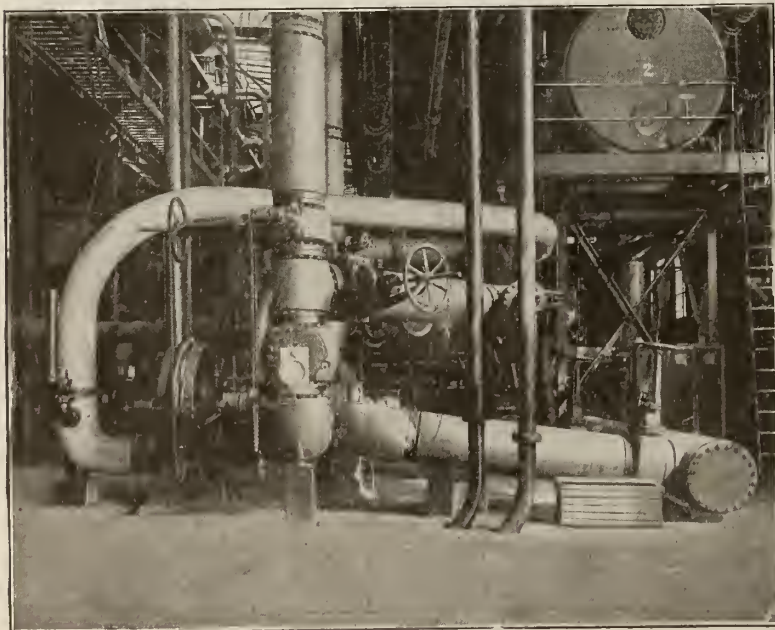
Our trade-mark is on all goods made by us, and we believe in maintaining its reputation. We fully guarantee our goods for the service sold.

Carefully conducted destruction tests of valves and fittings up to 36 in. have been made, and the data secured is an invaluable aid in making new designs.

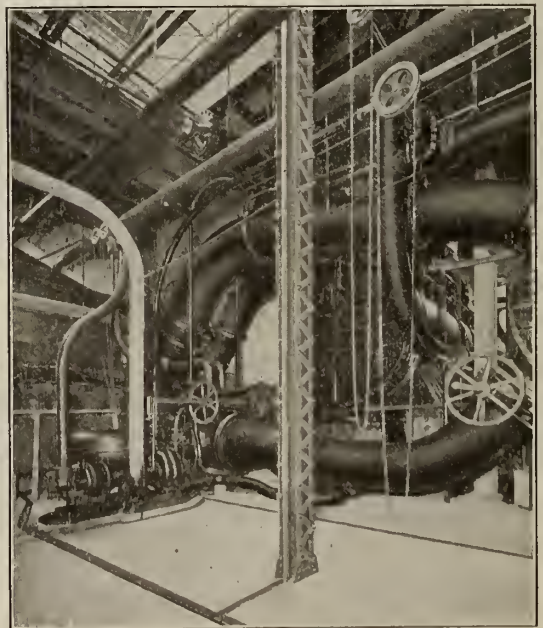
Gate Valves.

Made in parallel and taper seat types. For exhaust, water, air and gas, the parallel seat type is recommended; while for medium and high pressure steam and hydraulic service, the taper seat type is recommended.

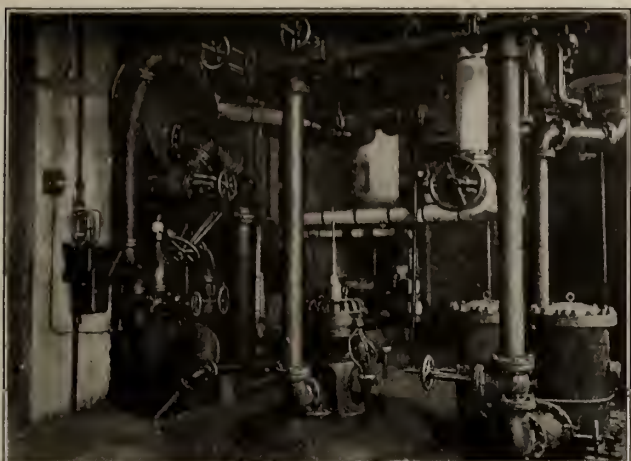
All types and sizes made either outside screw and yoke, or inside screw. Patterns are so arranged that valves can be made all iron or with bronze, monel or special mountings.



MISCELLANEOUS PIPING



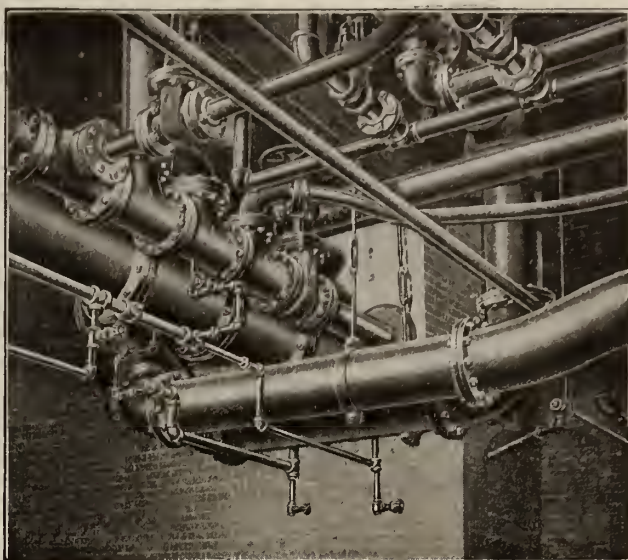
CONDENSER PIPING



MISCELLANEOUS PIPING AT CLEVELAND POWER PLANT OF PENNSYLVANIA LINES WEST OF PITTSBURGH

MOTOR OPERATED GATE VALVES—We have applied motor drives to gates for various classes of work, using either direct or alternating current. Gearing for our motor operated gate valve is designed to meet the requirements of strength and compactness. All gear teeth are cut. Motors fitted with metaline bearings which require no oiling or other attention.

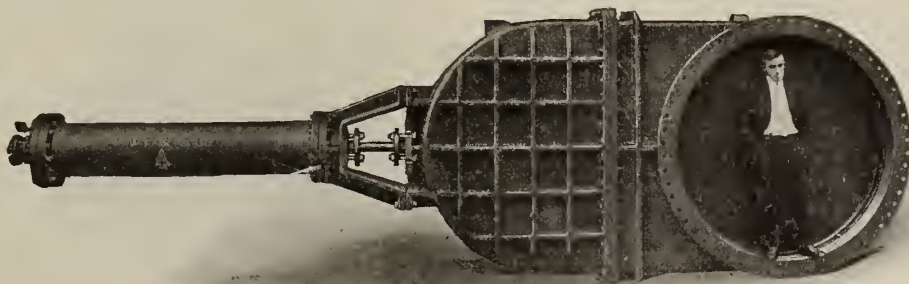
Unless otherwise specified, Stuart limit controller is used exclusively for this service, consisting of two automatic circuit breakers, mechanically operated, and incased in a box mounted on the gate yoke and out of reach of the operator, thus making it impossible for him to interfere with their proper functioning.



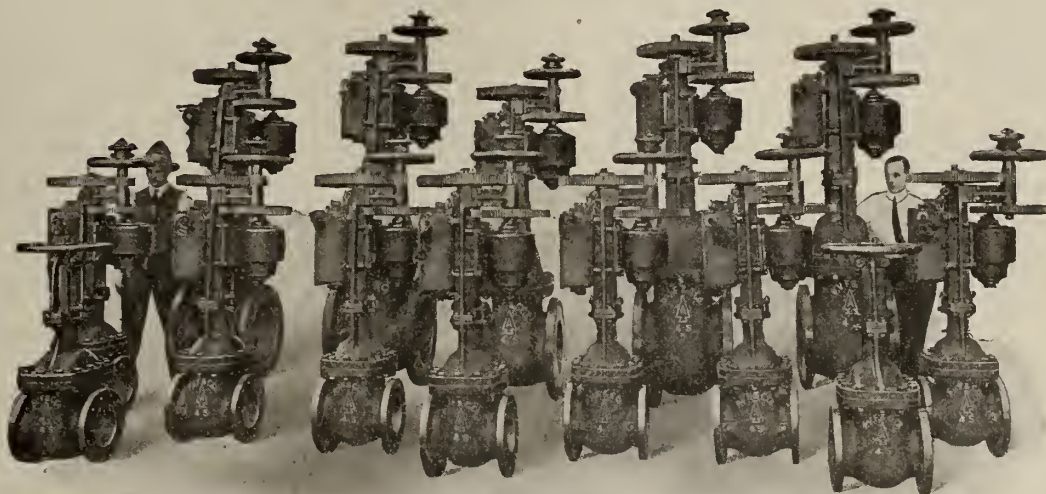
MISCELLANEOUS PIPING IN BRIDGEPORT PLANT OF REMINGTON ARMS AND AMMUNITION CO.
STONE & WEBSTER ENGINEERING CORP., Engineers

Underwriters' specifications have been met in all our designs.

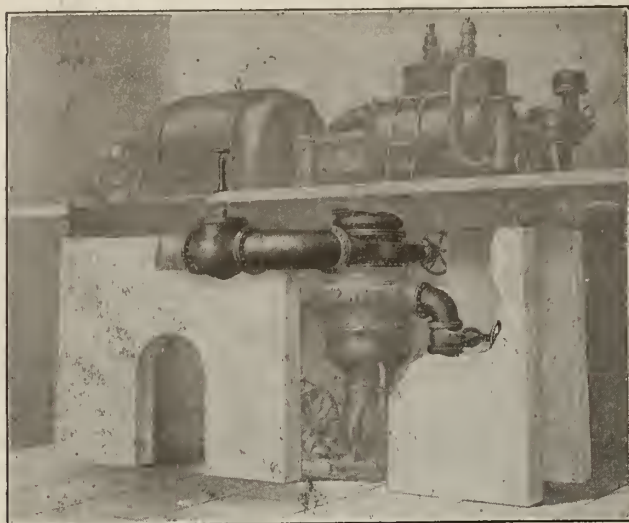
CYLINDER OPERATED GATE VALVES—Built for any pressure or service. Motive fluid may be water, air or steam. If the fluid is gaseous, as steam or air, placing the cylinder in a horizontal position is recommended. If, however, a vertical position can not be avoided, special attachments to meet conditions will be furnished.



72-INCH CYLINDER OPERATED GATE VALVE



GROUP OF MOTOR OPERATED CAST STEEL VALVES—PART OF AN ORDER FROM THE PUBLIC SERVICE ELECTRIC COMPANY OF NEW JERSEY



ATMOSPHERIC OUTLET GATE VALVE

Valve serves the purpose of a gate valve and a tee. Arrangement reduces depth of basement required for installation of condenser. Valve is of single disc and single seat type. Disc held against seat when valve is closed. Furnished either inside screw or outside screw and yoke. May be equipped with either bevel, spur or special gearing

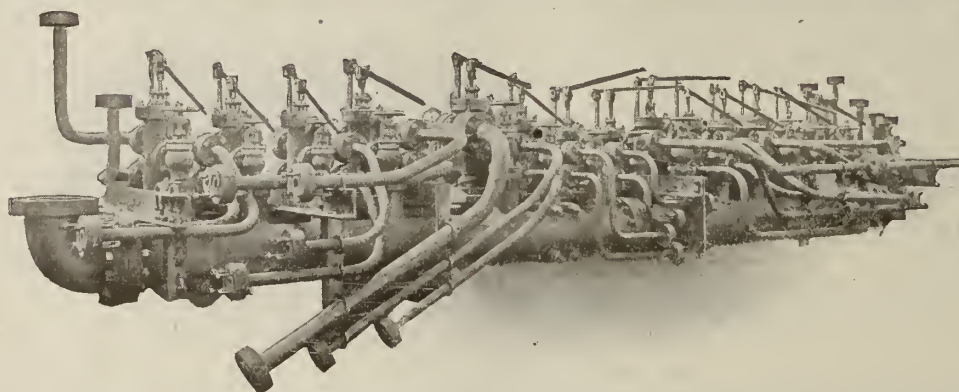


PIPE BEND

Contains 53 ft. of 14-in. pipe. The three lengths were connected by the Atwood line weld. On account of its size, it could not be shipped by rail. A river barge was used to deliver it to the Alliquippi plant of the Jones & Laughlin Steel Co.



Rear View



Front View

HYDRAULIC MANIFOLD FOR JONES & LAUGHLIN STEEL CO., BESSEMER DEPARTMENT

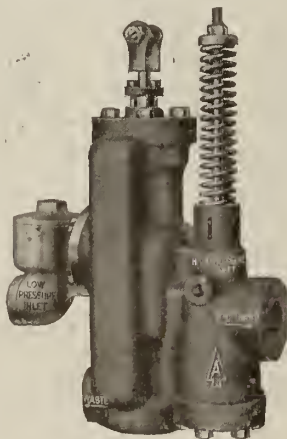
Fitted up complete in our shop and shipped as shown

Stuart Two-pressure Operating Valves.

Used extensively by the largest rubber manufacturers for operating heaters and presses with high and low pressure water.

Supply of high pressure water is controlled automatically, and can not be turned on at the wrong time, nor can either the high or low pressure be turned into the waste.

Operation is very simple. Moving lever up or down will raise or lower the press, using low pressure water only. When moulds come against the



STUART TWO-PRESSURE OPERATING VALVE

3/4-in. high pressure; 2-in. low pressure; 2 1/2 in. to cylinder; 2 1/2-in. waste. Lever furnished if so ordered

head of heater, or top of press, high pressure water is automatically turned on to squeeze moulds and low pressure is automatically cut off. After curing process is complete, lever is pulled as far as possible, which shuts off high pressure water and waste water in press.

This valve saves high pressure water; increases output; is foolproof; saves money and annoyance.

Steam Separators.

In these separators, every condition for good separation is met.

The standard horizontal, vertical and angle separators are made with cast iron bodies and wells.

Receiver type separators are made of semisteel bodies and wrought steel wells. They are constructed upon the same general principles as the smaller separators.

The welded receiver type separators have necks welded in by the "interlock" method. This type is guaranteed to be absolutely tight and has proved its reliability under the most severe service.

PRATT & CADY COMPANY INCORPORATED

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Products.

ANGLE, GLOBE, CHECK, GATE, BLOW-OFF and RADIATOR VALVES, in Bronze, Iron and Steel; ASBESTOS PACKED COCKS, in Bronze and Iron.

Stop and Check Valves, Electrically and Hydraulically Operated Gate Valves, Return Steam Traps, Indicator Posts, Floor Stands, Valve Boxes.

For Water Heaters and Pumps, see page 792.

Bronze Renewable Disc Valves.

Equipped with asbestos, bronze or special metal discs that are quickly removable and replaceable.



FIG. 1. Globe Valve, Screwed, Asbestos Disc



FIG. 8. Angle, with Union for Radiator



FIG. 31. Extra Heavy Globe Valve, Brass Disc

BRONZE GLOBE AND ANGLE RENEWABLE DISC VALVES

FIG. 1. ASB. DISC, GLOBE, SCRD. FIG. 3. ASB. DISC, ANGLE, SCRD.
FIG. 2. ASB. DISC, GLOBE, FLGD. FIG. 4. ASB. DISC, ANGLE, FLGD.

For 150 lbs. working steam pressure

Size, in.	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
End to end, globe, scrd.	1 1/2	1 1/2	2	2 1/2	3 1/4	3 1/4	4 1/4	4 1/4	5 1/4	6 1/4	7 1/4
Face to face, globe, flgd.	1 1/2	1 1/2	2	2 1/2	3 1/4	3 1/4	4 1/4	4 1/4	5 1/4	6 1/4	7 1/4
Center to end, angle, scrd.	3/4	1	1 1/8	1 1/8	1 1/8	1 1/8	2 1/8	2 1/8	3 1/8	3 1/8	4 1/8
Center to face, angle, flgd.	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	2 3/8	2 3/8	3 3/8	3 3/8	4 3/8
Diam. of flanges.	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	2 1/8	2 1/8	3 1/8	3 1/8	4 1/8

FIG. 5. ASB. DISC, RADIATOR GLOBE, NO UNION. FIG. 7. ASB. DISC, UNION, RADIATOR GLOBE.
FIG. 6. ASB. DISC, RADIATOR ANGLE, NO UNION. FIG. 8. ASB. DISC, UNION, RADIATOR ANGLE.

Size, in.	1/2	3/4	1	1 1/4	1 1/2	2
End to end, globe, no union.	2 1/2	3 1/4	3 1/4	4 1/4	4 1/4	5 1/4
Center to end, angle, no union.	1 1/8	1 1/8	1 1/8	2 1/8	2 1/8	3 1/8
End to end, globe, inc. union nipple.	4 1/4	4 1/4	5 1/4	6 1/4	6 1/4	8 1/4
Center to inlet, angle.	1 3/8	1 3/8	1 3/8	2 3/8	2 3/8	3 3/8
Center to end of union nipple.	2 3/8	2 3/8	3 3/8	3 3/8	4 3/8	4 3/8

FIG. 31. EX. Hvy. GLOBE, SCRD., BRONZE DISC. FIG. 33. EX. Hvy. ANGLE, SCRD., BRONZE DISC.
FIG. 32. EX. Hvy. GLOBE, FLGD., BRONZE DISC. FIG. 34. EX. Hvy. ANGLE, FLGD., BRONZE DISC.

For 250 lbs. working steam pressure

Size, in.	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
End to end, globe, scrd.	3 1/4	3 1/4	3 1/4	3 1/4	4 1/4	4 1/4	5 1/4	6 1/4	7 1/4	8 1/4
Face to face, globe, flgd.	3 1/4	3 1/4	3 1/4	3 1/4	4 1/4	4 1/4	5 1/4	6 1/4	7 1/4	8 1/4
Center to end, angle, scrd.	1 3/8	1 3/8	1 3/8	1 3/8	2 3/8	2 3/8	3 3/8	4 3/8	4 3/8	5 3/8
Center to face, angle, flgd.	2 3/8	2 3/8	2 3/8	2 3/8	3 3/8	3 3/8	4 3/8	5 3/8	5 3/8	6 3/8
Diam. of flanges.	1 1/8	1 1/8	1 1/8	1 1/8	2 1/8	2 1/8	3 1/8	4 1/8	4 1/8	5 1/8

Union Bonnet Valves.

Complete line of Union bonnet valves for 200 and 300 lbs. working steam pressure.

Body of highest grade bronze, designed with long, easy curves.

Stem of cast manganese bronze, having tensile strength of mild steel.

Disc is of swivel regrinding type and is removable and replaceable.



Union Bonnet Screw End Globe Valve 200 lbs. pressure



Union Bonnet Angle Valve 200 lbs. pressure



Union Bonnet Angle Valve 300 lbs. pressure



Union Bonnet Screw End Globe Valve 300 lbs. pressure

UNION BONNET GLOBE AND ANGLE VALVES

FIG. 9. 200-lb. GLOBE SCRD. FIG. 27. 300-lb. GLOBE SCRD.
FIG. 10. 200-lb. GLOBE FLGD. FIG. 28. 300-lb. GLOBE FLGD.
FIG. 11. 200-lb. ANGLE SCRD. FIG. 29. 300-lb. ANGLE SCRD.
FIG. 12. 200-lb. ANGLE FLGD. FIG. 30. 300-lb. ANGLE FLGD.

For 200 lbs. working steam pressure

Size, in.	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2
End to end, globe.	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	3 1/8	3 1/8	4 1/8	5 1/8
Center to end, angle.	1	1	1	1 1/8	1 1/8	1 1/8	2 1/8	2 1/8	3 1/8

For 300 lbs. working steam pressure

Size, in.	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2
End to end, globe.	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	3 1/8	3 1/8	4 1/8	5 1/8
Center to end, angle.	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	1 3/8	2 3/8	2 3/8	3 3/8

Iron Body Renewable Disc Valves.

Regular weight, Figs. 38 to 45, are equipped with iron discs, into which asbestos rings are inserted to serve as the faces. The extra heavy pattern valves, Figs. 50 to 53, have iron discs with copper rings to form the faces.

In all these valves the bronze seat rings, as well as the discs, are renewable.



FIG. 40. GLOBE SCREWED, WITH YOKE

IRON BODY GLOBE AND ANGLE VALVES

- FIG. 40. ASB. DISC, YOKED, GLOBE, SCRD.
- FIG. 44. ASB. DISC, YOKED, ANGLE SCRD.
- FIG. 41. ASB. DISC, YOKED, GLOBE, FLGD.
- FIG. 45. ASB. DISC, YOKED, ANGLE FLGD.

These four styles made in all sizes from 2 to 8 in., inclusive

For 150 lbs. working steam pressure

Size, in.....	1½	2	2½	3	3½	4	4½	5	6	7	8
End to end, globe, scrd....	5	6	7½	8½	9½	10½	10¾	11¼	13¾	14½	16¼
Face to face, globe, flgd....	5¼	6½	8	8½	10½	10¾	11¾	12	15½	15¾	17
Center to end, angle, scrd....	2½	3	4¼	4½	4¾	5¼	5¾	5¾	7	7¼	8½
Center to face, angle, flgd....	2¾	4½	4¾	4¾	5½	5½	6¼	7¾	7¾	8½	8½
Diam. of flanges....	5	6	7	7½	8½	9	9¾	10	11	12½	13½

Iron Body Globe and Angle Valves.

Yoke and bonnet is of one-piece type. Deep stuffing box. Stem, sizes 2 in. to 6 in., made of cast manganese bronze; in sizes 7 in. and larger, of cold rolled steel. Sizes 2 in. to 5 in. have solid bronze disc; sizes 6 in. and larger have cast iron disc with rolled-in-bronze ring. Solid bronze disc nut in all sizes. Seat ring is made of bronze and screwed into body; can be renewed whenever necessary.

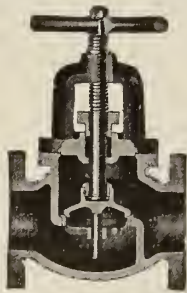


FIG. 47. Globe Flanged



FIG. 49. Angle Flanged

IRON BODY GLOBE AND ANGLE VALVES

- FIG. 46. GLOBE SCRD.
- FIG. 48. ANGLE SCRD.
- FIG. 47. GLOBE FLGD.
- FIG. 49. ANGLE FLGD.

Size, in.	2	2½	3	3½	4	4½	5	6	7	8
Diam. of wheel.....	6	7	8	8	9	11	11	12	14	16
Face to face.....	8	8½	9½	10½	11½	12	13	14	16	17
Diam. of flanges.....	6	7	7½	8½	9	9¼	10	11	12½	13½
Thickness of flanges.....	5/8	11/8	3/4	13/8	13/8	13/8	13/8	1	1 1/8	1 1/2
Center to top of stem, open-globe.....	10¾	11½	12¾	13¾	15¾	16¾	16¾	18¾	20	22
Center to top of stem, open-angle.....	9¾	10¾	11¾	12¾	14¾	14¾	15¾	16¾	18	19
Center to end, scrd.....	3¼	3½	4	4½	5	5¼	5¾	6½	7¼	8
Center to face, flgd.....	4	4¼	4¾	5¼	5¾	6	6½	7	8	8½
End to end, scrd.....	6½	7	8	9	10	10½	11¼	13	14½	16



FIG. 51. EXTRA HEAVY FLANGED GLOBE

EXTRA HEAVY GLOBE AND ANGLE VALVES

- FIG. 50. EX. HVY., COPPER DISC, YOKED, GLOBE, SCRD.
- FIG. 52. EX. HVY., COPPER DISC, YOKED, ANGLE, SCRD.
- FIG. 51. EX. HVY., COPPER DISC, YOKED, GLOBE, FLGD.
- FIG. 53. EX. HVY., COPPER DISC, YOKED, ANGLE, FLGD.

Extra heavy valves suitable for 250 lbs. working steam pressure

Size, in.....	2	2½	3	3½	4	5	6	7	8
End to end, globe, scrd.....	7	8	9½	10	11	13¾	15¼	15½	16¼
Face to face, globe, flgd.....	9	10	10¾	11¾	12½	14¼	15½	17½	18
Center to end, angle, scrd.....	3½	4¼	4¾	5½	5¾	6¾	7¾	7¾	8½
Center to face, angle, flgd.....	4½	4¾	5 1/8	5¾	6	7	7¾	8¾	9¼
Diam. of flanges.....	6½	7½	8¾	9	10	11	12½	14	15

Bronze Renewable Seat Gate Valves.

In these valves the seats are separate rings, made of asbestos, bronze or special metal. These seat rings are held in the body of the valve by retaining rings that screw into the body. This construction makes it simple to renew the seat rings, when they become worn or scored, *without having to remove the valve from the pipe line.*



FIG. 101. Screwed 150 lbs. pressure



FIG. 114. Screwed Rising Spindle 150 lbs. pressure



Showing renewable ring feature

BRONZE GATE VALVES, WITH RENEWABLE SEAT RINGS

- FIG. 101. INSIDE SCREW, SCRD.
- FIG. 114. RISING SPINDLE, SCRD.
- FIG. 102. INSIDE SCREW, FLGD.
- FIG. 115. RISING SPINDLE, FLGD.
- Made in sizes ¼ to 4 in. inclusive
- Made in sizes ½ to 2 in.
- FIG. 112. QUICK OPENING WITH SLIDING STEM AND LEVER, SCRD.
- FIG. 113. QUICK OPENING WITH SLIDING STEM AND LEVER, FLGD.

All for 150 lbs. working steam pressure

Size, in	¼	¾	½	¾	1	1¼	1½	2	2½	3	3½	4
End to end, scrd....	2½	2½	2½	2¾	3 5/8	3¾	4¼	4¾	5¾	6¾	6¾	7¼
Face to face, flgd....	3	3	3	3 3/8	3 11/8	4 3/8	4¾	5 5/8	6½	7	8	8½
Diam. of flanges....	3	3	3	3½	4	4½	5	6	7	7½	8½	9

- FIG. 118. EX. HVY., INSIDE SCREW, SCRD.
- FIG. 118A. EX. HVY., RISING SPINDLE, SCRD.
- FIG. 119. EX. HVY., INSIDE SCREW, FLGD.
- FIG. 118B. EX. HVY., RISING SPINDLE, FLGD.
- Made in sizes ½ to 3 in.
- Made in sizes ½ to 2 in.

All for 250 lbs. working steam pressure

Size, in.....	½	¾	1	1¼	1½	2	2½	3
End to end, scrd.....	2¾	3	3½	4	4¾	5¼	6	6½
Face to face, flgd.....	4½	4½	5¼	5¼	5¾	7¼	7½	8
Diam. of flanges.....	4½	5	5	5	6	6½	7½	8¼

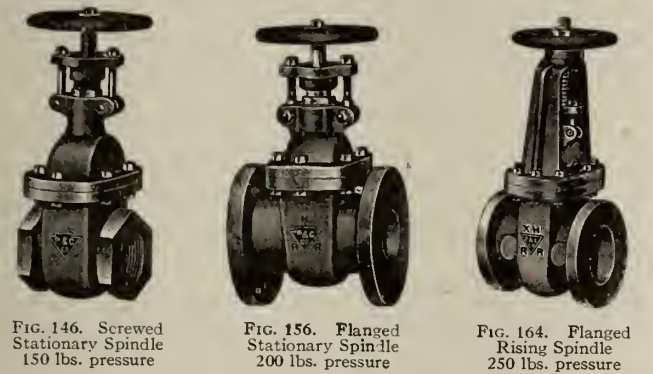
DIMENSIONS, BRONZE GATE VALVES, WITH RENEWABLE SEAT RINGS (Continued)

FIG. 120. HYDRAULIC, INSIDE SCREW, SCRD. FIG. 121. HYDRAULIC, INSIDE SCREW, FLGD.

For 800 lbs. working water pressure						
Size, in.....	1/2	3/4	1	1 1/4	1 1/2	2
End to end, scrd.....	3 3/8	3 3/4	4 1/2	4 1/4	5	6
Face to face, flgd.....	3 3/4	4 1/8	5	5 1/2	6	7 1/2
Diam. of flanges.....	3 3/8	3 3/4	4 1/2	5	6	6 1/2

Iron Body Renewable Seat Gate Valves.

The method of holding the seat rings in place is identical with that employed in the bronze valves.



IRON BODY GATE VALVES

DIMENSIONS, IRON BODY GATE VALVES						
FIG. 146. INSIDE SCREW, SCRD.	FIG. 147. INSIDE SCREW, FLGD.	FIG. 148. OUTSIDE SCREW, SCRD.	FIG. 149. OUTSIDE SCREW, FLGD.	FIG. 152. QUICK OPENING, WITH SLIDING STEM AND LEVER, SCRD.	FIG. 153. QUICK OPENING, WITH SLIDING STEM AND LEVER, FLGD.	
Made in sizes 2 to 12 in.	Made in sizes 2 to 16 in.	Made in sizes 2 to 12 in.	Made in sizes 2 to 16 in.	Made in sizes 2 to 12 in.	Made in sizes 2 to 12 in.	
All for 150 lbs. working steam pressure						
Size, in.....	2	2 1/2	3	3 1/2	4	4 1/2
End to end, scrd.....	5	6	6 1/2	7	7 1/2	8
Face to face, flgd.....	6 1/2	7 1/2	8 1/4	9	9 1/2	10
Diam. of flgs.....	6	7	7 1/2	8 1/4	9	9 1/2
Size of by-pass.....						

FIG. 155. HEAVY, INSIDE SCREW, SCRD.						
FIG. 156. HEAVY, INSIDE SCREW, FLGD.						
FIG. 157. HEAVY, OUTSIDE SCREW, SCRD.						
FIG. 158. HEAVY, OUTSIDE SCREW, FLGD.						
Made in sizes 2 to 12 in. with or without by-pass						
Made in sizes 2 to 16 in. with or without by-pass						
All for 200 lbs. working steam pressure						
Size, in.....	2	2 1/2	3	3 1/2	4	4 1/2
End to end, scrd.....	6 1/2	7 1/2	8 1/4	9	9 1/2	10
Face to face, flgd.....	7 1/2	8 1/4	9	10	10 1/2	11
Diam. of flgs.....	6 1/2	7 1/2	8 1/4	9	10	10 1/2
Size of by-pass.....						

FIG. 161. EX. HVY., INSIDE SCREW, SCRD.						
FIG. 162. EX. HVY., INSIDE SCREW, FLGD.						
FIG. 163. EX. HVY., OUTSIDE SCREW, SCRD.						
FIG. 164. EX. HVY., OUTSIDE SCREW, FLGD.						
Made in sizes 2 to 12 in. with or without by-pass						
Made in sizes 2 to 24 in. Both made with or without by-pass.						
All for 250 lbs. working steam pressure						
Size, in.....	2	2 1/2	3	3 1/2	4	4 1/2
End to end, scrd.....	6 1/2	7 1/2	8 1/4	9	9 1/2	10
Face to face, flgd.....	7 1/2	8 1/4	9	10	10 1/2	11
Diam. of flgs.....	6 1/2	7 1/2	8 1/4	9	10	10 1/2
Size of by-pass.....						

Cast Steel Gate Valves for High Pressure Superheated Steam.

Cast steel bodies, bonnets and yokes. Split pattern wedges.

Valves 6 in. and smaller have monel metal wedges; larger sizes have cast steel wedges with monel metal faces.

Seat rings are made of monel metal securely fastened so that they can not work loose, with rolled monel metal spindles, and monel metal spindle nuts.

End flanges have 1/8 in. smooth, tool finished raised faces extending the full width inside of the bolt holes. All bolt holes are spot faced.

Yokes are bolted to the bonnets. The bonnet joints are packed with superheated gaskets. To prevent the extreme heat from attacking the packing the bonnets are made with extra long necks.

The stuffing boxes are made with hinged bolts, very deep for asbestos packing.

This company also manufactures a full line of cast steel globe valves.



FIG. 144. Ex. Hvy., Outside Screw, Flanged, without By-pass

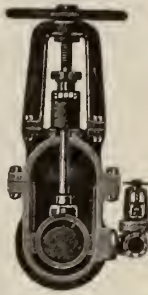


FIG. 145. Ex. Hvy., Outside Screw, Flanged, with By-pass

EXTRA HEAVY STEEL GATE VALVES FOR SUPERHEATED STEAM

For working steam pressures of 350 lbs. and a total temperature of 800° Fahr.

DIMENSIONS, CAST STEEL GATE VALVES

Size, in.....	2	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8	10	12	14	16	18
Face to face, flgd.....	8 1/2	9 1/2	11 1/8	11 7/8	12 13/16	13 1/4	15 15/16	16 3/4	16 1/2	18	19 3/4	22 1/2	24	26	28
Diam. of flgs.....	6 1/2	7 1/2	8 1/4	9	10 10 1/2	11 12 1/2	14	15	17 1/2	20 1/2	23	25 1/2	28		
Size of by-pass.....							1 1/4	1 1/4	1 1/2	1 1/2	2	2			3

Iron Body Water Gate Valves with Double Discs and Parallel Seats.

Valves of this design are operated easily, and there is absolutely no danger of the gates becoming wedged so as to prevent their operation.

As the gates are parallel there is an entire absence of friction while they are being forced against the seats in the body.

The stem nut, between the gates, and the stem are both made of solid bronze, preventing rust or corrosion.

One turn of the spindle acts directly on the gate, which has an inclined inner side, thereby releasing the wedge hooks in the locking mechanism and permitting the rocker gate to come away from its seat.



FIG. 187. IRON BODY WATER GATE VALVE
Inside Screw Hub Ends

DIMENSIONS, IRON BODY WATER GATE VALVES

FIG. 170. STATIONARY SPINDLE, SCRD.	FIG. 171. STATIONARY SPINDLE, FLGD.	FIG. 172. RISING SPINDLE, SCRD.	FIG. 173. RISING SPINDLE, FLGD.
Made in sizes 3 to 12 in.	Made in sizes 3 to 12 in.	Made in sizes 3 to 12 in.	Made in sizes 3 to 12 in.
FIG. 174. STATIONARY SPINDLE, HUB ENDS			
Made in sizes 3 to 48 in.			
Sizes 3 to 12 in. are suitable for working water pressures of 150 lbs.			
Sizes 14 to 48 in. are suitable for working water pressures of 125 lbs.			

Size, in.....	3	4	6	8	10	12	14	16
End to end, scrd.....	7	8	9	11	12 1/2	13 1/2	15	17
Face to face, flgd.....	8 1/2	9 1/2	11	12	12 1/2	13 1/2	15	17
Diam. of flanges.....	7 1/2	9	11	13 1/2	16	19	21	23 1/2
End to end hubs, no by-pass.....	9	10 1/4	12 1/2	13 3/4	14 1/2	15	15 1/4	16 1/4

Size, in.....	18	20	24	30	36	42	48
End to end, scrd.....	19	21	23	27	31	35	40
Face to face, flgd.....	25	27 1/2	32	38 3/4	46	53	59 1/2
Diam. of flanges.....	17 1/4	18 1/2	20 1/4	22	23 3/4	27 1/2	28 1/4
End to end hubs, no by-pass.....	17 1/4	18 1/2	20 1/4	22	23 3/4	27 1/2	28 1/4

DIMENSIONS, IRON BODY WATER GATE VALVE (Continued)
 FIG. 175. STATIONARY SPINDLE, SCRD. FIG. 176. STATIONARY SPINDLE, FLGD.
 FIG. 177. RISING SPINDLE, SCRD. FIG. 178. RISING SPINDLE, FLGD.
 FIG. 180. QUICK OPENING, SCRD. FIG. 181. QUICK OPENING, FLGD.
 FIG. 179. STATIONARY SPINDLE, HUB ENDS
 All styles made in sizes 2 to 12 in. for 125 lbs. working water pressures

Size, in.	2	2½	3	3½	4	4½	5	6	7	8	9	10	12
End to end, scrd.	4¾	5½	6	6½	7	7½	8¼	9	9½	10	10½	10¾	11½
Face to face, flgd.	6¼	7	7½	8	8¾	9	9¼	9½	10	10½	10¾	10¾	11
Diam. of flanges	6	7	7½	8½	9	9¼	10	11	12½	13½	15	16	19
End to end hubs	7¾	8¼	9	9¾	10½	10¾	11	11½	12	12½	13	13½	14

FIG. 182. STATIONARY SPINDLE, FLGD. FIG. 183. RISING SPINDLE, FLGD.
 FIG. 184. STATIONARY SPINDLE, HUB ENDS
 All made in sizes 14 to 48 in.
 Sizes 14 to 24 in. for working water pressures of 100 lbs.
 Sizes 26 to 48 in. for working water pressures of 75 lbs.

Size, in.	14	16	18	20	24	26	30	36	48
Face to face, flgd., no by-pass	12	13	14	15	17	18½	19½	25½	28½
Diam. of flanges	21	23½	25	27½	32	34½	38¾	46	59½
End to end hubs, no by-pass	13	14	14½	14¾	16	16¾	17¾	20½	22¾

FIG. 185. STATIONARY SPINDLE, FLGD. FIG. 186. RISING SPINDLE, FLGD.
 FIG. 187. STATIONARY SPINDLE, HUB ENDS
 All made in sizes 10 to 60 in.
 Sizes 10 and 12 in. for 75 lbs. working water pressure
 Sizes 14 to 24 in. for 50 lbs. working water pressure
 Sizes 30 to 60 in. for 35 lbs. working water pressure

Size, in.	10	12	14	16	18	20	22	24
Face to face, flgd.	10½	11	11½	12	12½	13	13¾	13½
Diam. of flanges	16	19	21	23½	25	27½	29½	32
End to end hubs	11½	12	12½	13½	13½	13¾	14	14½

Size, in.	30	32	36	42	48	54	60
Face to face, flgd.	15	15½	16	17½	18½	21	25
Diam. of flanges	38¾	41¾	46	53	59½	66¼	73
End to end hubs	15½	16	17	19	20	22	24

These valves are equipped, if so ordered, either with an electric motor or a hydraulic cylinder for ease of operation.

Bronze Swing Check Valves with Renewable, Rotating Bronze Discs and Regrindable Seats.

A valve of this type is easily reground. By removing the cap, inserting a screwdriver blade into the slot in the disc head, the disc may be rotated on the seat until the damaged surface of the seat is restored to perfect shape. Should the disc become badly worn, it is the work of an instant to substitute a new one by unscrewing the side plugs and removing the interior parts.



FIG. 201. Horizontal or Vertical Pattern, Screwed

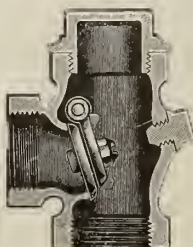


FIG. 203. Angle Pattern, Screwed

BRONZE SWING CHECK VALVES

DIMENSIONS, BRONZE SWING CHECK VALVES
 FIG. 201. HORIZONTAL OR VERTICAL PATTERN, SCRD. FIG. 203. ANGLE PATTERN, SCRD.
 FIG. 202. HORIZONTAL OR VERTICAL PATTERN, FLGD. FIG. 204. ANGLE PATTERN, FLGD.

For 150 lbs. working steam pressure

Size, in.	¼	¾	½	¾	1	1¼	1½	2	2½	3
End to end } horizontal or } scrd.	2½	2½	2½	2½	3½	3½	4½	5½	6½	7½
Face to face } vertical patt. } flgd.	5	5	5	5	5½	6½	6½	8½	8½	8½
Center to end } angle } scrd.	1½	1½	1½	1½	1½	2½	2½	3½	3½	3½
Center to face } patt. } flgd.	2	2½	2½	2½	3	3½	4½	4½	4½	4½
Diam. of flanges	3	3½	4	4½	5	6	7	7½	8	8½

FIG. 205. HORIZONTAL OR VERTICAL PATTERN, SCRD.
 WITH ROTATING ASBESTOS RING DISC

For 150 lbs. working steam pressure

Size, in.	½	¾	1	1¼	1½	2
End to end, horizontal or vertical patt., scrd.	2½	3¼	3¾	4¼	4¾	5½

DIMENSIONS, BRONZE SWING CHECK VALVES (Continued)

FIG. 212. EX. HVY., HORIZONTAL OR VERTICAL PATTERN, SCRD.

For 250 lbs. working steam pressure

Size, in.	¼	¾	½	¾	1	1¼	1½	2	2½	3
End to end, horizontal or vertical patt., scrd.	2½	2½	2½	3½	3½	4	4¾	5¾	7½	8¼

FIG. 217. HYDRAULIC, HORIZONTAL OR VERTICAL PATTERN, SCRD.

For 800 lbs. working water pressure

Size, in.	½	¾	1	1¼	1½	2
End to end, horizontal or vertical patt., scrd.	4	4¾	5½	6	6¾	7¼

FIG. 213. EX. HVY., HORIZONTAL OR VERTICAL PATTERN, SCRD. FIG. 215. EX. HVY., ANGLE PATTERN, SCRD.

FIG. 214. EX. HVY., HORIZONTAL OR VERTICAL PATTERN, FLGD. FIG. 216. EX. HVY., ANGLE PATTERN, FLGD.

These four styles have bolted caps

For 250 lbs. working steam pressure

Size, in.	2½	3	3½	4
End to end, scrd.	7¾	8	9¾	10
Face to face, flgd.	9½	10¼	12	12½
Center to end, scrd.	3¾	4	4¾	5
Center to face, flgd.	4½	4	4¾	5½
Diam. of flanges	7½	8¼	9	10

Iron Body Swing Check Valves, Underwriter's Pattern with Rotating Discs and Renewable Bronze Seats

Sizes 7-in. and smaller have solid bronze discs. The 8-in. to 24-in. sizes have iron discs with bronze faces. Made in the 30-in. and 36-in. sizes with multiple discs. Particulars on request.

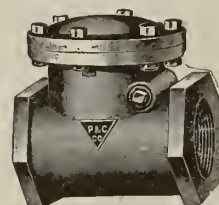


FIG. 219. HORIZONTAL OR VERTICAL PATTERN, SCREWED IRON BODY SWING CHECK VALVE

FIG. 219. HORIZONTAL OR VERTICAL PATTERN, SCRD. FIG. 220. HORIZONTAL OR VERTICAL PATTERN, FLGD.

Made in sizes 2 to 12 in.

Made in sizes 2 to 36 in.

FIG. 223. HORIZONTAL PATTERN, HUB ENDS

Made in sizes 2 to 36 in.

All for 150 lbs. working water pressure or 125 lbs. working steam pressure

Size, in.	2	2½	3	3½	4	5	6	7
End to end } horizontal or } scrd.	5¾	7¾	8	9¾	10	12	13½	15
Face to face } vertical patt. } flgd.	8¾	9½	10¼	12	12½	13½	15	16½
End to end of hubs, horizontal patt.	9¾	12½	16¼	17¼	19	20½	21½	22½
Diam. of flanges	6	7	7½	8½	9	10	11	12½

Size, in.	8	10	12	14	16	18	20	24
End to end } horizontal or } scrd.	16½	18¾	21½	25	27½	30½	32½	38
Face to face } vertical patt. } flgd.	18	21¾	23½	26¾	29	31¼	34¼	41
End to end of hubs, horizontal patt.	21½	24¾	26¾	29	31¼	34¼	41	48
Diam. of flanges	13½	16	19	21	23½	25	27½	32

FIG. 226. EX. HVY. HORIZONTAL OR VERTICAL PATTERN, SCRD.

FIG. 227. EX. HVY. HORIZONTAL OR VERTICAL PATTERN, FLGD.

Made in sizes 2 to 10 in.

For 300 lbs. working water pressure or 250 lbs. working steam pressure

Size, in.	2	2½	3	3½	4	5	6	7	8	10
End to end, scrd.	7½	9¾	9¾	13¼	14	14½	16½	16¾	17	19½
Face to face, flgd.	9	11¾	12¾	14	15½	17	19	19¼	19¼	23
Diam. of flanges	6½	7½	8¼	9	10	11	12½	14	15	17½

Iron Asbestos Packed Cocks, Three-way Pattern.

This type of cock is found extremely useful for controlling the flow through branch lines. It has U-shaped grooves in the body, into which loose asbestos is driven and then vulcanized. There are two designs in this type: one has two openings in the central plug, and the other three openings.

For many years these cocks have been used with unparalleled success for air, ammonia, gas, steam and water.

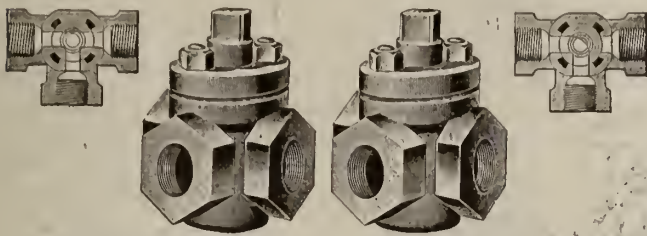


FIG. 272 Three Openings in Plug
All three ports can be open; any two can be open and the third closed

FIG. 273 Two Openings in Plug
Side port and either line port can be connected; all three ports can be closed

IRON ASBESTOS PACKED COCKS, THREE-WAY PATTERNS

Size, in.....	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5
End to end of run.....	3 3/4	4	4 3/4	5 1/4	6	7	8 1/4	8 3/4	9 1/2	11 1/2	11 1/4
Center of run to end of side opening.....	1 5/8	2	2 1/4	2 1/2	3	3 1/2	4 1/4	4 3/4	4 3/4	5 3/4	6

Iron Asbestos Packed Cocks, Groove Packed Pattern.
Instead of having a removable asbestos bushing, cocks of this design are packed with loose asbestos in U-shaped grooves in the body. This packing is done by hand, and afterwards the entire cock is subjected to a special vulcanizing process. This vulcanizing process makes the cock more serviceable and better able to withstand higher pressure and temperature. These cocks give unexcelled service as blow-off valves on boilers where no other type of valve has given satisfaction.

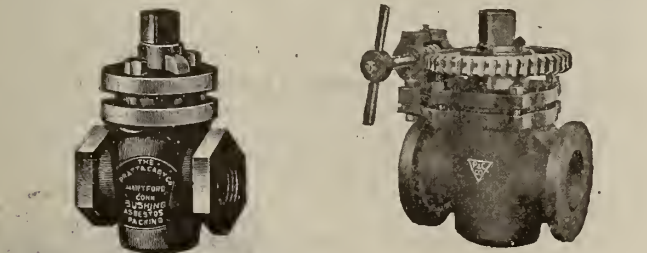


FIG. 247. Screwed 125 lbs. pressure

FIG. 259. Worm and Gear Flanged End Cock

IRON ASBESTOS PACKED COCKS

FIG. 247. STRAIGHTWAY, SCRD. FIG. 259. WORM AND GEAR, FLGD.

FIG. 249. STRAIGHTWAY, FLGD. FIG. 261. EXTRA HEAVY WORM AND GEAR, FLGD.

For 125 lbs. working steam pressure

SCREWED

Size, in.....	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6
End to end.....	2 3/4	2 3/4	2 3/4	3	3 3/4	4	4 3/4	5 1/4	5 1/4	6 1/4	7 1/4	8 1/4

FLANGED

Size, in.....	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6
Face to face.....	5 1/2	5 3/4	5 7/8	7 1/8	8 1/4	9 1/4	10 1/4	11 1/2	13 1/4	16
Diam. of flanges.....	4	4 1/2	5	6	7	8 1/4	9 1/4	10 1/2	11 1/2	11

FIG. 251. HEAVY, STRAIGHTWAY, SCRD. FIG. 253. HEAVY, STRAIGHTWAY, FLGD

For 150 lbs. working steam pressure

SCREWED

Size, in.....	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4
End to end.....	3 1/4	3 1/4	3 3/4	4 1/4	4 3/4	5 3/4	5 7/8	6 7/8	7 3/4	10	10 1/2	13 3/4

FLANGED

Size, in.....	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4
Face to face.....	5 1/2	5 3/4	6 1/4	7 1/4	8 1/4	10 1/4	11 1/4	12 1/4
Diam. of flanges.....	4 1/2	5	6	6 1/2	7 1/2	8 1/4	9	10

DIMENSIONS, IRON ASBESTOS PACKED COCKS (Continued)

FIG. 255. EXTRA HEAVY STRAIGHTWAY, SCRD. FIG. 257. EXTRA HEAVY STRAIGHTWAY, FLGD.

For 250 lbs. working steam pressure

SCREWED

Size, in.....	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4
End to end.....	3 3/4	4 1/4	4 3/4	5 3/4	5 7/8	6 3/4	8 3/4	10 7/8	12	15

FLANGED

Size, in.....	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4
Face to face.....	5 1/4	5 5/8	6 3/4	8	10 1/4	11 1/4	12 3/4	15
Diam. of flanges.....	4 1/2	5	6	6 1/2	7 1/2	8 1/4	9	10

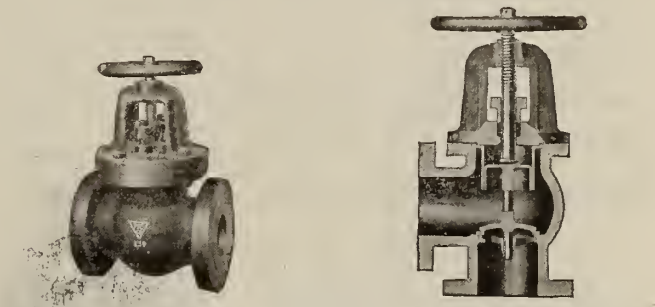
Automatic Stop and Check Valve.

In semisteel for 250 lbs. working pressure, in cast steel for 350 lbs. working pressure and 800° Fahr. temperature.

Design is based primarily on simplicity and ruggedness with full regard to the exacting requirements of the service. The generous length of the piston and cylinder provides an ample dashpot and eliminates the possibility of hammer or chatter of disc.

The piston and disc are of one piece and provide perfect alignment at the only two points where such is required. The absence of a stuffing box prevents any hindrance to free movement of all the reciprocating parts.

The metal thickness of the piston and the dashpot walls is the same; expansion under various temperatures will, therefore, be the same. This, taken in conjunction with the large steam chamber surrounding the outside of the dashpot which insures equal temperatures, prevents the possibility of binding or sticking, which is liable to occur where the dashpot and piston walls are of unequal thickness, or where the outside of the dashpot is in close proximity to the body shell.



Globe Pattern

Angle Pattern

EXTRA HEAVY AUTOMATIC STOP AND CHECK VALVE

GLOBE PATTERN

Size, in.....	2	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8
Face to face.....	9	10	10 3/4	11 3/4	12 1/2	13 1/2	14 1/4	15 1/2	17 1/2	18
Diam. of flanges.....	6 1/2	7 1/2	8 1/4	9	10	10 1/2	11	12 1/2	14	15
Thickness of flanges.....	3/8	1	1 1/8	1 1/4	1 1/2	1 5/8	1 3/4	1 7/8	2 1/4	2 1/2
Center to top of wheel (closed).....	11	12 1/2	14 1/4	15 3/8	16	18 5/8	19 5/8	22 1/4	25 1/2	26 3/4

ANGLE PATTERN

Size, in.....	2	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8
Center to face of flange.....	5 1/4	5 3/4	6 1/4	6 5/8	7	7 1/2	7 7/8	8 3/4	9 5/8	10 1/2
Diam. of flanges.....	6 1/2	7 1/2	8 1/4	9	10	10 1/2	11	12 1/2	14	15
Thickness of flanges.....	3/8	1	1 1/8	1 1/4	1 1/2	1 5/8	1 3/4	1 7/8	2 1/4	2 1/2
Center to top of wheel (closed).....	10 1/2	11 1/4	12 1/2	14 1/4	15 1/2	16 1/2	18	20	22 1/4	25

THE M. SMOLENSKY MFG. CO.
Manufacturers of Valves
CLEVELAND, OHIO

Products.

SMOLENSKY ROTARY CHECK VALVES;
SUCTION VALVES; POP SAFETY VALVES.

Description.

Smolensky valves are a departure from the generally accepted idea that a check valve, to be efficient, must be bulky and complicated. The standard size rotary flange and rotary screwed check valves are manufactured with 50% less material, and special design valves with 75% less material than ordinary valves. There are but three parts in the small sizes—the housing, the plug and the retaining ring—and two in the larger sizes, no retaining ring being necessary. Plug, which is held in position by ribs cast integral with housing, is cup shaped with closed bottom and ribbed openings on sides. When valve is open the fluid flows through these openings. Quick, accurate and tight closing is secured, because seating edge of valve plug is rounded, while valve seat is a straight bevel.

Rotary Air Line Check Valve.

Constructed entirely of steam brass. Equipped with a spring for an air working pressure of 200 lbs.

PRICES, ROTARY AIR LINE CHECK VALVES

Size, in.....	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2
Price.....	\$0.81	0.99	1.17	1.41	1.72	3.29	4.57	6.98

Standard Screwed Rotary Check Valve with Drip Cock.

CONSTRUCTION—Valve housing and valve plug made entirely of steam brass.

WORKING PRESSURES—Water, 150 lbs.; steam, 180 lbs.

PRICES, STANDARD SCREWED ROTARY CHECK VALVES WITH DRIP COCK

Size, in.....	3/8	1/2	3/4	1	1 1/4	1 1/2
Price.....	\$1.74	1.89	2.09	2.75	3.66	4.79

Standard Screwed Rotary Check Valve.

DESCRIPTION—This valve gives perfect service and has greater durability combined with simplicity. It has no screws, nuts, doors or hinges to work loose, nor a ball which would necessitate the removal of the valve to clean.

CONSTRUCTION—Constructed of three pieces: valve housing, valve plug and retaining ring. Valve housing is cast with solid seat and ribs on inside. Valve seat being a finished straight bevel, the ribs hold valve plug in position. Valve plug is made with ribbed openings on side through which fluid flows when valve is open. Seating edge of valve is rounded, fitting in straight bevel valve seat. Retaining ring is of brass, and keeps valve plug in housing.

OPERATION—See standard rotary flanged check valves.

WORKING PRESSURE—Guaranteed for steam, 150 lbs.; for water, 180 lbs.

CATALOGUE—Send for catalogue.



TRADE-MARK

PRICES, STANDARD SCREWED ROTARY CHECK VALVES BRONZE

Size, in..	1/8	1/4	3/8	1/2	3/4	1
Price....	\$0.68	0.68	0.83	1.06	1.18	1.60
Size, in..	1 1/4	1 1/2	2	2 1/2	3	3 1/2
Price....	\$2.70	3.83	5.92	10.92	14.97	18.70

*IRON BODY

Size, in....	2	2 1/2	3	3 1/2	4
Price.....	\$4.55	9.75	12.25	14.75	15.85

*Cast iron valve housing. Valve plug, renewable seat and retaining ring made of steam brass. Work at any angle.

Standard Screwed Rotary Suction Valve.

DESCRIPTION—This is the only valve which does the work of two ordinary pump valves.

It is of the 3-way screw type. Made of bronze.

WORKING PRESSURES—Guaranteed for steam, 150 lbs.; for water, 180 lbs.



STANDARD SCREWED ROTARY SUCTION VALVE

PRICES, STANDARD SCREWED ROTARY SUCTION VALVES

Size, in.....	1/8	1/4	3/8	1/2	3/4	1
Price.....	\$1.25	1.25	1.56	1.83	2.23	3.08
Size, in.....	1 1/4	1 1/2	2	2 1/2	3	3 1/2
Price.....	\$5.27	7.55	11.71	21.75	29.84	37.25

Extra Heavy Rotary Flanged Check Valve.

DESCRIPTION—Designed for use on marine engines and all places where heavy pressure is required.

Its efficiency is not affected by the rolling of ship, because it works perfectly at any angle.

CONSTRUCTION—Attached by single bolts which pass entirely through the housing. The interior construction is the same as all Smolensky rotary check valves.

WORKING PRESSURE—Guaranteed for 500 lbs.



ROTARY FLANGED CHECK VALVE

Extra heavy, special design

DATA, EXTRA HEAVY ROTARY FLANGED CHECK VALVES

Size, in.....	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
Face to face, in.	1	1 1/8	1 3/4	2	2 1/4	2 1/2	2 3/4	3 3/4
Price.....	\$9.25	11.75	16.25	19.75	32.64	44.57	59.75	77.80

Standard Rotary Flanged Check Valve.

CONSTRUCTION—This valve is much shorter from face to face, requiring for construction 50% less material than an ordinary valve of corresponding size. The 6-in. valve is only 8 1/4 in. long in comparison with a usual length of 16 in.

There are but two parts to this valve—valve housing and valve plug. Valve housing, the interior of which has ribs cast integral to hold plug in position, is made of cast iron in cylindrical form, bulging in center. A separate renewable valve seat is also provided. Valve plug is of cast iron, made in skeleton form, with ribbed openings on sides. There is a renewable bronze ring on each end of plug fastened with screws.

OPERATION—Valve plug slides up and down, or back and forth, on the ribs in valve housing as fluid passes through. Valve operates at any angle and can be used for any fluid. It is self-cleaning and self-grinding.

SAVING—There are no doors, hinges, etc., to cause a leakage in this valve. Can be used with perfect satisfaction in vertical or horizontal positions or as foot valves.

WORKING PRESSURES—Guaranteed for steam, 150 lbs.; for water, 180 lbs.

CATALOGUE—Send for catalogue.



STANDARD ROTARY FLANGED CHECK VALVE

Noiseless Rotary Flanged Check Valve.

DESCRIPTION — Specially designed for locations where there must be no noise. A spiral spring is adjusted to valve plug in such manner that there is no unnecessary motion or vibration, thus doing away with “clattering” and “shivering” in pump.

CONSTRUCTION—In manufacturing this valve, 75% less material is used than in the constructing of former types of corresponding sizes. The 6-in. valve is only 4¾ in. from face to face, in comparison with customary length of 16 in.

Valve housing is made in cylindrical form and inner ribs hold valve plug in position. Valve plug is harder material than valve housing, and is made in cup form having ribbed openings on sides through which fluid flows. Retaining ring which holds spring in place is made of bronze.



NOISELESS ROTARY FLANGED CHECK VALVE, SPECIAL DESIGN

Steam bronze. All sizes furnished to order. Length face to face on 6-in. valve, 4¾ in. Other sizes in proportion

SELF-CLEANING—There are no recesses in any Smolensky rotary check valve housings.

Accumulations of lime or other matter can not form, consequently there is no necessity for removing valve frequently for cleaning.

SELF-GRINDING—Smolensky valves are automatically self-grinding, due to the rotary motion of the plug.

OPERATION—Valve plug slides up and down or back and forth on ribs of valve housing.

Made especially for use on centrifugal pumps and there is no clatter nor leak.

PRICES, NOISELESS ROTARY FLANGED CHECK VALVES

Size, in.	4	4½	5	6	7	8	9	10	12
Price.....	\$42.10	56.60	66.45	90.50	109.25	137.25	263.70	302.65	447.40

Pop Safety Valves.

DESCRIPTION—Only five parts and 40% less material. Can be used at any angle, set at any pressure, and used for any fluid.

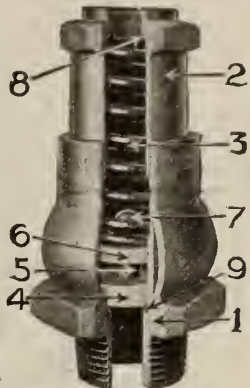
CONSTRUCTION—Valve plug seat (4) and support (5) is cast of bronze in one piece, (5) acting as guide and axis for spring seat (6) when valve is closing, support entering countersunk recess in spring seat. Housing (1) is cast with inner ribs to hold valve seat (4) and spring seat (6) in position when valve is in operation.

Pressure nut (2) is cast with shoulder (8) to hold pressure spring. Pressure spring (3) fits into shoulder (8) at top and rests on spring seat disk (6) at bottom. Valve seat (4) and spring seat (6) are separate. Vulcabeston seat (9) is fitted securely to valve housing box after machining, producing a smooth tight connection.

WORKING PRESSURE—Guaranteed from 100 to 200 lbs.

PRICES, POP SAFETY VALVES

Size, in.	¾	1	1½	2	2½	3	4
Price.....	\$1.82	1.95	2.70	3.56	4.32	6.10	9.47



POP SAFETY VALVE

Globe Valves and Angle Valves.

CONSTRUCTION—Made entirely of steam brass with cast iron hand wheel, screwed ends. Body and disk are made of “hard metal” having almost the hardness of steel. Gives maximum efficiency.

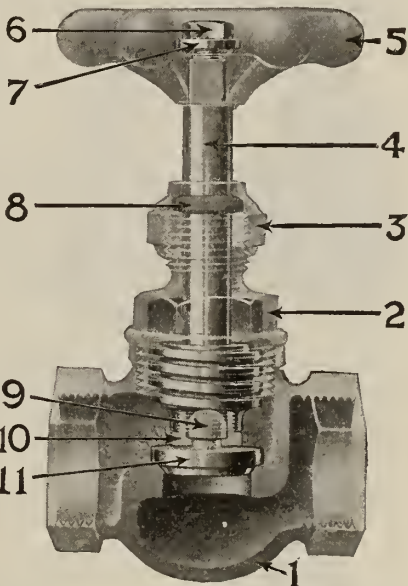
Valve plug (11) is connected to stem (4) by swinging support (9) and held by half split nut (10). Valve nut (2) is fastened to housing (1) by screw threads and stem (4) passes through valve nut, and turns in valve nut on square threads. Cap nut (3) is fastened to valve nut, thus holding packing (8) securely. Hand wheel (5) is held fast to stem by nut and washer (6-7). Seat (11) closes against one flat and one tapered surface, assuring accuracy and tightness. Note manner in which seat is hung by support (9) allowing it to swing as well as rotate, and causing it to gently and automatically find its own seat when closing.

WORKING PRESSURE—Guaranteed working pressure 125 lbs.

CATALOGUE—Send for catalogue.

PRICES, BRASS BODY, SCREWED ENDS, GLOBE VALVES

Size, in.	¾	1	1½	2	2½	3	4
Price.....	\$0.72	0.72	0.77	1.00	1.26	1.80	2.52



GLOBE VALVE

ESTABLISHED 1842

WALWORTH MANUFACTURING COMPANY

Manufacturers of Valves

BOSTON, MASS.

WESTERN DIVISION
OFFICES, CHICAGO, ILL.
WORKS, KEWANEE, ILL.

BOSTON	CHICAGO	NEW YORK	PHILADELPHIA	PORTLAND, ORE.	SEATTLE
SALES OFFICES					
BUENOS AIRES, ARGENTINA	HAVANA, CUBA			JOHANNESBURG, SO. AFRICA	
LONDON, ENGLAND	MEXICO CITY, MEXICO	PARIS, FRANCE	SAN FRANCISCO, CAL.		
SAN PAULO, BRAZIL	SANTIAGO, CHILE	SYDNEY, AUSTRALIA			

Products.

VALVES, including Low Pressure, Special, Standard, Medium, Heavy and Extra Heavy; Brass, Special Bronze, Iron Body and Cast Steel; Angle, Check, Swing Check, Cross, Blow-off, By-pass, Gate, Geared, Globe, Hose Gate, Hub End, Hydraulic, Jenkins Type Walworth, Lock Shield, Marine Type, Needle, Quick Opening, Reducing, Regrinding, Relief, Safety, Throttle and Vacuum.

Oldest continuous manufacturers in the United States (since 1842) of a complete line of Valves, Fittings and Tools for Steam, Water, Gas and Air.

Originators of the famous "Genuine Walworth Stillson" Wrench and the "Kewanee" Union.

For Power Piping and Wrenches, see page 425.

Quality of Walworth Valves.

Quality of material, thickness and distribution of metal and general design of Walworth valves, together

with the careful inspections and rigid tests to which they are subjected, insure the purchaser that they are suitable for the pressures specified herein.

They are the culmination of many years of successful valve manufacture and are being used extensively throughout the world.



Non-rising Stem,
Solid Wedge
with Gland
WALWORTH
BRASS GATE
VALVE

Steam pressure,
125 lbs.
Screwed or
flanged.
Made for tem-
peratures up to
700° Fahr.; also
for 100, 175 and
250 lbs. steam
pressure



Non-rising Stem Rising Stem and Yoke
WALWORTH IRON GATE VALVES—
SCREWED OR FLANGED

For 25, 125, 175 and 250 lbs. steam pressure;
also globe, angle and check valves, solid wedge,
taper disc, renewable seats. Can be fitted with
by-pass

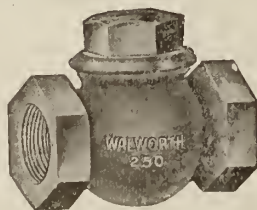


Non-rising Stem Outside Screw and Yoke Hub End
WALWORTH IRON GATE VALVES—LOW PRESSURE

Steam pressure, 25 lbs. Water pressure, 50 lbs.
Flanged or hub end; iron body; brass trimmings. 42 in. and 48 in.
sizes furnished with gears



Globe Valve



Horizontal Check Valve



Angle Valve

WALWORTH BRASS VALVES—HIGH DUTY BRONZE

Pressure, 250 lbs. Tested to 800 lbs., hydraulic pressure. Screwed or flanged.
Globe, angle and check valves made also for 100 and 125 lbs. steam pressure and
for temperatures up to 700° Fahr.



WALWORTH
"KEWANEE" RE-
GRINDING VALVES
—HIGH DUTY
BRONZE

Steam pressure, 200
lbs. Convex seat and
disc insure perfect con-
tact. Globe or angle,
screwed or flanged



WALWORTH CAST-STEEL
GATE VALVES FOR
SUPERHEAT—800° FAHR.

Outside screw and yoke.
Steam pressure, 350 lbs. Globe,
angle and check valves; also
cold rolled steel stems, nickel-
plated rolled monel metal seat and
disc rings.

Sizes 2 in. and smaller have
solid monel metal discs. Sizes
3 in. and smaller have solid
yokes

GOLDEN-ANDERSON VALVE SPECIALTY CO.

Manufacturers of Automatic Valves, Especially Life and Property Insurance Valves

1213 Fulton Building
PITTSBURGH, PA.

Products.

LIFE and PROPERTY INSURANCE VALVES (patented).
AUTOMATIC CUSHIONED CONTROLLING ALTITUDE VALVES.

AUTOMATIC CUSHIONED STEAM PRESSURE REDUCING VALVES.

DOUBLE CUSHIONED QUICK CLOSING EMERGENCY TRIP VALVES.

What Every Boiler Steam Connection Should Have.

Every boiler steam connection should have a Golden-Anderson Life and Property Insurance Valve.

Even when provided with some safety device, the absolute safety of any plant is demonstrated only by a frequent testing of the device.

Golden-Anderson valves can be tested at any minute while in service. They are something to bank on—full confidence may be placed in them.

No Shut-down When a Tube Bursts.

No boiler tube rupture or steam main burst will result in a wrecked plant or total shut-down, if Golden-Anderson valves are used.

Golden-Anderson Life and Property Insurance Valves.

Golden-Anderson valves are the only valves which can be tested at any minute while in service.

They prevent flow of steam from other boilers to one in which a tube has ruptured.

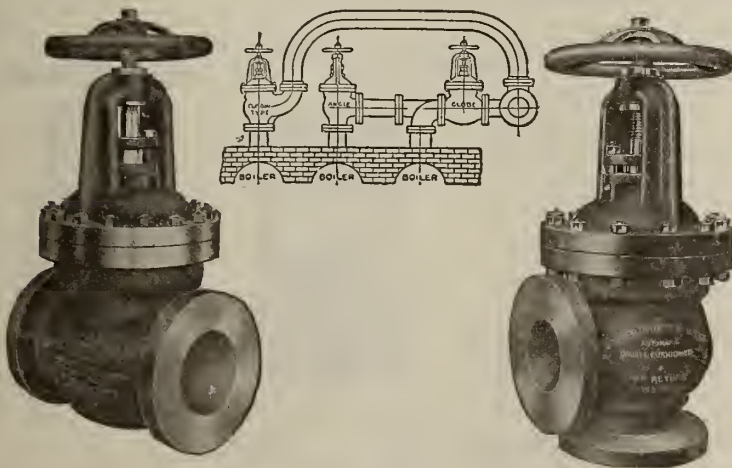
They will cut off all boilers when steam main bursts.

Pressure is equalized between boilers automatically.

No live steam can enter cold boiler, thus protecting workman.

Fitted with double Corliss dashpot, preventing pounding, chattering and spinning. *Heaviest valves made.*

There are 1800 in use in the United States Steel Corporation plants.



LIFE AND PROPERTY INSURANCE VALVES
Angle, Globe or Elbow

Golden-Anderson Patent Automatic Cushioned Controlling Altitude Valves.

For automatically maintaining uniform stage of water in tank, reservoir or standpipes, doing away with the annoyances of freezing. No float fixtures inside or outside of tanks.

THREE WAYS OF CLOSING THESE VALVES—First, automatically by water.

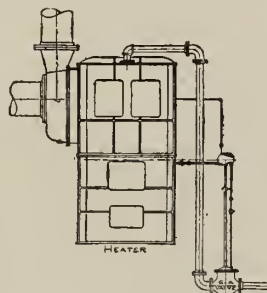
Second, by electricity, if desired.

Third, by hand.

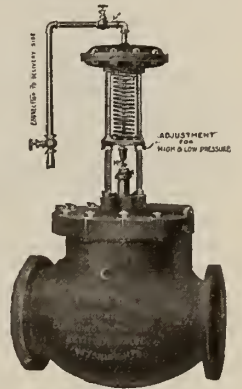
Golden-Anderson Patent Automatic Cushioned Controlling Float Valves.

They carry a constant water level in feed water heaters by perfectly controlling the flow of make-up water. Operated by protected enclosed copper float. Cushioned by both air and water. Operate without hammering, sticking or chattering. No metal-to-metal seats.

Made angle or straight-way.



PATENT AUTOMATIC CUSHIONED CONTROLLING FLOAT VALVES



PATENT AUTOMATIC CUSHIONED CONTROLLING ALTITUDE VALVE

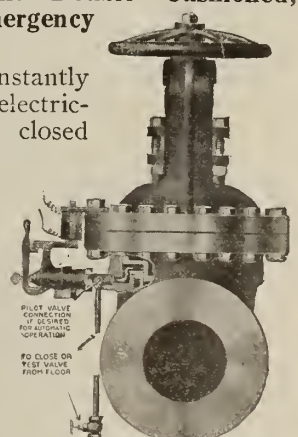


Golden-Anderson Patent Double Cushioned, Quick Closing Emergency Trip Valves.

They can be tripped instantly from distant points by electricity on either open or closed circuits. The only valves that can be arranged to open and reset by electricity from distant points.

Fitted with Corliss dashpot that insures perfect cushioning. Operate without springs or tightfitting parts.

The H. C. Frick Co. have given 150 repeat orders.



DOUBLE CUSHIONED QUICK CLOSING EMERGENCY TRIP VALVE
Sizes to 20 in.

ESTABLISHED 1904

THE D. T. WILLIAMS VALVE CO.

CABLE ADDRESS

"GOOD VALVE,
CINCINNATI"

MAIN OFFICE AND WORKS

Spring Grove Avenue, Township and Jessamine Streets
CINCINNATI, OHIOCODES
ABC, 5th Edition
Liebers,
Seegers & Williams

Products.

Manufacturers of WILLIAMS BRONZE REGRINDING VALVES; REGRINDING RADIATOR and BLOW-OFF VALVES; HYDRAULIC VALVES; NEEDLE VALVES; REGULATING CHECK, REGRINDING CHECK, REGRINDING SWING CHECK and BALL CHECK VALVES; STEAM STOP COCKS; DOUBLE DISC, WEDGE DISC and IRON BODY GATE VALVES; BRASS and IRON BODY STOP and CHECK VALVES; QUICK OPENING LEVER THROTTLE VALVES; COOKSON STEAM TRAPS.

Also, Angle, Globe, Cross, Air, Hose, Yoke, Heavy and Extra Heavy Valves; Gauge Cocks (Boiler, Steam); Water Gauges; Steam and Oil Separators; Steam Traps; Grease Cups; Oil Cups; Oil Pumps; Steam Engine and Gas Engine Lubricators; Brass Fittings; Iron and Brass Flanges; Expansion, Swing and Swivel Joints; Unions; etc.

Special Goods, of all varieties, made to order from sample, sketch or blue print.

Identification Marks.

The name "Williams" is cast in sunken or raised gothic letters on all valves, traps, separators, etc., while the complete firm name and address (and trade-name if any) are stamped on finished and polished articles in order to identify genuine Williams products from undesirable substitutes.

Facilities and Co-operation.

Modern equipment and long experience enable this company to manufacture practically any product made from brass, bronze, nickel, aluminum, iron or steel, either cast or stamped, including necessary machining operations, assembling, etc.; and the construction of standard goods can be modified to suit local requirements. The plant is operated on a highly economical basis and all quotations are based on an accurate cost system. Write for Catalogue No. 10 which shows complete line.

Advantages of Williams Regrinding Valves.

The use of these durable and efficient regrinding valves (Fig. 107-B) adds to economical operation of any power plant, due chiefly to following advantageous features: (1) Design, simplicity and liberal proportions of valve—smallest area in body is larger than nominal diameter of pipe, permitting no reduction in pressure of steam, water, oil, air or gas. (2) Valves made with screwed or flanged ends for these steam pressures: medium pattern, 200 lbs.; extra heavy, 350 lbs. (3) Made of best quality of metal. (4) Regrinding disc and seat eliminates *all leakage and incidental waste of fuel*. (5) Cheap light valves are always liable to leakage, frequent renewals and waste of fuel, time, labor and patience. (6) Stems made of special bronze composition as hard as steel; are durable, larger in diameter and heavier than other valve stems; will, therefore, not bend or break. When valve is closed and under greatest strain, every thread on stem is utilized, none being idle, thus preventing unequal wear and "stripping." (7) Valve has a steamtight joint at base of stem ("C" when

raised up) and seating against bottom of hub (B); and *when wide open valve can be repacked under full pressure with absolute safety*. (8) Stuffing box packed with special moulded ring packing, not requiring renewal for several years; has drive gland and heavy packing nut, and is readily accessible for repacking. (9) Discs and seats are of bronze, to stand high pressures and temperatures, year after year, without being affected. No extra discs or seats are necessary. In case seat or disc is marred by reason of gritty water or otherwise, regrinding seating surface within a few minutes *without expense or disconnecting pipes* is a simple operation. (10) Note union ring (L), making strong non-corroding connection between hub and body.

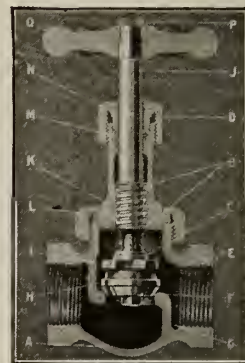


FIG. 107-B
INTERIOR VIEW OF
WILLIAMS REGRINDING
VALVE

A, thickness and curve of body. B, all threads utilized, when valve closed. C, when valve wide open (stem) seat forms a tight bearing on bottom of bonnet, preventing steam, etc., from blowing through, and enabling *repacking under pressure* with safety. D, heavy, durable, hexagon packing nut. E, threads on pipe end, conforming to U. S. Briggs standard. F, radial seat, can be reground any number of times. G, showing area of valve in excess of nominal diameter of pipe. H, disc, of hard bronze, can be reground any number of times, is renewable at nominal cost and stands highest temperatures and pressures. I, bronze hexagon lock nut, securing disc to stem. J, long stem, of tough bronze composition, large in diameter and very heavy. K, strong substantial hub—long, to properly support stem; bottom is machined to insure tight joint with seat C while repacking, when valve open wide. L, union ring, screwing over hub and neck of body (threads not exposed), makes steamtight joint. M, special, moulded, asbestos ring packing. N, packing gland follower (in all Williams valves above ½-in. size). O, japanned hand wheel with ball at end of each spoke. P, brass lock nut.



FIG. 107
MEDIUM TYPE
Screw- Flanged
ed Flanged
Fig. Fig.
107 Globe 280
108 Angle 281
106 Cross 282



FIG. 107-E
Applying oil and emery, which is always at hand, when new discs are not. Contrast this with costly method of inserting new discs which are not always available when needed

Different Types of Williams Valves.

In addition to the union bonnet ring construction and inside screw stem (Fig. 107) described above, the screwed yoke type (with outside screw stem) has been developed (Fig. 119), in the globe, angle and cross valves; designed for places where fluid may cause

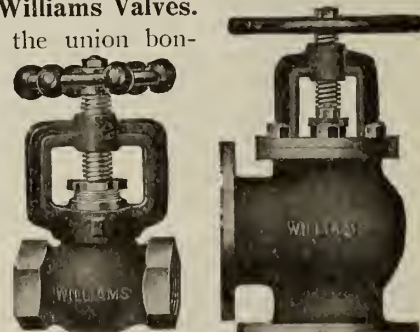


FIG. 119. MEDIUM SCREWED YOKE TYPE			FIG. 397. MEDIUM FLANGED YOKE TYPE		
Screw- ed	Fig.	Flanged	Screw- ed	Fig.	Flanged
Fig. 119	Globe	409	Fig. 393	Globe	396
407	Angle	410	394	Angle	397
408	Cross	411	395	Cross	398

corrosion of threads on stem or where valve must be inserted in pipe with wheel handle *down*; also, the flanged yoke type (Fig. 397), differing only in manner of securing yoke to valve body, threads (accessible) never being in contact with steam. Both yoke types are built with screwed or flanged ends, in medium and extra heavy patterns.

Other styles of Williams valves are described and illustrated on this and succeeding page.

Williams Regrinding Radiator Valves.

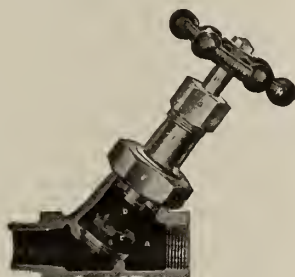
Substantially made of best materials, with female and male and female ends. Illustration (Fig. 122) shows a male union on outlet end to facilitate connection to radiator. Discs and seats are of bronze, easily renewed when worn, by regrinding. Furnished with hardwood wheels or lock shields at same price, and can be repacked under pressure, either wide open or closed.



FIG. 122. ANGLE VALVE
With male union, Globe, Fig. 358; female ends—Angle, Fig. 120 and Globe, Fig. 335

Williams Regrinding Blow-off Valves.

Made of brass in medium and extra heavy pattern; screwed and flanged ends; union bonnet with inside screw stem; liberal areas for blowing off mud, grit and scale. Disc and seat can be reground. Steam working pressures guaranteed—medium, 200 lbs.; extra heavy, 350 lbs.



SCREWED END BLOW-OFF VALVE
Medium, Fig. 243, male and female
Medium, Fig. 272, female ends
Extra heavy, Fig. 621, male and female
Extra heavy, Fig. 289, female ends

Williams Hydraulic Valves.

Made of brass, with screwed ends; for steam working pressures up to 2,000 lbs. Used in rubber factories, cotton and linseed oil mills, on cotton and baling presses, etc. Heavily constructed for any high hydraulic pressures. Disc and stem are of one piece; disc and seat can be reground.

These valves are also furnished in check type.



FIG. 581. GLOBE HYDRAULIC VALVE
Angle, Fig. 592
Cross, Fig. 560

Williams Regulating Check Valves.

Made with screwed or flanged ends, in medium and extra heavy pattern, for working steam pressures of 200 and 350 lbs., respectively. Lift of disc controlled by a threaded stem, giving any degree of opening through valve. Valve quickly reground; union bonnet with inside screw stem. Also furnished in globe pattern, either screwed or flanged ends.

These valves are used on boiler feed lines.



ANGLE CHECK VALVE
Medium, Fig. 454
Extra heavy, Fig. 255

Williams Regrinding Check Valves.

Made with screwed and flanged ends, in medium and extra heavy pattern, for 200 and 350 lbs. working steam pressures, respectively. Small wings cast on bottom of disc insure correct alignment, perfect seating, and tight check. Top-heavy wing guides eliminated.

Recommended for use on boiler feed lines.

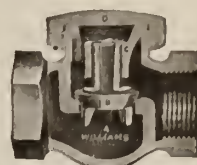


FIG. 114. SECTIONAL VIEW OF MEDIUM REGRINDING CHECK VALVE

Screwed Fig. 114
Flanged Fig. 283
Horz. Fig. 283
Angle Fig. 284
Vert. Fig. 285

Williams Regrinding Swing Check Valves.

Made with screwed and flanged ends, in medium and extra heavy pattern, for 200 and 350 lbs. pressure, respectively; designed for steam, water, oil or gas.

Recommended for use on boiler feed lines, steam trap installations, return systems, control of heavy liquids, etc. Can be installed in either horizontal or vertical position.



FIG. 254. SECTIONAL VIEW OF MEDIUM REGRINDING SWING CHECK VALVE

Screwed, Fig. 254
Flanged, Fig. 296

Williams Ball Check Valves.

Made with screwed ends, in medium pattern, for working pressures up to 200 lbs. Made of best steam bronze, and designed for steam and water service. Ball used is round and spherical as possible, is made of a hard, dense, bronze composition, and is guided in its action by cylindrical extensions on inside of cap.



MEDIUM BALL CHECK VALVE

Horz., Fig. 116
Angle, Fig. 439
Vert., Fig. 440

Williams Needle Valves.

Made of steam bronze; medium pattern, with female ends, for controlling gas, gasoline, oil, liquid, air, etc., where close regulation of volume through valve is required. Long, tapering needle point and seat opening, with fine pitch of threads on stem, permit close degree of opening. Steel stems and union ends furnished, when so ordered.



FIG. 606. GLOBE NEEDLE VALVE
Angle, Fig. 607
Cross, Fig. 608

Williams Steam Stop Cocks.

Made of best steam metal, with screwed and flanged ends, in medium pattern, for working pressures up to 200 lbs.

All parts are carefully machined, and keys are ground in by hand to a perfect bearing.

All Williams cocks are guaranteed steamtight.

Keys operate easily, will not stick, bind or leak.

Write for further particulars.



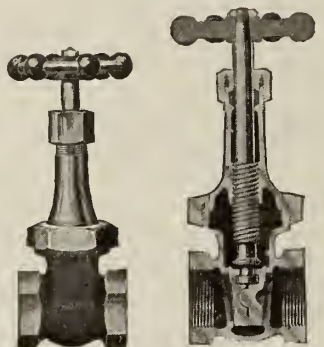
STEAM STOP COCK
Square head; screwed ends,
Medium, Fig. 154; flanged
ends, Medium, Fig. 155

Williams Double Disc Gate Valves.

Made of best bronze composition and heavily built

to stand any excessive strains. Manufactured in two patterns—medium and extra heavy, for 200 and 350 lbs. working pressure, respectively; with screwed and flanged ends.

The construction (shown in Fig. 127) of the double disc mechanism is simple, also flexible, by reason of ball and socket bearing between discs A and B. Discs (tapering) are suspended from stem F. Perfect alignment is secured by means of lugs on either side of disc which travel in a corresponding groove in center line of body; in closing valve, discs automatically drop into position and adjust themselves to same taper of seats. Ball and socket bearing of discs distributes a uniform wedging action to both, causing them to bear tightly to seats, insuring perfect contact at all points. These valves are also furnished with screwed yoke, similar to Fig. 119 shown on a preceding page.



Exterior—Fig. 127—Sectional
MEDIUM DOUBLE DISC GATE
VALVE
Fig. 127 screwed; Fig. 317 flanged

Williams Wedge Disc Gate Valves.

Made with screwed and flanged ends, in medium pattern, for working pressures up to 200 lbs. Stationary, non-rising stem. For steam, water, oil, air or gas.

Construction includes a single brass disc, with its seating surfaces machined and ground to a taper corresponding with angle of valve seats. Disc is held to stationary stem by means of Acme standard thread; is guided by means of lugs cast on either side, similar to double disc type of construction, perfect alignment being thus secured. Operation of valve is entirely frictionless.



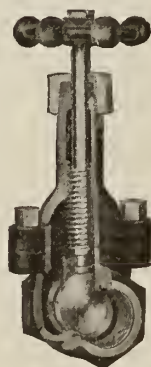
MEDIUM WEDGE
DISC GATE VALVE
Hose pattern
Fig. 474 screwed
Fig. 475 flanged

Cino Iron Body Gate Valves.

Made with screwed and flanged ends. Used for steam, water, oil, air or gas.

Guaranteed for working steam pressures up to 100 lbs. Adapted for efficient service in mines, railroad tanks, refineries, paper mills, oil and gas wells, chemical factories, paint or soap factories, distilleries, breweries, water tanks, irrigation purposes, for handling cyanides, acids, etc.

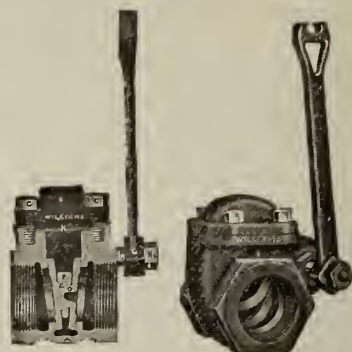
Construction includes two bronze discs having a ball and socket at their center; discs suspended from and held in position by a malleable iron, wedge shaped holder. Wedging action of disc holder, and ball and socket bearing, insure necessary tightness of disc against their seats.



CINO GATE VALVE
IRON BODY, BRASS
MOUNTED
Fig. 300 screwed
Fig. 338 flanged
ALL IRON
Fig. 420 screwed
Fig. 406 flanged

Williams Quick Opening Lever Throttle Valves.

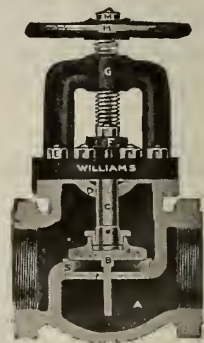
Manufactured of iron and brass, with screwed ends, in medium and heavy patterns, for working steam pressures as follows: Brass, medium, for 100 lbs.; brass, heavy, for 200 lbs.; iron, medium, for 100 lbs.; iron, heavy, for 150 lbs. Heavily constructed throughout; bodies and caps of cast iron, discs, seat rings and packing nuts of best bronze composition. Positive double disc mechanism.



Sectional View
Showing Double
Disc Construction
QUICK OPENING LEVER
THROTTLE VALVES
Iron
Medium, Fig. 328
Heavy, Fig. 132

Williams Iron Body Stop and Check Valves.

STOP VALVES—Made of a hard, close grained cast iron having great tensile strength, with flanged yoke and outside bronze screwed stem; brass mounted; screwed and flanged ends. Built in medium pattern for 125 lbs. working steam pressure, also in heavy type for 175 lbs. Threads of stem never come in contact with steam or liquids passing through body. Valves can be repacked under pressure, when wide open; discs easily re-ground. Both patterns are fitted with renewable bronze seat rings.



MEDIUM ANGLE STOP
VALVE
Screwed Fig. 180 . Globe . Fig. 628
Flanged Fig. 181 . Angle . Fig. 629
Fig. 528 . . Cross . . Fig. 529

CHECK VALVES—Made with screwed and flanged ends, in medium and heavy patterns, for 125 and 175 lbs working steam pressures respectively. Construction includes cast iron body and bolted cap; bronze disc, disc guide and seat, and renewable bronze seat rings. Valves are positive in operation, strong, and durable.



MEDIUM HORIZONTAL
CHECK VALVE
Screwed Fig. 144 . . . Horz. . . Fig. 631
Flanged Fig. 145 . . . Angle . . . Fig. 632
Fig. 575 . . . Vert. . . Fig. 576

Williams Cookson Steam Trap.

Increased leverage of valve mechanism makes possible a discharging capacity much larger than that of any other similar trap. Few working parts; no stuffing boxes. Body and cap are of cast iron; strainer and float of copper; disc "J" and seat "K" of monel metal; other parts, of best grade of bronze composition.

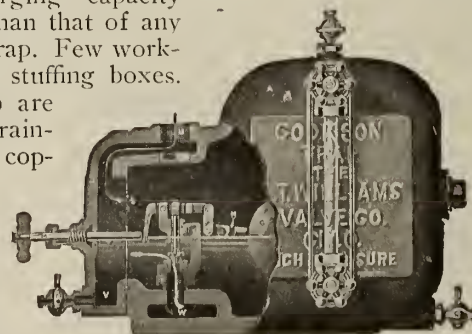


FIG. 500. COOKSON STEAM TRAP
For any pressure up to 200 lbs.

Write for catalogues and further particulars.

THE CHAPMAN VALVE MANUFACTURING CO.

CABLE ADDRESS:
"VALVE, INDIAN ORCHARD"

GENERAL OFFICE AND WORKS
INDIAN ORCHARD, MASS.

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BOSTON, MASS., 141 High Street
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NEW YORK, N. Y., 180 Lafayette Street
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Building

Products.

CHAPMAN SLUICE GATES, for hand, hydraulic, electric and pneumatic operation; SHEAR GATES, TIDE FLAP VALVES and MUD VALVES.

Butterfly Valves.

For Chapman Solid Wedge Gate Valves in bronze, semisteel and iron, in all sizes and for all pressures and purposes, and Floor Stands for valves and sluice gates, see pages 436-39.

Chapman Sluice Gates.

Chapman sluice gates are furnished for a variety of services, such as intake gates for penstocks, waste gates for dams, controlling gates for tunnels and canals, inlet and outlet gates for filter plants, sewage disposal plants and reservoirs; distributing gates for reclamation and irrigation projects, etc.

The gates are designed with either circular or rectangular openings. Size of gate denotes the size of clear waterway through the gate.

Gates may be furnished with a standard frame, flanged frame, bell frame or spigot frame. Standard frame type has a wall flange to bolt against the face of the wall, and in addition a short spigot extension around the waterway to be embedded into the concrete. When standard frame type is furnished with top hook wedges, slots must be provided in the wall to permit hook wedges to travel up and down. The short spigot stiffens the frame, assists in carrying the load, and provides a short lining for the waterway. The flanged frame type may be bolted to a flanged pipe or directly



against face of the concrete wall. The spigot frame type is of the same general construction as the standard frame type, but the spigot is much longer and hence provides a superior lining for the waterway.

In the construction of Chapman sluice gates nothing but the best materials are used—cast iron for the gate frame, plug and guides; bronze for the wedges, adjusting screws and lock nuts, also for the faces of the plug and seat. All inside screw gates of standard construction are furnished with a solid bronze spindle and a bronze stem nut. On all gates the plug and seat faces are made of bronze, finished in the most approved manner to form a watertight joint when the gate is closed.

Both outside screw or rising spindle gates and inside screw or non-rising spindle gates are manufactured. The use of the rising spindle type, operated by a floor stand, is recommended, as the rising spindle is a perfect indicator of the position of the plug or gate and the threaded portion can readily be kept clean and properly lubricated.

Sluice gates should be installed so that they will be subject to face pressure, that is, that the pressure will force the plug to its seat on the frame.

Ball bearings are furnished where required or when specified. They are made of the very best materials, the race plates and balls being of tool steel, hardened and ground.

Sluice gates may be operated by hand, hydraulically, electrically or pneumatically. Hand operation is usually employed through the medium of a floor stand; and for electric operation, the motor is usually attached to the floor stand. Hydraulic cylinders may be either attached to the gate frame or mounted on the top of the dam or floor of the gate chamber.

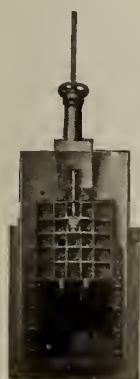


FIG. 474A
Rectangular
Sluice Gate in
Concrete Dam



FIG. 475B
Self-contained or
Stationary
Spindle Circular
Sluice Gate



FIG. 492
Chapman Plug or
Mud Valve



FIG. 487F
Chapman Tide Flap Valve
All sizes furnished, with connec-
tions to meet every requirement



FIG. 490
Chapman Shear
Gates with
Bronze Seat

SHOWING PART OF COMPLETE LINE OF GATE VALVES, SLUICE AND SHEAR GATES, MUD VALVES AND FLOOD GATES FOR WATER, SEWAGE, FILTRATION AND IRRIGATION SERVICE

COFFIN VALVE COMPANY

GENERAL OFFICE AND WORKS

NEPONSET, SUBURB OF

BOSTON, MASS.

NEW YORK, N. Y., C. W. BERGEN, 95 Liberty Street

PHILADELPHIA, PA., DE HUFF & HOPKINS, Morris Building

Products.

SLUICE GATES, GATE VALVES, CHECK VALVES, FLAP VALVES, FOOT VALVES, SHEAR SEWER GATES, OPERATING STANDS.

Also, Butterfly Valves, Automatic Sewage Regulators, Fire Hydrants, etc.

Service.

This company furnishes designs and prices for all sizes and types of valves for use in connection with water power plants, water works, sewerage systems, irrigation projects, etc.

Coffin Sluice Gates.

Standard sluice gates are made of cast iron with bronze mountings, and are furnished in all regular sizes, either circular or rectangular. They have either spigot frames to embed in masonry or flange frames to bolt to masonry or to flanged pipe. All gates have bronze seat facings, dovetailed into the frames and disks and scraped to form a watertight joint.

There are two general types of sluice gates:

FIXED WEDGE TYPE—Fig. 81, for light face pressures. These gates have bronze faced fixed wedges at the sides and are furnished with rising or non-rising stem. The most common type of fixed wedge gate is the so-called self-contained gate (Fig. 81) having a non-rising bronze stem and bronze stem nut cast into the disk. Such gates can be supplied with extension stem having operating nut, hand wheel or gate stand at top for operation.

ADJUSTABLE WEDGE TYPE—Figs. 57 and 76, for all pressures. This gate is a more expensive type of gate than the fixed wedge type and has solid bronze adjustable wedges at the sides and backwater guides machined to take tongue of disk. Sluice gates should be installed so that the pressure tends to push the disk against its seat, but where it is impossible to install them in this manner they are supplied with adjustable top hooks and bottom wedges as shown in Fig. 57. Sluice gates should be used where possible with rising stem so that the screw section will be out of water and the stem forms an indicator. These gates can be supplied with a non-rising stem where

necessary, by bolting a solid bronze stem nut to the top of the disk, through which the stem threads.

STEM—Sluice gates are supplied with cold rolled steel or Tobin bronze stems or with a combination stem of steel coupled to a bronze screw section. Long stems are supplied with cast steel couplings, threaded and pinned to stem. Bronze

bushed adjustable stem guides are furnished for every 10 ft. of unsupported stem. Anchor bolts are furnished for gates, stands, stem guides, etc., but are not included in quotations unless desired.

OPERATION—Sluice gates may be operated by hand, by hydraulic cylinder or by electric motor driven stand. Large sluice gates should be operated hydraulically or electrically, as hand operation is very slow on account of the necessary reduction gearing.

ESTIMATES—When requesting quotations on sluice gates, the following data are essential for close and intelligent prices:

- (1) *Type of Gate*—Circular or rectangular, size of opening, rising or non-rising stem.
- (2) *Frame*—Flanged or spigot end.
- (3) *Pressure*—Maximum on center of gate, tending to force gate towards or away from seat.
- (4) *Stem*—Distance from center of gate to base of operating stand.
- (5) *Operation*—Electric, hydraulic or hand.

We include the necessary stems, stem guides, stem couplings, stop collars, etc., but do not include any anchor bolts, unless so requested.

Coffin Operating Stands.

For small sluice gates or gate valves under light loads, plain (without ball bearings) gate stands with or

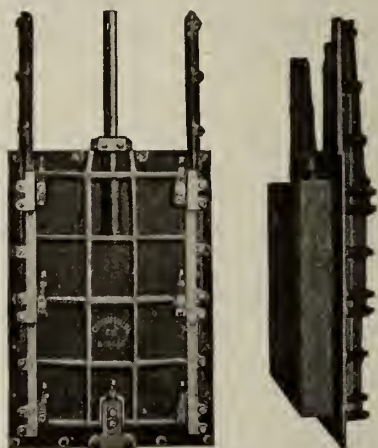


FIG. 57. COFFIN RECTANGULAR SLUICE GATE
Rising stem; spigot end; adjustable wedges



FIG. 76. COFFIN CIRCULAR SLUICE GATE
Rising stem; adjustable wedges



FIG. 81. CIRCULAR SLUICE GATE
Self-contained type; flange frame

without gearing are furnished. For heavier loads, ball bearing stands are furnished having the necessary gear ratio so that one man can easily operate the gate under full head pressure. Where the load is sufficient, 2-speed stands are furnished to lessen the time of operation. Stands with enclosed gearing furnished where desired. Stands without gears are furnished with hand wheels, and stands with gears are furnished with removable crank handles.

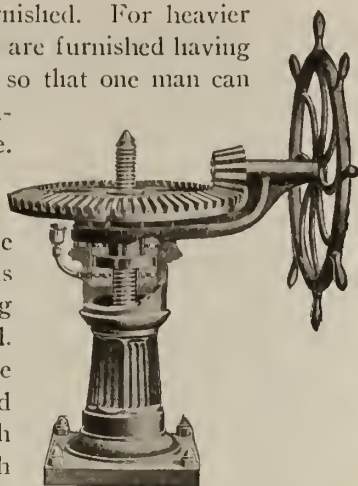


FIG. 72. COFFIN BALL BEARING GATE STAND

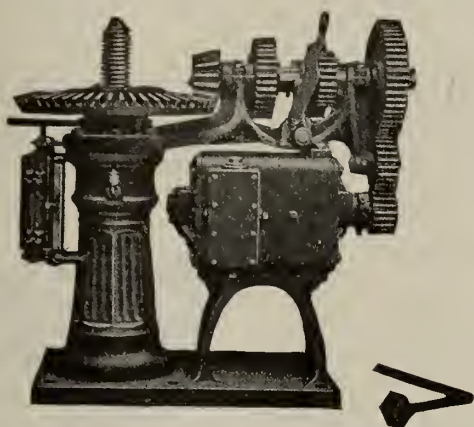


FIG. 390. COFFIN ELECTRICALLY OPERATED GATE STAND



FIG. 234. COFFIN HYDRAULICALLY OPERATED GATE VALVE, WITH BY-PASS

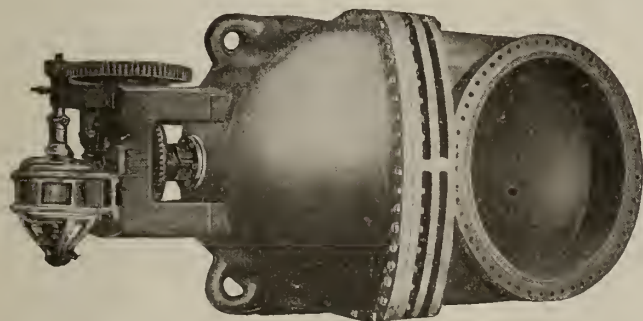


FIG. 517. COFFIN ELECTRICALLY OPERATED GATE VALVE
Ball bearing yoke

Other Products.

Coffin gate valves furnished in all sizes for steam and water, and arranged for hand, hydraulic or electric operation.

Coffin foot valves furnished in all standard sizes with solid bronze flaps and bronze seats, with or without strainers.

Coffin flap valves, bronze mounted, spigot or flange end, single or double pivot.

Coffin check valves, bronze mounted, single or multiport, flange or hub end.

Coffin shear gates, bronze mounted, spigot or flange end, notched lifting handle with wall loop.



FIG. 451. COFFIN FLAP VALVE

Single pivot; flange end;
bronze mounted



FIG. 69. COFFIN FOOT VALVE WITH STRAINER



FIG. 51. COFFIN SHEAR SEWER GATE

Bronze seats

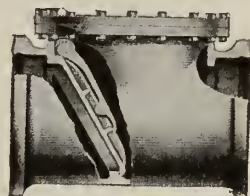


FIG. 10. COFFIN CHECK VALVE

Single flap; hub end

Some Recent Large Installations.

Norfolk Navy Yard Dry Dock—Five 8' x 8' and five 7' x 9' Sluice Gates, operated by oil cylinders.

Philadelphia Navy Yard Dry Dock—Six 8' x 8' Sluice Gates, operated by oil cylinders.

Boston Dry Dock—Six 6' x 8' Sluice Gates, operated by oil cylinders.

Oklahoma City Water Works—Four 9' x 14' electrically operated Sluice Gates.

Utica Gas & Electric Company—Three 66" hydraulically operated Gate Valves.

Connecticut Light & Power Company—Four 8' 6" x 15' 6" electrically operated Sluice Gates.

Southern Power Company—Thirteen electrically driven Hoists, for 18' x 22', 12' x 22' and 10' x 15' concrete head gates.

New Orleans Navigation Canal—Eight 6' x 10' hydraulically operated Sluice Gates, and eight 8' x 8' electrically operated Sluice Gates.

Catskill Aqueduct, N. Y.—30" and 48" Solid Bronze Gate Valves.

U. S. Shipping Board—Electrically operated Sluice Gates and Gate Valves, also Check and Flap Valves for floating dry docks.

COLDWELL-WILCOX COMPANY

Manufacturers of Sluice Gates and Other Water Works Appliances

NEWBURGH, N. Y.

Products.

SQUARE, RECTANGULAR and CIRCULAR SLUICE GATES for all conditions and heads; ROLLER BEARING PEDESTALS and HOISTING STANDARDS.

Also, Modern Sluice Gate Appliances, Electric Hoisting Standards (roller bearing), for either single gate hoists or series.

Plug Drain Valves; Shear and Flap Valves; Screens and Hoists; Flexible Joints.

Experience.

This company is among the oldest designers and manufacturers of sluice gates and water works appliances in America, and is a leader in quality, design and workmanship.

Sluice Gates.

FRAME—Gate frame is cast in one piece, channel shape, for flange connections; flange faces machined to true surface; back flange drilled to bolt direct to masonry, or to special casting or pipe built in the masonry; other flange, bronze mounted, acts as bearing surface of frame and is drilled for guides to be bolted thereto.

GUIDES—Strong, heavy castings, bolted to gate frame. Guides, fitted with stationary bronze wedges (conforming to gate wedges), extend above gate opening.

GATE—Heavy, well-ribbed casting, finished to receive bronze facing to match that on frame. Adjustable bronze wedges, to match those on guides, bring all bearing surfaces in contact at same time and force gate to its seat. When gate moves up, all wedges are immediately released. A hub to which the stem is keyed is on ribbed side of gate (upper part).

STEM—Stem, stationary or rising, is made of cold rolled steel, or bronze; if longer than 24 ft. is required, made in two or more pieces coupled together. Couplings are cross-keyed with taper keys, and keys are drilled at one end to receive cotter pin. Upper part of rising stem is threaded sufficient length to raise gate to full opening; and threaded part is fitted to bronze nut in hoisting standard. The lower part of stationary stem is always bronze and is threaded to engage the bronze nut in gate.

STEM GUIDE BRACKETS—Stems over 15 ft. long are provided with bronze lined adjustable guide brackets, to be set true in line with stem and anchored securely to masonry.

Operation.

Sluice gates are operated by means of roller bearing pedestals. Pedestals are (a) hand wheel, for light sluice gates; (b) geared, for heavy sluice gates, and (c) twin stem, for working two gates with same pedestal.

Compound geared pedestals have two speeds.

They insure (by clutch) either high speed and quick operation, or low speed and great power for starting. Roller bearings (inside pedestal body) reduce friction over 75%.

For further particulars, catalogues will be sent on application.

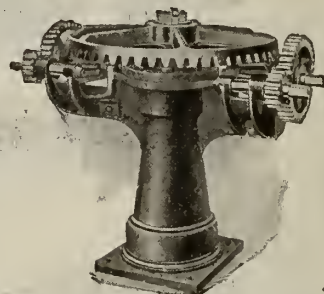


FIG. 82. TWO-SPEED ROLLER BEARING PEDESTAL

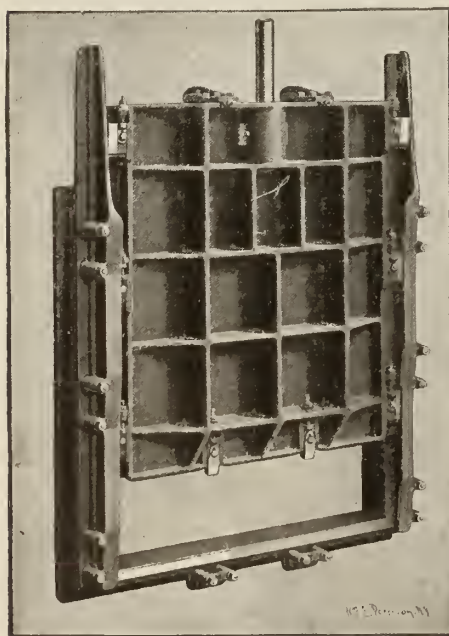


FIG. 6. BACK PRESSURE SLUICE GATE
4 ft. by 4 ft.
Made with adjustable wedges

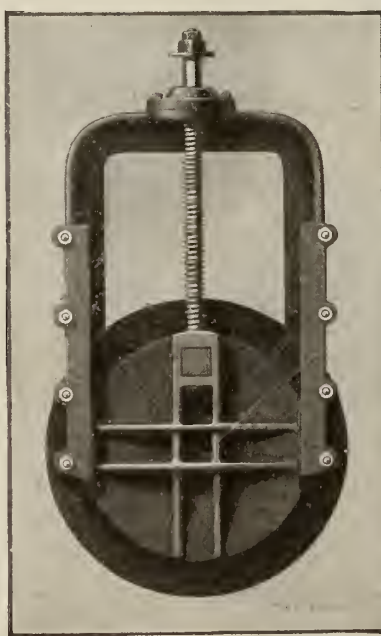


FIG. 10. SELF-CONTAINED SLUICE GATE
12 ins. diameter
All gates bronze mounted

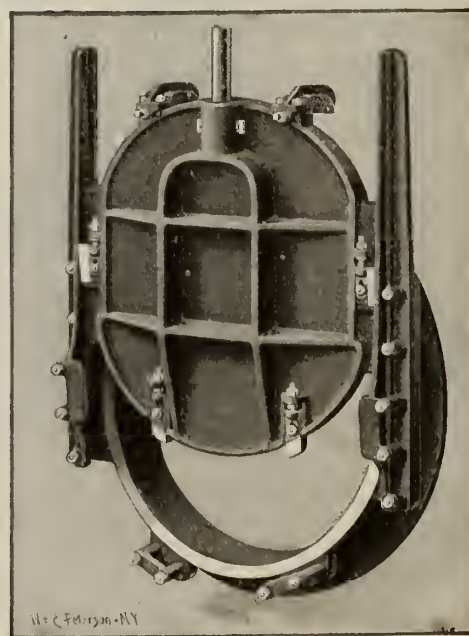


FIG. 48. CIRCULAR SLUICE GATE
42 ins.
For back pressure

FLOWER VALVE MANUFACTURING CO.

Manufacturers of Sluice Gates, Valves and Hydrants

120 Parkinson Street
DETROIT, MICH.

Products.

SLUICE GATES, GATE VALVES, FIRE HYDRANTS, SLEEVES.

Indicator Posts, Valve Boxes, Check Valves, Foot Valves, Shear Valves, Drip Valves, Tide Valves.

Trade-names.

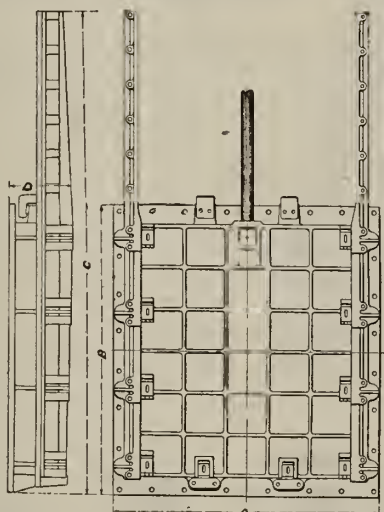
"Michigan" and "Flower."

Service.

This company, because of its unusual manufacturing facilities, is able to ship promptly all standard products, and to furnish with a minimum of delay special supplies designed to meet special conditions. Full data will be supplied on request.

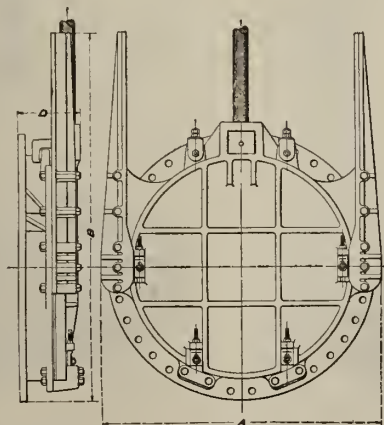
Rectangular and Circular Sluice Gates.

RECTANGULAR—The standard rectangular sluice gates are made in a full range of sizes from 8 by 8 in. up to 120 by 120 in. All are fitted with adjustable bronze wedges.



DETAILS OF RECTANGULAR SLUICE GATE

CIRCULAR—Circular sluice gates are similar in construction to the rectangular, and have the same adjustable bronze wedges. They are built in all sizes, from 6 to 120 in.



DETAILS OF CIRCULAR SLUICE GATE

Gate Valves.

Gate valves of all sizes, from 4 in. up and of all types, high and low pressure, hand operated, geared, and electrically or hydraulically operated, are built by this company.

Special designs are furnished to meet any requirements of service.

All types of valves for hydraulic installations, such as check valves, vertical and horizontal, shear valves, and foot valves are also manufactured in all sizes.



GATE VALVE

Fire Hydrants.

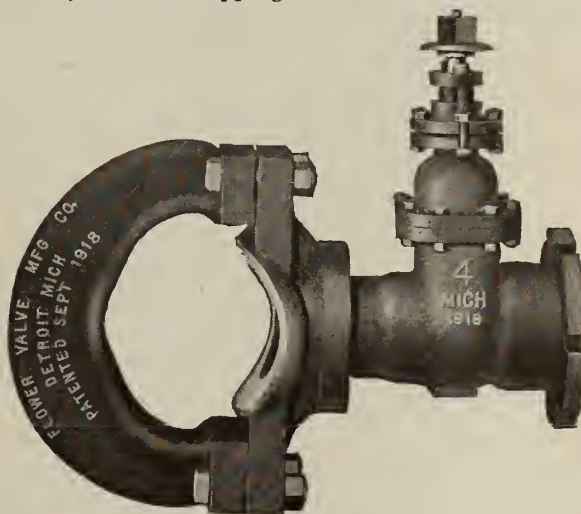
"Michigan" hydrants have been standard in many of the large cities for nearly 70 years. They are built with or without frost cases, and in both compression and compound wedge types.

The Michigan compression hydrant with frost case is the most widely used type. Over a half century of use proves its excellence. It can be removed, for inspection and repair, without digging.

Improved Sleeve.

The lead is dovetailed into the sleeve and fitted to the contour of the pipe. No pouring of lead in the trench is necessary and little if any calking, allowing a dry trench, a shallower one, less labor, greater speed, and a considerable saving in lead.

Any standard tapping machine can be used.



IMPROVED SLEEVE

THE LUDLOW VALVE MANUFACTURING CO.

Manufacturers of Sluice Gates

TROY, N. Y.

For Branch Offices and Foreign Agencies, see page 464

Products.

SLUICE GATES, with Bronze Mountings, Rising and Non-rising Stem, for use in connection with FLOOR STANDS or other similar devices; SHEAR GATES; FLAP VALVES.

For Valves for steam, water, gas, oil, and Hydrants, see pages 464-69.

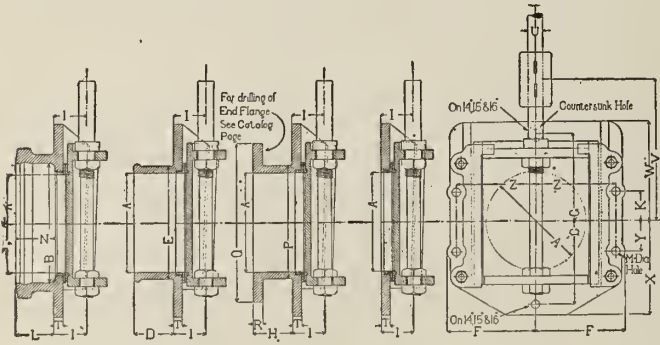
Scope of Use.

The Ludlow sluice gates are designed for use in filtration plants, reservoirs, dams, etc., or places where there is but light or medium pressure. Gates should be so placed that pressure comes on back of gate, forcing same to its seat.

Sluice Gates.

Substantially built and strong in every part, bronze mounted, with bronze gate and seat rings, and with bronze strips on both frame and guide bars. In the non-rising type, threaded stem and stem nut through which stem works are also of bronze.

Gates are constructed with circular, square or rectangular opening, as desired; with flat frame for bolting to wall; with flange neckpiece for bolting to pipe; with hub or spigot neckpiece for calking; or with wall pipe for building into masonry.



DIMENSION DIAGRAM, RISING STEM SLUICE GATES, IRON AND BRONZE MOUNTINGS

Size, in.	4	6	8	10	12	14	15	16	18	20	22	24	28
V	16 3/4	17 3/4	19 3/4	21 3/4	23 3/4	25 3/4	26 3/4	28 3/4	30 3/4	32 3/4	34 3/4	36 3/4	40 3/4
X	5 1/4	7 3/4	8 3/4	9 3/4	11 3/4	13 3/4	13 3/4	15 3/4	17 3/4	19 3/4	21 3/4	23 3/4	27 3/4
W	5 1/4	7 3/4	8 3/4	9 3/4	11 3/4	13 3/4	13 3/4	15 3/4	17 3/4	19 3/4	21 3/4	23 3/4	27 3/4
F	5	7 3/4	8 3/4	9 3/4	11 3/4	13 3/4	13 3/4	15 3/4	17 3/4	19 3/4	21 3/4	23 3/4	27 3/4
Z	4 3/4	6 3/4	7 3/4	8 3/4	9 3/4	11 3/4	11 3/4	13 3/4	15 3/4	17 3/4	19 3/4	21 3/4	25 3/4
K	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
Y	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
G	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
C	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
M	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
U	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
I	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
T	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
L	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
B	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
N	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
D	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
E	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
H	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
O	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
R	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4
P	1 1/8	2 3/8	2 3/8	3	3 1/4	3 3/4	3 3/4	4 1/4	4 3/4	5 1/4	5 3/4	6 3/4	8 3/4

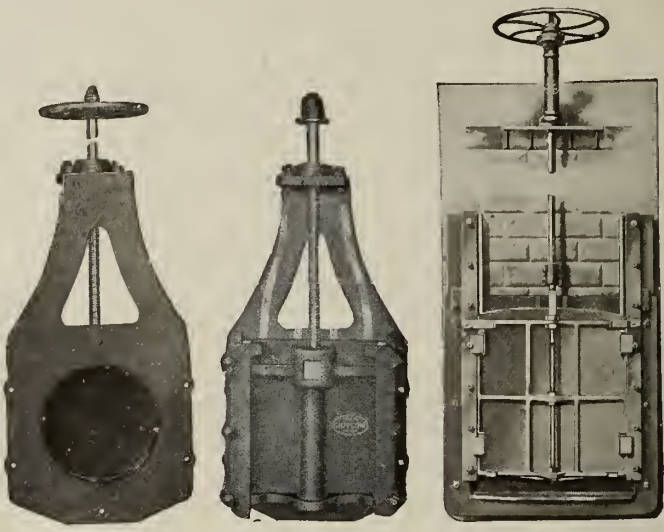


FIG. 215 List No. 21. With Bronze Mountings, Extended Frame and Stationary or Non-rising Stem. Stem can be extended if desired. Sizes: 8, 10, 12, 14, 15, 16, 18, 20, 24, 28 30, 36, 40, 42, 44, 48, 50, 54, 60, 72, in. FIG. 214 Frame and Stationary or Non-rising Stem. Sizes: 8, 10, 12, 14, 15, 16, 18, 20, 24, 28 30, 36, 40, 42, 44, 48, 50, 54, 60, 72, in. FIG. 57* Bronze Mountings, Flat Frame and Rising Stem to Bolt to Wall. *Same sizes as Figs. 215 and 214, and larger

TYPES OF LUDLOW SLUICE GATES

Floor Stands (List No. 20).

Plain standards are used with valves where it is not necessary to know exact position of valve gates (disks). Standards with indicators (Fig. 15) used where it is necessary to know at a glance whether gates are fully or partly opened or closed. Standards with rising stem (Fig. 140) used with sluice gates or slide stem valves.

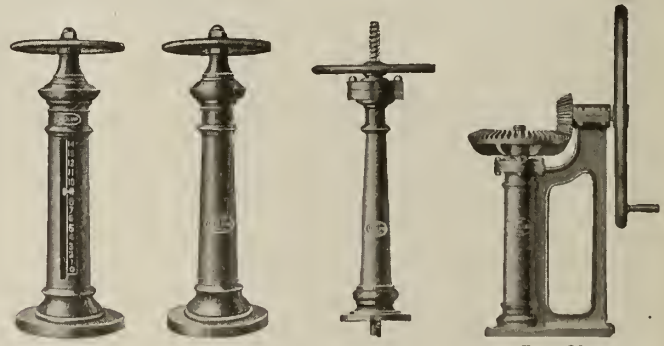


FIG. 15 With Indicator FIG. 119 Without Indicator FIG. 140 With Rising Stem FIG. 203 Geared Operating Standard

FLOOR STANDS



FIG. 15 SHEAR GATE Made all-iron or iron body, bronze mounting. Sizes, 6 to 24 in. FIG. 203 FLAP VALVES Made all-iron or iron body, bronze mounting. Sizes, 3 to 36 in.

THE CUTLER-HAMMER MFG. CO.

Dean Valve Control

MILWAUKEE, WIS.

DISTRICT OFFICES

NEW YORK, N. Y., 50 Church Street, Hudson
Terminal Building
CHICAGO, ILL., Peoples' Gas Building
CLEVELAND, OHIO, Guardian Building

CINCINNATI, OHIO, Gwynne Building
PITTSBURGH, PA., Farmers' Bank Building
PHILADELPHIA, PA., Commonwealth Building
BOSTON, MASS., 77 Franklin Street

PACIFIC COAST AGENTS, H. B. SQUIRES COMPANY

SAN FRANCISCO, CAL.

LOS ANGELES, CAL.

SEATTLE, WASH.

Products.

DEAN ELECTRIC VALVE CONTROL SYSTEM.

Also, Electric Control for Pumps, Compressors, Machine Tools, etc.

Description.

The Dean Control is a complete electrically operated unit for attaching to new and existing steam and water valves to accomplish closing and opening by power. The whole unit is self-contained and in one casing, consisting of a high torque totally enclosed electric motor, geared to combination worm and planetary reduction gearing together with electrical limit switch.

The whole unit is totally enclosed, steamproof and waterproof, to withstand varying weather conditions, and all electrical operating mechanisms are fully protected against moisture.

Four bolts or studs hold the unit onto the valve yoke. Four sizes of Dean Control units are manufactured capable of operating valves from 4 to 72 in. in diameter at low, standard and high pressures.

Operation.

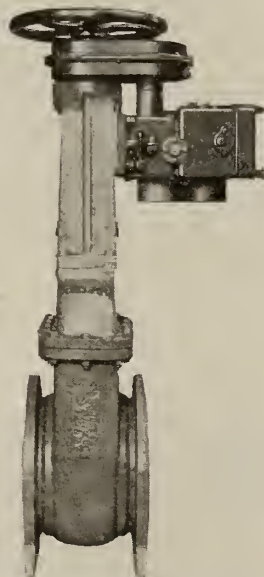
The projecting slow speed shaft carries the gear which meshes into a similar gear attached to the valve stem and is arranged to run at a suitable slow speed to close the valves at the regular rate of 12-in. per minute.

The electrical limit mechanism may be set to stop the valve instantly when it is properly closed and opened and without jamming.

Lubrication is automatic, the gear casing being partly filled with oil, while the high speed motor and worm shafts are arranged with ball bearings.



DEAN VALVE CONTROL
INSTALLED ON 18-IN.
CAST STEEL VALVE



APPLICATION OF DEAN
CONTROL TO RISING
STEM WATER VALVE

Dean Valve Control Station.

Control is obtained by a small station which opens and closes the valves, and shows by "red" and "green" indicating bullseyes, the actual position of the gate at the two extreme points.

Distant control is obtained from any number of points.



STANDARD DEAN CONTROL
STATION

Used singly or with any number of like equipments for one or more points of control

Adaptability.

The Dean unit may be easily attached to existing valves without shutting down the line. Application to rising stem or outside screw and yoke type necessitates welding two brackets onto the valve yoke to carry the Dean unit or securing a new yoke with the brackets already cast on.

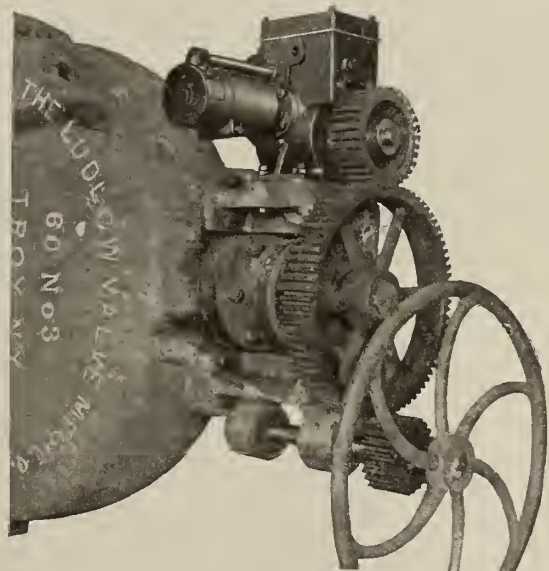
For inside screw or non-rising stem type of valve having gears, a new yoke only is necessary.

All valve manufacturers are prepared to supply complete new parts together with the Dean system necessary for the change over from hand to electrical operation.

Further Information.

For further information on the Dean system write to nearest district office.

Estimates on application.



METHOD OF MOUNTING DEAN ELECTRICAL VALVE CONTROL
ON INSIDE SCREW VALVE

JOHN W. BARTON CO.
Manufacturer of Automatic Steam Traps
Vestry Avenue
CLEVELAND, OHIO

Products.

BARTON EXPANSION AUTOMATIC STEAM TRAPS.

Construction and Operation.

Trap operation is effected by the differences in expansion or contraction between an inner (bronze expansion) sleeve and an outer (steel) casing, due to differences of temperature. The inlet end of the inner sleeve and the corresponding end of the outer casing are rigidly attached to a common fitting, which in turn is connected to the discharge from the system (see illustration). The discharge valve seat forms the free end of the inner sleeve; the floating valve disc and its casing are attached to the free end of the outer casing. As the casing and sleeve are firmly united at one end of the apparatus and are free at the other, movements caused by changes of temperature are entirely independent, one of the other, and will vary with the differences of expansion between them; therefore the seat and valve will approach or recede according to the relative changes in the lengths. Steam entering the inner sleeve causes it to expand and seat against the valve disc sealing the trap. When the steam condenses, the inner sleeve contracts, opens the valve and discharges the condensate. The action of the trap is absolutely positive and automatic. The trap is always water sealed when steam is on the system, and always open when not in use, preventing any accumulation of water. A universal trap for high or low pressure steam, vacuum or gravity systems.

Uses.

Especially adapted for agitators, cookers, dry kilns, dryers, greenhouses, heating systems, kitchen steam tables, laundry machinery, low pressure steam mains, steam hammers, sterilizers, submerged coils, underground tanks, vats, and wherever condensation has to be taken care of.

Advantages of the Barton Trap.

Its simplicity and metal construction throughout. The straight flow and right angle flush valve seat. No intermediate members of expansion such as carbons or liquids or mechanism such as diaphragm, bellow, float, lever, hinge, spring, etc.

Can not blow steam, become airbound, clog up or freeze. Gives continuous discharge of condensate.

AUTOMATIC—When used on a vacuum heating system a vacuum is in between the inner and outer tubes and subjects the outer tube to the temperature of the vacuum. For instance if a vacuum of 15 in. was maintained on the system, the temperature would be 176° Fahr. Should the vacuum become lost for any reason, the vapor discharge of the trap will enter between the two tubes and raise the temperature of the outer tube to 212° —a change of 34°—which causes the outer tube to expand and draw the disc off the

seat, thereby increasing the opening to allow for the loss of the vacuum.

Method of Installing.

Trap is placed in a horizontal position at the lower end of the coil so that the water will flow through the trap. Connect the end of the coil to the opening in the trap marked "inlet." The outlet, (the large opening) may be piped to feed tank, waste outlet, or to a vacuum pump.

Leave valve open and allow steam to blow through the coil pipe until thoroughly cleaned and the trap heated, then close the trap valve until there is no escape of steam. The trap is then set for operation and will require no further attention.

Guarantee.

Guaranteed against defects in workmanship and material during the life of the trap. All worn or defective parts will be replaced free of cost, within two years, upon their presentation.

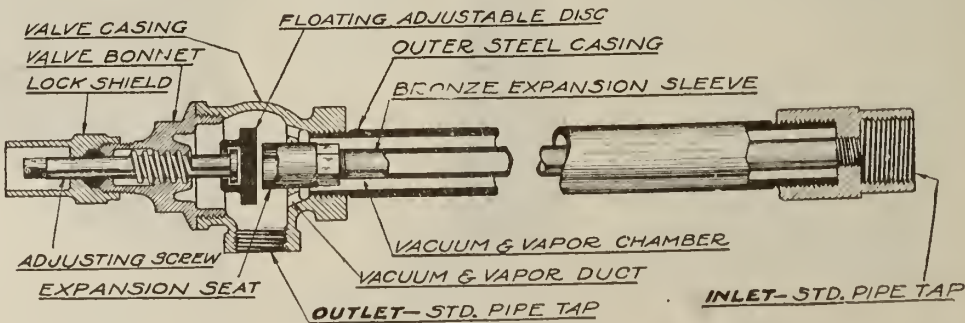


BARTON AUTOMATIC STEAM TRAP

Trap number.....	0	1	2	3	4	5
Inlet, in.	1/2	3/4	1	1 1/4	1 1/2	2
Outlet, in.	1/2	3/4	2	1 1/4	2	2 1/2
Length from end to center of valve, in.	20	26	38	50 1/2	63	76
Min. sq. ft. radiation.....	400	800	1400	2000	4000	8000
Max. sq. ft. radiation.....	1600	3200	5600	8000	16000	32000
Min. lin. ft. radiation.....	1200	2400	4200	6000	12000	24000
Max. lin. ft. radiation.....	4800	9600	16800	24000	48000	96000
Price.....	\$20 00	24 00	32 00	45 00	65 00	80 00

References and Installations.

Youngstown Sheet & Tube Co., Youngstown, Ohio
Brier Hill Steel Co., Youngstown, Ohio
Carnegie Steel Co. (Ohio Works), Youngstown, Ohio
M. A. Hanna & Co., Cleveland, Ohio
The American Sterilizing Co., Erie, Pa.
Ohio Brass Mfg. Co., Mansfield, Ohio
Cleveland Light & Power Co., Cleveland, Ohio
Great Western Oil Co., Cleveland, Ohio
Great Lakes Dredge & Dock Co., Detroit, Mich.
Dangler Stove Co., Cleveland, Ohio
National Stove Co., Lorain, Ohio
Born Steel Range Co., Cleveland, Ohio
Paige Motor Car Co., Detroit, Mich.
American Car and Foundry Co., Chicago, Ill.
Chisholm-Moore Mfg. Co., Cleveland, Ohio
White Co., Cleveland, Ohio
Baker-R & L Co., Cleveland, Ohio
Ducktown Sulphur, Copper & Iron Co., Isabella, Tenn.
Bruce-Macbeth Engine Co., Cleveland, Ohio
Illinois Glass Co., Alton, Ill.



SECTIONAL VIEW OF BARTON AUTOMATIC STEAM TRAP

ATLAS VALVE COMPANY

Manufacturers of Pressure and Temperature Regulators
NEWARK, N. J.

PLANT ENGINEERING & EQUIPMENT CO., INC., DISTRIBUTERS
WITH THE FOLLOWING BRANCHES
(Please write nearest branch office)

BOSTON, MASS., 10 High Street
BRIDGEPORT, CONN., 53 John Street
TROY, N. Y., 422 River Street
ROCHESTER, N. Y., 119 East Main Street
PHILADELPHIA, PA., 527 Commercial Trust Building
BALTIMORE, MD., 311 South Charles Street
ROANOKE, VA., 1225 Clark Avenue
ASHEVILLE, N. C., P. O. Box 667
NEWMAN, GA., P. O. Box 246
BIRMINGHAM, ALA., 113 Hawkins Street, South
LITTLE ROCK, ARK., 211 East Markham Street
PITTSBURGH, PA., 1204 Hartje Building
DETROIT, MICH., 814 Penobscot Building

CLEVELAND, OHIO, 629 Euclid Avenue
CINCINNATI, OHIO, 3621 Columbia Avenue
CHICAGO, ILL., 30 North Michigan Boulevard
NEW ORLEANS, LA., 821 Union Street
KANSAS CITY, MO., 312 Elmhurst Building
MINNEAPOLIS, MINN., 423 Fifth Street, South
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SAN FRANCISCO, CAL., 58 Sutter Street
SAINT JOHN, N. B., CAN., P. O. Box 1053
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HAVANA, CUBA, VICTOR MENDOZA Co., Cuba No. 3, Havana
KINGSTON, JAMAICA, KINGSTON INDUSTRIAL WORKS

Products.

"ATLAS" REDUCING VALVES; PUMP GOVERNORS, VACUUM and PRESSURE REGULATORS, BALANCED VALVES, FLOAT VALVES, SWING JOINT FITTINGS and UNIONS.

"VICTOR" HOT WATER REGULATORS and DAMPER REGULATORS.

"Atlas" Fan Engine Regulators; "Victor" Industrial Thermostats and Humidity Regulators.

"Atlas" Reducing Valve, Type A.

In this valve the auxiliary or pilot mechanism is located outside of the valve body, away from the intense heat and easily accessible for inspection, adjustment or replacement, without using any special wrenches or other tools.

For the most severe continuous or dead-end service—and this company does not hesitate to say that (notwithstanding there is also an "Atlas" valve of the

"internal auxiliary" type) the Type A valve is to be preferred wherever space permits its use.

Changes in initial pressure do not affect the reduced pressure; for the valve is seated by the initial pressure, and therefore the higher this pressure the more tightly is the valve seated.

The Type A valve with cast steel bodies and monel metal internal parts is recommended for superheated steam.

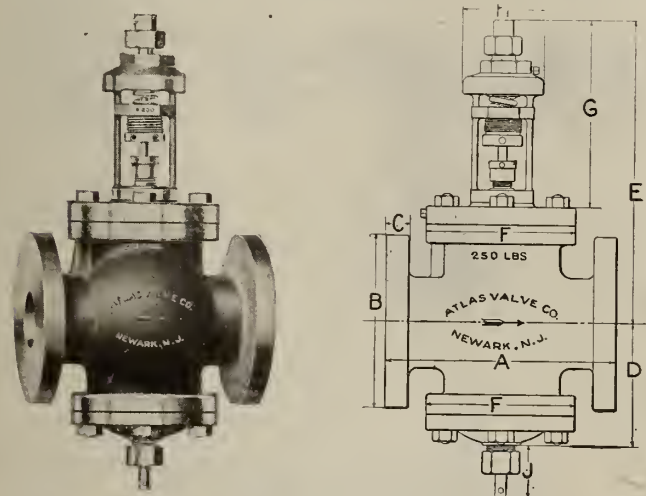
"Atlas" Reducing Valve, Type B.

The Type B valve is made from the same patterns as the Type A except that the auxiliary or pilot valve mechanism is contained within the valve.

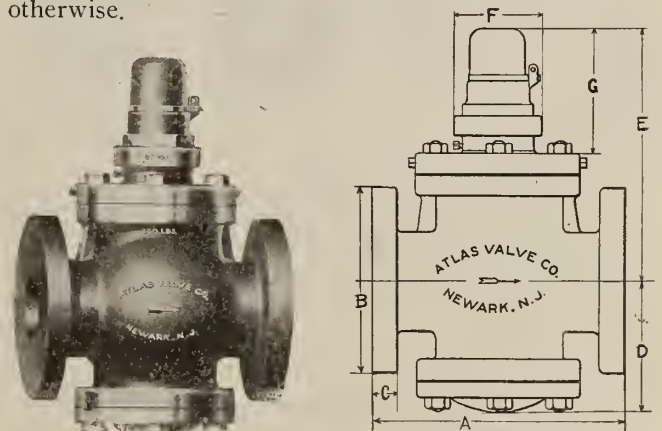
It is intended for marine or other work where space is too limited for the Type A valve.

A cap that can be locked is provided, to prevent unauthorized changes in adjustment.

Valves for reduced pressures below 5 lbs. are equipped with large diaphragms. Bronze body valves flanged, are furnished at slightly higher list prices. Flanged body valves are faced and drilled extra heavy standard unless ordered otherwise.



TYPE A "ATLAS" REDUCING VALVE



TYPE B "ATLAS" REDUCING VALVE

Size	2½"	3"	3½"	4"	4½"	5"	6"	8"	10"
A	10"	10½"	11"	12½"	13½"	15"	17"	20¾"	24"
B	7½"	8½"	9"	10"	10½"	11"	12½"	15"	17½"
C	1"	1½"	1¾"	1½"	1¾"	1¾"	1¾"	1¾"	1¾"
D	5¼"	5¾"	6½"	6¾"	6¾"	7¾"	8¾"	10¼"	12¾"
E	13"	13½"	14¼"	14½"	14¾"	16"	16¾"	18¼"	20½"
F	6½"	7½"	7¾"	8½"	9"	9½"	11½"	14"	16"
G	7¾"	7¾"	7¾"	7¾"	7¾"	8"	8"	8"	8"
H	3½"	3½"	3½"	3½"	3½"	5¼"	5¼"	5¼"	5¼"
J	3"	3"	3"	3"	3"	4½"	5"	5½"	6"

NOTE. Dimensions of Type A valve, ½ in. to 2 in. in size, with screw ends, same as those in table of Type A pump governor.

Size	2½"	3"	3½"	4"	4½"	5"	6"	8"	10"
A	10"	10½"	11"	12½"	13½"	15"	17"	20¾"	24"
B	7½"	8½"	9"	10"	10½"	11"	12½"	15"	17½"
C	1"	1½"	1¾"	1½"	1¾"	1¾"	1¾"	1¾"	1¾"
D	5¼"	5¾"	6½"	6¾"	6¾"	7¾"	8¾"	10¼"	12¾"
E	13"	13½"	14¼"	14½"	14¾"	16"	16¾"	18¼"	20½"
F	6½"	7½"	7¾"	8½"	9"	9½"	11½"	14"	16"
G	7¾"	7¾"	7¾"	7¾"	7¾"	8"	8"	8"	8"
J	3½"	3½"	3½"	3½"	3½"	5¼"	5¼"	5¼"	5¼"
	4½"	4½"	4½"	4½"	4½"	4½"	6"	6"	6"

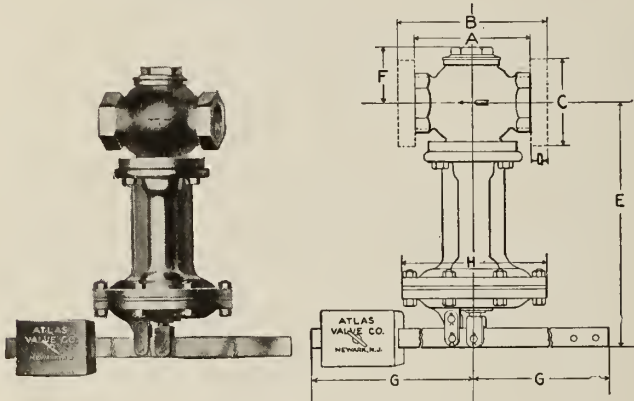
NOTE—Dimensions of Type B valve, ½ in. to 2 in. in size, with screw ends, same as those in table of Type A pump governor.

“Atlas” Lever Operated Reducing Valve, Type C.

A reducing valve of the double seated, balanced valve type, recommended especially for use on low pressure heating systems, dry kilns, vats, cookers, etc., where from 1 to 15 lbs. reduced pressure is carried.

This valve is not recommended, however, for dead-end service, nor for the service where initial pressure is above 125 lbs. For dead-end service a lever operated valve similar to the illustration, but of the single seated type is recommended.

The body of the Type C lever operated reducing valve is of cast iron, with valve seat, spindle, and all wearing surfaces of Government bronze. Up to 2 in. the bodies have screwed ends; those above that size have flanged ends, drilled as ordered.

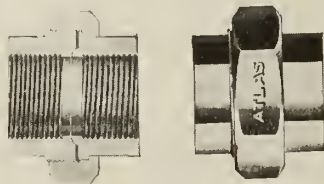


TYPE C “ATLAS” LEVER OPERATED REDUCING VALVE

Size...	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	4 1/2"	5"	6"	8"	10"
A....	4"	4"	4 1/4"	5"	5 1/2"	6 1/2"	8 1/2"	9"	10 1/2"	12"	12 3/4"	14"	16"	19 1/2"	23"
B....							7"	7 1/2"	8 1/2"	9"	9 1/4"	10"	11"	13 1/2"	16"
C....							1 1/8"	1 1/4"	1 1/2"	1 3/4"	1 7/8"	2"	2 1/8"	2 3/8"	2 7/8"
D....							3/4"	3/4"	1"	1 1/8"	1 1/4"	1 1/2"	1 3/4"	1 7/8"	2"
E....	10 1/2"	10 1/4"	10 3/8"	10 5/8"	10 3/4"	11 1/8"	13"	13 1/4"	14 1/8"	15 1/4"	15 11/16"	16 3/8"	17 1/8"	21 3/8"	25 1/8"
F....	2 3/8"	2 3/8"	2 3/8"	2 3/8"	3 1/4"	3 1/4"	4 3/4"	5 1/4"	5 3/4"	6 5/8"	7 1/4"	7 3/8"	8 1/4"	11"	13 3/8"
G....	6"	6"	6 1/2"	7"	7"	8"	12"	15"	16"	18"	18"	18"	18"	18"	18"
H....	6 1/4"	6 1/4"	6 1/4"	6 1/4"	6 1/4"	6 1/4"	8 3/4"	8 3/4"	8 3/4"	8 3/4"	8 3/4"	8 3/4"	8 3/4"	11 1/2"	12"

“Atlas” Bronze Unions.

Carefully made, each individually ground to make a perfectly tight joint. Can be connected and disconnected any number of times without destroying threads or spoiling joint.



UNION INTERIOR AND EXTERIOR

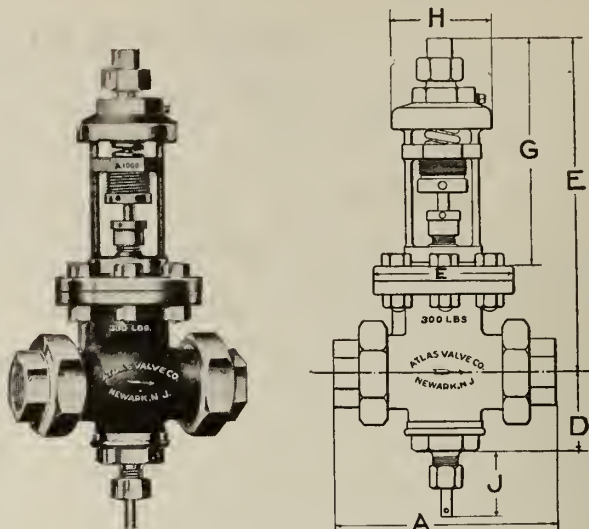
“Atlas” Pump Governor, Type A.

Aside from certain modifications, the Type A pump governor is constructed like all other “Atlas” Type A valves, and is of the auxiliary operated type, in which a secondary or pilot valve operates the main valve by means of a piston.

The modifications are found in the phosphor bronze diaphragm, to provide sensitive operation and at the same time preclude pump pulsation and waterhammer.

A distinctive feature of this type of “Atlas” pump governor is the limit screw, which can be adjusted to limit the speed of the pump and prevent racing.

Guaranteed for all classes of service because of its excellent record, covering many years, and recommended especially for high pressure discharges, elevator pumps, boiler feed pumps, house pumps, air compressors, ammonia and brine pumps, automatic sprinkler and refrigerating plants and any other service where dependability and long life are essential.



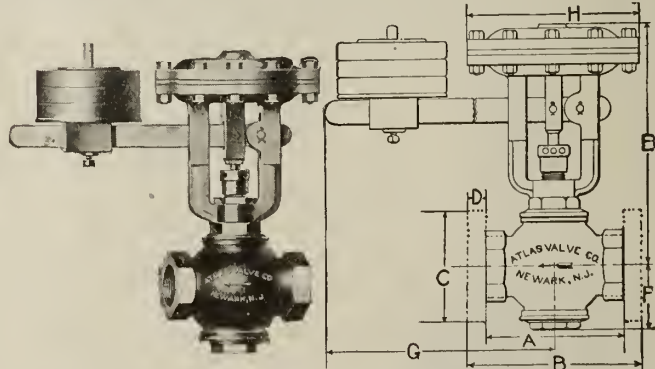
TYPE A “ATLAS” PUMP GOVERNOR

Size.....	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
A.....	6"	6 1/2"	7"	7 1/4"	8 1/4"	9"
B.....	5 1/2"	5 1/2"	6"	6"	7"	7 1/2"
C.....	3 1/4"	3 1/4"	4 1/2"	5"	6"	6 1/2"
D.....	1 3/8"	1 3/8"	1 1/2"	1 1/2"	1 3/4"	1 3/4"
E.....	2"	2"	2"	2"	3 1/4"	3 1/2"
F.....	10 1/2"	10 1/2"	11"	11"	11 1/2"	12"
G.....	3 3/4"	3 3/4"	4 1/4"	4 1/4"	4 7/8"	5 1/8"
H.....	7 3/4"	7 3/4"	7 3/4"	7 3/4"	7 3/4"	7 3/4"
J.....	3 1/2"	3 1/2"	3 1/2"	3 1/2"	3 1/2"	3 1/2"
J.....	2 3/4"	2 3/4"	2 3/4"	2 3/4"	2 3/4"	2 3/4"

NOTE—Dimensions of Type A governor, over 2 in. in size with flange ends, same as dimensions of Type A reducing valve.

“Atlas” Vacuum Pump Governor, Type C.

The double seated, balanced valve in this governor is held open by the weighted lever, and is closed when the vacuum is great enough to lift the diaphragm attached to the top of the valve stem. Used for regulating pumps for vacuum heating systems and for any other service where it is necessary to maintain a uniform vacuum. Valve body is of cast iron, with valve seat and other wearing surfaces of Government bronze.



TYPE C “ATLAS” VACUUM PUMP GOVERNOR

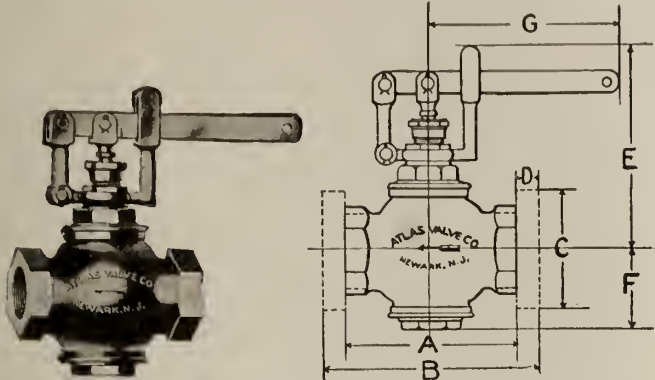
Size.....	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"
A.....	4"	4"	4 1/4"	5"	5 1/2"	6 1/2"	8 1/2"	9"	10 1/2"	12"
B.....							7 1/2"	8 1/2"	9"	9"
C.....							1 1/8"	1 1/4"	1 1/2"	1 3/4"
D.....							3/4"	3/4"	1"	1 1/8"
E.....	8 1/2"	8 1/2"	8 3/4"	9"	9 1/4"	10 1/4"	10 3/4"	15"	15 1/2"	16 1/4"
F.....	2 3/8"	2 3/8"	2 3/8"	2 3/8"	3 1/8"	3 1/8"	4 3/4"	5 1/4"	5 3/4"	6 3/8"
G.....	11"	11"	11 1/4"	11 1/4"	11 3/4"	12 3/4"	24"	30"	32"	36"
H.....	6 1/4"	6 1/4"	6 1/4"	6 1/4"	6 1/4"	6 1/4"	8 3/4"	8 3/4"	8 3/4"	8 3/4"

“Atlas” Balanced Valves, Type C.

This balanced valve is of the double seated type, with beveled discs, and is extensively used in connection with various automatic controlling devices. Its lever yoke can be swung to, and locked in any position, to facilitate operation by the controlling device.

The list prices given cover the standard pattern as illustrated, which has cast iron body with Government bronze trim, seats, and spindles.

Bronze body valves can be furnished, at special prices.

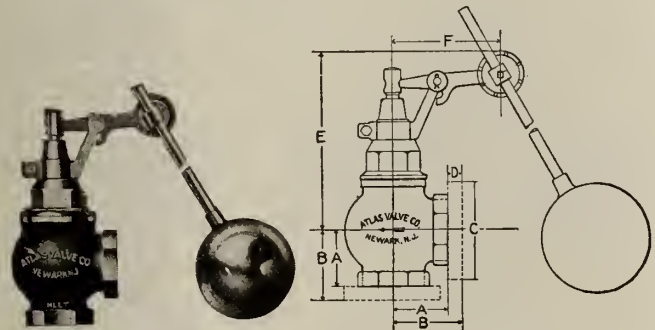


TYPE C "ATLAS" LEVER OPERATED BALANCED VALVE

Size . . .	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	4 1/2"	5"	6"	8"	10"
A.	4"	4"	4 1/4"	5"	5 1/2"	6 1/2"	8 1/2"	9"	10 1/2"	12"	12 3/4"	14"	16"	19 1/2"	23"
B.	4"	4"	4 1/4"	5"	5 1/2"	6 1/2"	8 1/2"	9"	10 1/2"	12"	12 3/4"	14"	16"	19 1/2"	23"
C.	4"	4"	4 1/4"	5"	5 1/2"	6 1/2"	8 1/2"	9"	10 1/2"	12"	12 3/4"	14"	16"	19 1/2"	23"
D.	4"	4"	4 1/4"	5"	5 1/2"	6 1/2"	8 1/2"	9"	10 1/2"	12"	12 3/4"	14"	16"	19 1/2"	23"
E.	5 3/4"	5 3/4"	5 1/2"	6 1/8"	6 1/8"	6 1/8"	10 3/4"	11 1/4"	11 3/4"	12 5/8"	13 1/4"	13 1/2"	14 1/2"	17 1/2"	19 3/8"
F.	2 3/4"	2 3/4"	2 3/8"	2 3/8"	2 3/8"	3 1/8"	4 3/4"	5 1/4"	5 3/4"	6 5/8"	7 1/8"	7 1/2"	8 1/2"	11"	13 1/8"
G.	8"	8"	8"	10"	12"	14"	18"	20"	20"	22"	24"	26"	28"	32"	36"

“Atlas” Float Valve, Auxiliary Operated.

The “Atlas” float valve can be installed on the end of the line directly over or into the tank, or installed in the supply line outside of the tank, and operated by a float in the tank. In either case, the operation of the valve is smooth and positive and guaranteed not to clatter or hammer, and that it will remain droptight under the most severe service.

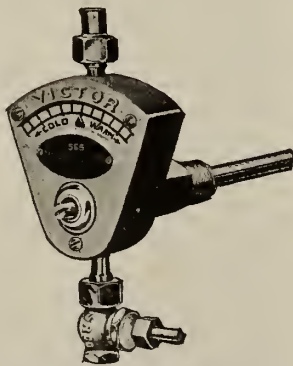


“ATLAS” FLOAT VALVE AUXILIARY OPERATED

Size . . .	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	4 1/2"	5"	6"	8"	10"
A.	1 3/8"	1 1/2"	1 3/4"	2 1/8"	2 1/4"	2 7/8"	3 7/8"	4 1/2"	5"	6"	6 1/4"	6 5/8"	8"	9 3/8"	10 3/4"
B.	2 1/4"	2 1/2"	2 5/8"	3 1/8"	3 3/8"	3 7/8"	4 3/8"	4 5/8"	5 3/8"	5 7/8"	6 1/2"	6 5/8"	8"	9 1/4"	10 5/8"
C.	3 1/4"	3 1/2"	4"	4 1/4"	4 3/8"	5"	6"	7"	7 1/2"	8 1/2"	9"	9 1/2"	10"	11 1/2"	13 1/8"
D.	3 3/8"	3 1/2"	4"	4 1/4"	4 3/8"	5"	6"	7"	7 1/2"	8 1/2"	9"	9 1/2"	10"	11 1/2"	13 1/8"
E.	5 1/4"	5 3/8"	5 1/2"	5 1/2"	5 5/8"	6 1/8"	7 3/8"	8"	8 3/8"	8 3/4"	9 1/4"	9 1/2"	10 1/4"	11 1/2"	12 1/4"
F.	6"	6"	6"	6"	6"	6"	15 1/2"	15 1/2"	15 1/2"	15 1/2"	15 1/2"	15 1/2"	15 1/2"	15 1/2"	15 1/2"

“Victor” Hot Water Regulator.

Simple, indestructible all-metal construction; so sensitive that it operates the largest steam control valve, at any pressure, with 1° variation in temperature; easily adjusted to act at any temperature up to 400°. These are some of the things that make the Victor a most satisfactory device for regulating the temperature of hot water tanks, instantaneous and flash heaters, etc. It will



“VICTOR” HOT WATER REGULATOR FOR ALL PRESSURES

operate the control valve with either water or air pressure.

Tanks and heaters equipped with the “Victor” operate to full capacity because the control valve stays wide open until the desired temperature is reached.

When ordering, state size of steam supply, maximum steam pressure, and the minimum water or air pressure available for operating the control valve.

The control valve used in connection with regulator is single seated, and the upper end of its stem carries the “saucer” upon which the flexible diaphragm acts.

The diaphragm is made of the very best extra heavy heat resisting rubber, and the valve has a Jenkins composition or steam metal disc. In every feature this valve is extra strong, designed for severe service.



“VICTOR” DIAPHRAGM CONTROL VALVE

“Victor” Diaphragm Control Valve.

This valve is described above in conjunction with the “Victor” hot water regulator.

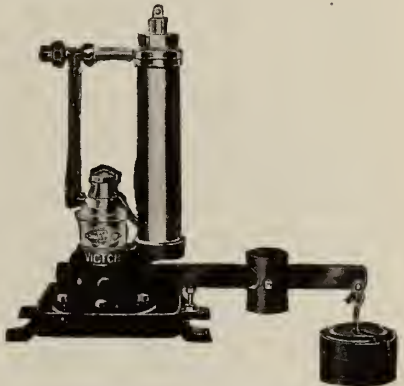
“Victor” Damper Regulator.

The “Victor” damper regulator is designed to regulate the pressure of steam boilers by automatically adjusting the drafts or damper in the smoke breeching.

It is operated by water pressure, acting upon either side of a double acting piston, which by chains is connected to the dampers or drafts.

The water supply to the regulator is controlled by a diaphragm with a weighted lever, which rises and lowers with variations in boiler pressure, thereby operating the pilot valve which applies the water pressure to either side of the piston.

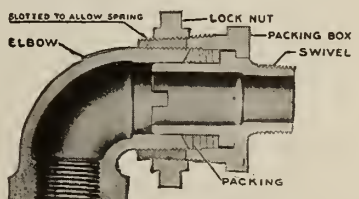
In the high pressure regulator there is a compensating attachment which holds the damper in a balanced position and moves it as much as needed under ordinary variations in boiler pressure, but opens and closes the damper fully only under extreme variations. Regulators are of three classes: low pressure, for pressures up to 25 lbs.; high pressure, for pressures up to 100 lbs.; and extra high pressure, for pressures up to 200 lbs.



“VICTOR” DAMPER REGULATOR

“Atlas” Swing Joint Fittings.

For steam, water, air or gas up to 200 lbs. working pressure, they make connections that are free to turn or swivel through any part of a circle, and remain at the same time perfectly tight. Made in form of elbows, tees and universal fittings.



SWING JOINT ELBOW

THE ASHTON VALVE COMPANY

Safety and Relief Valves, Pressure and Vacuum Gauges

MAIN OFFICE AND WORKS
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Products.

Manufacturers of ASHTON POP SAFETY and RELIEF VALVES; PRESSURE and VACUUM GAUGES; GAUGE TESTERS; ENGINE ROOM GAUGE FRAMES and TABLETS.

Ashton Pop Safety Valves.

The Ashton pop safety valves have been on the market for the past 46 years, and have an established reputation for quality, efficiency and durability. They are made for those who discriminate for dependable service in preference to low first cost. Their principal and special features in design are as follows:

ASHTON LOCKUP POP SAFETY VALVES—In Ashton valves the pop, or blow back, is controlled by a patented hollow screw plug, termed the pop regulator. This projects through the valve body and is located on the back side opposite the outlet, where it is readily accessible for adjustment by means of a wrench, all of which can be done while steam is on the boilers and without taking the valve apart. This obviates the necessity of internal screw rings, which easily clog up and are not handy to operate.

ASHTON KNIFE EDGE LIP WING VALVE—Ashton patented knife edge lip wing is an exclusive form of construction, which insures the most steady and invariable pop, or blow back. The knife edge lip does not extend beyond the seat bushing and thereby increases its lap as the seat wears, which creates a greater pop; but it is made to wear down proportionately to the valve seat, thus maintaining the same relation of inlet to outlet of pop chamber, and requiring the minimum amount of adjustment of the outside pop regulator.

BASE OUTLET CONSTRUCTION—The base outlet construction of Ashton valves makes it possible to take them apart for inspection, cleaning or regrinding without in any way disturbing the outlet pipe, thus saving much time and labor.

CONNECTIONS—Either flanged or screwed inlet and outlet connections may be furnished, and at the same price. No extra charge for special sizes.

SPRINGS—The springs in Ashton valves are of Jessop's best cast steel, and are carefully made by hand and tested in our own factory. When used at the pres-

ures for which they are designed, they will, under ordinary conditions, maintain their strength throughout the life of the valve.

COMPOUND TRIP LEVER—The compound trip lever makes it possible to lift the valve off its seat by hand at all times, being sufficiently powerful to accomplish this regardless of whether there may be pressure on the boiler or not. This lever may also be raised to a vertical position, and held there, as may be desired, to serve as a means for quickly blowing down the boiler pressure.

TESTING CLAMPS—Testing clamps are furnished without extra charge with all Ashton valves. By their use hydrostatic boiler tests can be conducted at any reasonable excess pressure without requiring any change of set pressure adjustment of the safety valve.

MATERIAL—Valve bodies, unless otherwise specified, are of best quality cast iron, levers of malleable iron, and interior working parts of high grade composition.

CAPACITY OF RELIEF—Ashton pop safety valves are regularly made with moderate lift of .10 in., which insures ease of operation, greatest durability and lowest cost of maintenance. They will be furnished, however, with any desired lift and capacity to suit special requirements.

When specified, they are made to conform to the requirements of the new Boiler Code of the American Society of Mechanical Engineers, as well as any state or local regulations.

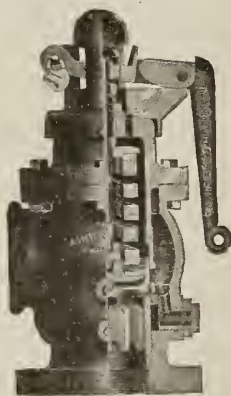
Styles of Pop Safety Valves.

The No. 20 single and No. 20A duplex style valves are those most commonly used on stationary or marine boiler applications. The No. 17 is specially adapted for use on superheated steam. It has steel body, solid nickel seat, nickel wing valve, and outside spring. Any of these styles are made in sizes from 2 to 6 ins., inclusive, for pressures up to 300 lbs. maximum.

For smaller service requirements, other style valves are made with composition body and in sizes from $\frac{3}{4}$ to 3 ins., inclusive, as follows:

No. 6 style with top open discharge, without lever or lockup.

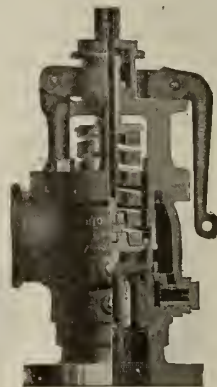
No. 8 style with top open discharge, with lever and lockup.



NO. 20 VALVE



NO. 20A DUPLEX VALVE



NO. 17 VALVE
For superheat



NO. 9 VALVE

No. 9 style with side pipe outlet, with lever and lockup.

No. 14 style with bottom open discharge, with lever and lockup.

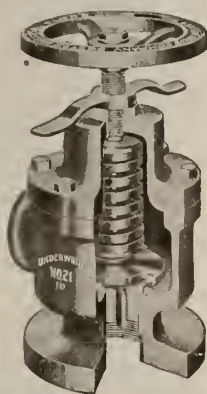
These valves are equally adaptable for use on steam or air; and are for pressures up to 250 lbs., with the exception of the No. 14 style, which is for low pressure service not exceeding 15 lbs., being the style approved by the Massachusetts and Ohio State Board of Boiler Rules for use on boilers not operated by licensed engineers.

For water pressure service, the No. 24 style with composition body in sizes $\frac{3}{4}$ to 3 ins., and the No. 22 style with iron body and extra long spring in sizes 2 to 6 ins. are furnished. Both have top wheel adjustment, and are for pressures up to 300 lbs. For Underwriter service, No. 21 style is approved by the Associated Factory Mutual Insurance Companies for use on Underwriter fire pumps. For high pressure hydraulic service, the No. 25 style with composition body is furnished, or special designs with steel body for any desired size or pressure.

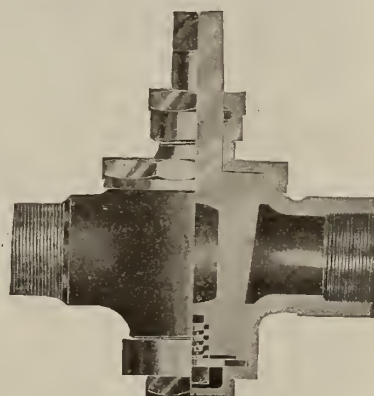
Other style valves are the No. 10 for engine cylinder relief, and the No. 23 for ammonia relief.

The No. 13 improved boiler blow-off valve is made with composition body and designed for long service and ease of operation. The illustration shows the plug cock in its closed position.

The valuable feature is the screw adjustment at bottom, whereby in opening the cock the plug is raised slightly from its seat, turning freely in the case; in closing, the plug is drawn down to its seat, avoiding friction and sticking.



NO. 21 UNDERWRITER RELIEF VALVE



NO. 13 BLOW-OFF VALVE

Ashton Pressure and Vacuum Gauges.

Ashton pressure and vacuum gauges are conscientiously made of the best material. Solid drawn seamless tubes are used. The movements are non-corrosive, having german silver pinions and arbors. Each dial is accurately and separately made to exactly correspond with the spring and movement of the gauge to which it is fitted. The graduations and figures are indented, so that they can be easily read, and will not wear off. The springs are well seasoned to prevent setting.

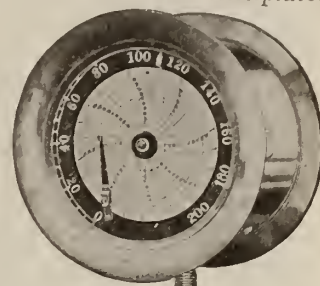
The No. 51 style pressure gauge is commonly used on stationary boilers; is made in all sizes up to 24-in. diameter dial, and with either iron, brass or nickel-plated case. The No. 52 style, with double spring, is similarly made; but more adapted for locomotive,

marine or water pumping service where there is considerable vibration, or rapid fluctuation in pressure.

Recording pressure gauges with 24-hour charts and graduated for any desired pressure are made in two styles, Nos. 73 and 74, and with brass or nickel-plated



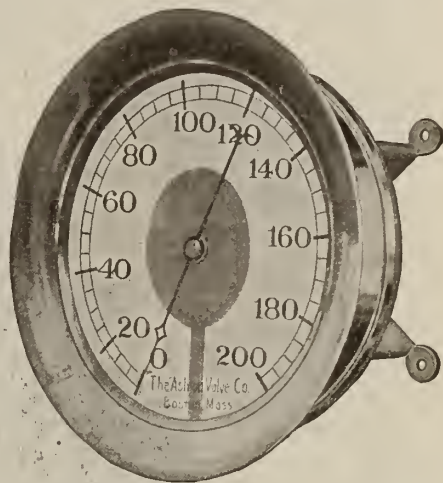
NO. 51 PRESSURE GAUGE



NO. 74 INDICATING AND RECORDING GAUGE

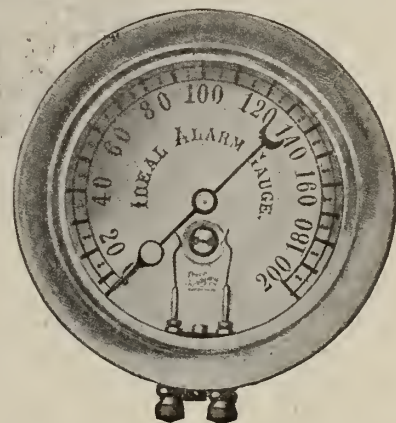
cases. The latter is both registering and recording.

No. 69 is so constructed that an incandescent electric light may be placed behind it, and by means of a glass back the light is directed on to the ground glass dial. This is especially valuable in poorly lighted boiler rooms, or for night operation.



NO. 69 ILLUMINATED DIAL GAUGE

No. 78 is a new design alarm gauge combined with an automatic electric circuit closing attachment, which can be operated to give an electric bell alarm at any desired pressure and at any distance away from the gauge.



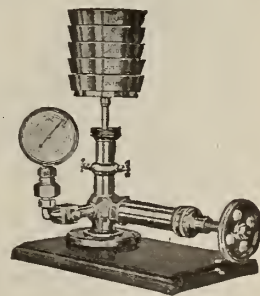
NO. 78 IDEAL ALARM GAUGE

Ashton Dead-Weight Gauge Testers.

The Ashton dead-weight gauge testers are made in several styles and capacities up to 1,000 lbs. These furnish the most accurate and reliable method of testing pressure gauges.

Engine Room Gauge Frames and Tablets.

Furnished in slate, marble or wood, and in special designs of various dimensions to suit any required installation.



NO. 79 DEAD-WEIGHT GAUGE TESTER

BOYLSTON STEAM SPECIALTY CO.

116-122 West Illinois Street
CHICAGO, ILL.

Products.

BOYLSTON PRESSURE REGULATING VALVES; BACK PRESSURE, RELIEF, and TANK VALVES; BOYLSTON STEAM TRAPS; BOYLSTON CONDENSATION, PUMP and VACUUM GOVERNORS; AUTOMATIC WATER SPRAYS.
Automatic and Cut-off Valves; Grease and Oil Extractors, Governors and Traps; Water Feeders, Suction Strainers and Strainer Connections.

Boylston High Pressure Pilot Reducing Valve.

The extreme sensitiveness, simplicity of design and great reliability of this valve have won a reputation for it of highest quality. It can be adjusted from as low as 5 lbs. to within nearly the original pressure, and when the adjustment is made the delivery pressure will remain constant irrespective of variations in initial pressure or volume of discharge.

Pressure is regulated by a single diaphragm provided with a direct regulating spring adjustment. The slightest change of reduced pressure on the diaphragm causes it to open or close a small auxiliary valve acting on a piston which engages the main valve. The area of the piston is double that of the main valve, which causes it to respond instantly to slightest variation in pressure.

Notwithstanding this valve has a very wide range of operation, no part is of delicate construction or can be readily displaced. It occupies no more space than a globe valve and can be made, at additional cost, of steel and nickel suitable for superheat steam.

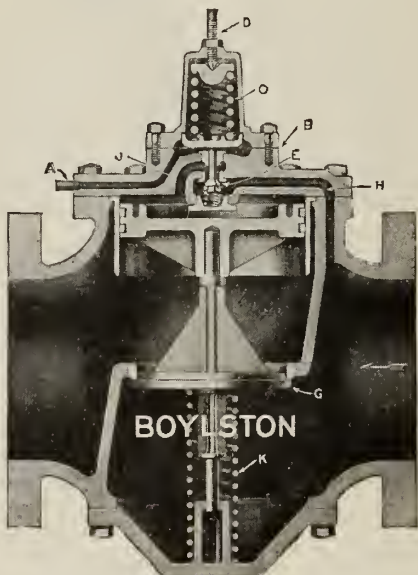


FIG NO. 205
BOYLSTON HIGH PRESSURE PILOT
REDUCING VALVE
DATA

Size, in.	Dist. face to face, in.	Dist. bottom to top, in.	Dist. center to bottom, in.	Weight, lbs.	List prices
1½	5½	11	2½	35	\$45.00
2	10	17¾	4¾	90	55.00
2½	11	18	4¾	96	65.00
3	11¾	18½	4¾	125	82.00
3½	12½	19¼	5¼	152	95.00
4	13½	20	6	175	115.00
5	15	22¼	7	245	148.00
6	16½	24	8	400	190.00
7	18	26½	9	500	250.00
8	20	28	10	705	310.00
10	23	31	11½	900	520.00
12					800.00
14					1000.00

When ordering give pressure desired to reduce from and pressure to reduce to; also service the valve is to perform.

Boylston Improved Pattern Fig. No. 98 Pressure Regulating Valve.

The latest development of the Boylston Fig. 98 pressure regulating valve is shown in sectional view in the accompanying illustration. This valve can be relied upon to meet the conditions of any vacuum, atmospheric or low pressure system of steam heating. It has gone

through nearly 10 years of the century's evolution and its extensive specification by heating engineers at the present time is the best possible evidence of its recognized superior merit.

This valve is suitable for reducing from 125 lbs. boiler pressure on the high side to from 0 to 10 lbs. on the low pressure side, and can be absolutely relied upon to constantly maintain the fixed reduced pressure at which the valve is set on the heating mains. The large diaphragm insures unusual sensitiveness. Long life is secured by the heavy type of construction. The adjustable stop is an exclusive feature and effectually prevents the valve from jumping or pounding.

A characteristic of this valve is that pressure on the heating mains can be regulated or controlled by it at a considerable distance from its location. This is accomplished by running the small ½-in. pipe from the diaphragm chamber to the desired point of operation, which may be as great a distance as 50 ft.

The pressure regulating valve is made in two styles: with increased size outlet and with inlet and outlet of the same size. All castings and parts of these valves are machined by special tools and are interchangeable.

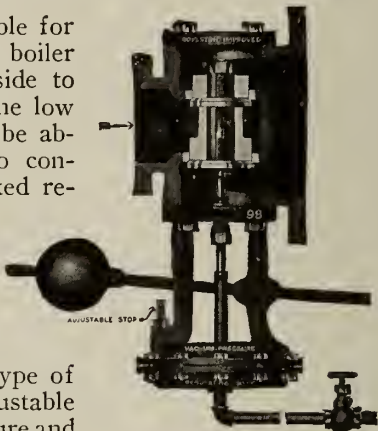


FIG NO. 98
BOYLSTON IMPROVED
PATTERN PRESSURE
REGULATING VALVE

DATA, FIG. NO. 98 PRESSURE REGULATING VALVE
INCREASED OUTLET PATTERN INLET AND OUTLET SAME SIZE

Diam. inlet, in.	Diam. outlet, in.	Dist. face to face, in.	Dist. center of diaphragm to center of inlet, in.	Weight, lbs.	List prices	Diam. pipe openings, in.	Dist. face to face, in.	Dist. center of diaphragm to center pipe opening, in.	Weight, lbs.	List prices
1	2	4½	10	75	\$33.00	¾ x ¾				\$30.00
1½	2½	7¼	10½	80	42.50	1 x 1				30.00
1½	3	7¾	10½	90	53.50	1¼ x 1¼				33.00
2	3	7¾	10½	100	65.00	1½ x 1½				38.00
2	4	7¾	14½	115	72.00	2 x 2				50.00
2½	5	8	15	130	96.00	2½ x 2½	7½			57.00
3	5	8½	15	140	115.00	3 x 3	8½	15	100	72.00
3	6	8½	15½	160	126.00	3½ x 3½	9½	15½	140	85.00
3½	7	11	16	180	140.00	4 x 4	11	15½	160	100.00
4	6	11	16	190	140.00	5 x 5	11¾	15½	185	135.00
4	7	11½	16	198	160.00	6 x 6	12¾	17½	216	180.00
4	8	11½	16	210	187.50	7 x 7	13½	17	232	225.00
5	8	11¼	16	230	200.00	8 x 8	14½	18½	340	275.00
5	10	12	16¾	260	242.00	10 x 10	16½	19½	420	350.00
6	8	13	17½	290	275.00	12 x 12	18½	22	565	470.00
6	10	13¼	17½	350	300.00					
6	12	13¼	17½	365	325.00					
8	14	15	19½	490	400.00					
8	16				500.00					

Sizes 1x2 in. made with screwed ends only. Sizes 1½x2½ in. to 2x4 in. made with inlet end screwed, and outlet end flanged. All larger sizes have both ends flanged.

Sizes 1, 1¼, 1½ and 2 in. made only with screwed ends. Size 2½ in. and larger made with flanged ends.

The Boylston Steam Trap.

The present Boylston steam trap is the result of over 30 years' experience in the steam trap business. It combines capacity, durability and positiveness of operation with a design affording easy accessibility to all wearing parts. It is "get-at-able" and quick repairable.

Other features of its construction are the longevity of the seat and disk combined with the ease and cheapness of renewals, which are accomplished by taking the nuts off of two bolts and removing the cap.

As shown in the accompanying phantom view, the Boylston trap employs the open bucket non-collapsible float, dispensing with complicated mechanism such as collapsible floats, counterbalancing weights and multiple levers, simplifying the design and affording a trap of greater capacity.

All castings and parts of Boylston steam traps are accurately machined to templets and are interchangeable. Material used in seat and valve disk, the only wearing parts, is Boylaney metal, the hardest known non-corrosive metal. All other castings are charcoal gun iron.



Figs. No. 213 and No. 214
BOYLSTON STEAM TRAP

DATA, IMPROVED STEAM TRAPS

Number.....	1	2	3	4	5	6
Pipe connections, in.....	3/4	1	1 1/4	1 1/2	2	2 1/2
Capacity of water per hour, lbs.....	750	1,700	2,700	3,800	6,600	7,500
Capacity of radiation, sq. ft.....	3,200	3,500	7,000	10,000	16,000	20,000
Capacity lin. ft. 1-in. pipe.....	6,000	10,000	15,000	25,000	40,000	50,000
Style A, in.....	12 1/4	13 1/2	15 7/8	17 1/2	19	20 1/2
Style B, in.....	9 3/8	10 1/2	12 1/2	13 1/2	14 1/2	15 1/2
Style C, in.....	8	9	10 1/2	11 3/8	13 3/8	14 3/4
Style D, in.....	5 1/4	5 7/8	7	7 7/8	8 1/2	9 1/4
Style E, in.....	10 3/4	12	14 1/2	15 1/2	17	18 1/4
Weight, high and low pressure, lbs.....	70	90	150	180	225	298
Weight, extra heavy, lbs.....	95	115	170	210	290	365
List prices.....	\$25.00	35.00	45.00	60.00	80.00	100.00

Boylston steam traps are made in four classes:
Style A, Fig. 214, for pressures ranging from 1 lb. to 30 lbs.
Style AA, Fig. 213 1/2, for pressures ranging from 30 lbs. up to 75 lbs.
Style B, Fig. 213, for pressures ranging from 75 lbs. to 150 lbs.
Style C, Fig. 215, extra heavy pattern for pressures ranging from 150 lbs. to 250 lbs. per sq. in.

Boylston Patent Vacuum Pump Governor.

For regulating the speed of vacuum pumps and controlling the amount of vacuum carried in the heating system. The simplest vacuum pump regulator ever designed, extremely sensitive and positive and reliable in action. This vacuum governor is guaranteed to regulate to within a fraction of an inch of vacuum. Diaphragm mechanism can be turned to any one-quarter of a circle on the valve body bonnet.

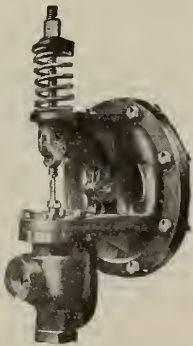


FIG. No. 238
BOYLSTON PATENT
VACUUM PUMP
GOVERNOR

Richter Automatic Water Spray.

This water spray is designed for use in the suction pipe of the vacuum pump of a vacuum heating system for condensing the steam so that the required vacuum may be maintained. It is extremely compact and is a cheap and reliable automatic means of doing this work. The nozzle is equally efficient on a small or large volume, and with a constant change of volume the spray adjusts itself automatically to meet the varying requirements. It automatically adjusts itself to any pressure or volume and is positively self-cleaning.



FIG. No. 240
RICHTER AUTOMATIC
WATER SPRAY
Size of pipe threads, 2 1/2 in.
Each, \$50.00 list

Boylston Junior Regulating Valve.

One of the most compact, sensitive and durable pressure regulating valves on the market. Suitable for reducing pressure of steam, air, gas or water. Renewable and readily replaced. Will work upside down or can be placed in a vertical pipe if necessary. Made in either straight or angle pattern. When ordering, mention whether for steam, air, gas, hot or cold water, also give initial pressure and about pressure desired on outlet or reduced side. Made in two styles: No. 88, single seat, and No. 89, double seat. No. 89 is for steam pressure only and has balanced double seated valve.



FIG. No. 86
BOYLSTON JUNIOR
REGULATING VALVE

DATA, JUNIOR REGULATING VALVES

Size, in.....	3/8	1/2	3/4	1	1 1/4	1 1/2	2
List prices.....	\$22.00	22.00	24.00	26.00	30.00	35.00	44.00

Universal Pattern Noiseless Back Pressure Valve.

Boylston universal back pressure valves are noiseless in operation, perfectly tight when closed and have the full area opening of the pipe to which they are connected. A feature is the spring loading mechanism connected with the outside oil dashpot, which insures the valve working perfectly noiseless both in opening and closing. It dispenses with the inside dashpot, which frequently sticks and permits pressure to increase to a dangerous point. Sizes 8 in. and larger are made with double seats, or semibalanced, thus dispensing with the heavy weights required to load a large single seated valve for high back pressures.



FIG. No. 234
UNIVERSAL PATTERN NOISELESS
BACK PRESSURE VALVE

Catalogue.

The complete line of Boylston steam specialties is described in Catalogue No. 14. Write for it.

G. M. DAVIS REGULATOR CO.

Manufacturers of Valve Specialties for the Automatic Regulation of Pressure

418 Milwaukee Avenue
CHICAGO, ILL.

NEW YORK BOSTON PHILADELPHIA BRANCHES PITTSBURGH BALTIMORE SAN FRANCISCO

Products.

DAVIS REDUCING VALVES; STOP and CHECK VALVES; CONDENSATION RECEIVER and PUMP GOVERNOR; BALANCED, FLOAT, BACK PRESSURE, WATER CONTROL and EXHAUST, RELIEF VALVES; STEAM TRAP; COMBINATION BACK PRESSURE and RELIEF VALVE; SPECIAL VALVES.

Pump Governor; Vacuum Pump Governors; Valves: Victor Air, Altitude, Non-return Bleeder Line, Emergency Stop, Balanced Relief for steam, air and water; Regulators: Damper, Flow; Fluid Level Controller; Valve Floor Stands.

Stop and Check Valves.

Davis Class C valve has outside oil dashpot and counterweight lever. Will not stick on account of scale formation or expansion of parts. Has indicator, and may be tested by hand. Made in sizes from 2 to 12 ins., with extra heavy flanged ends, in globe and angle patterns.

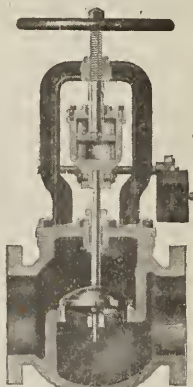


FIG. 233
STOP AND CHECK VALVE

PRICE LIST AND DIMENSIONS

Size, ins.	2	2½	3	3½	4	4½	5	6	7	8	10	12
List price.	\$45	48	50	55	60	65	70	90	120	140	190	250
Length, f to f, globe, ins.	9½	9½	14¾	14¾	14¾	14¾	14¾	15½	19½	19½	22½	23½
Length, c to f, angle, ins.	4¾	4¾	7¾	7¾	7¾	7¾	7¾	7¾	9¾	9¾	11¼	11¼
Height, center to top, ins.	14½	14½	22	22	22	28	28	28	30½	38½	38½	38½

Back Pressure Valve.

The original noiseless back pressure valve. Has piston type inner valve which is semibalanced. Operates without injury to seats. Only comparatively small counterweight required to maintain any reasonable back pressure. Valve may be used horizontally or vertically. Has full pipe area through seats, and may be held open permanently.

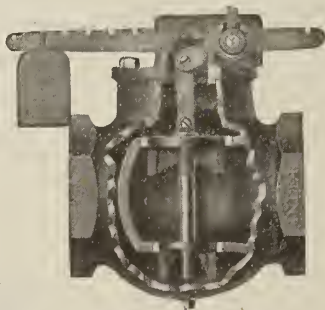


FIG. 217
BACK PRESSURE VALVE

PRICE LIST AND DIMENSIONS

Size, ins.	2	2½	3	3½	4	4½	5	6	7	8	9	10
List price.	\$14	16	18	22	25	30	40	60	80	100	120	145
Length, f to f, scd., ins.	7½	7½	8¾	9¼	10¼	11	12	13½	15	17	20	20
Length, f to f, flgd., ins.	8¼	8¼	8½	9	10	11	11½	13	14½	16½	19	19

Size, ins.	12	14	15	16	18	20	22	24	26	28	30
List price.	\$220	345	400	465	600	750	900	1050	1200	1400	1600
Length, f to f, scd., ins.	22¼	24	24	27½	29½	30½	38	38	48	48	47
Length, f to f, flgd., ins.	22	24	24	27½	29½	30½	38	38	48	48	47

Combination Back Pressure and Relief Valve.

For use with engine or turbine that is run both condensing and non-condensing. Will hold tight under high vacuum, and may be set to maintain a back pressure. May be used in either horizontal or vertical position, preferably in horizontal. Sizes from 6 to 36 ins.

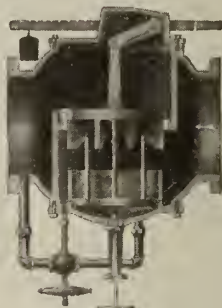


FIG. 227
COMBINATION BACK PRESSURE AND RELIEF VALVE

Balanced Valve.

Has balanced piston disc, and should be operated by some force applied to lever. Used largely as water inlet valve on feed water heaters. Will handle steam, air, gas, water and other fluids. Sizes up to 1½ ins. have swivel head so that lever may be shifted in any direction. Larger sizes may be so equipped when necessary.

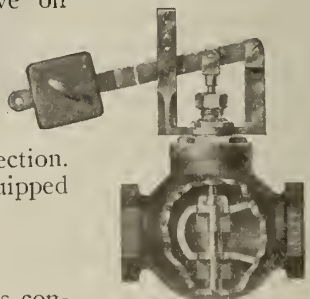


FIG. 212
BALANCED VALVE

Float Valve.

Automatically maintains constant water level in a tank. Has single seated inner valve, and is tight when closed. Disc and seat are renewable. Valve will not stick. No leather cup packing used. No leakage from top of valve to run down over body. Inner valve and cylinder of iron body valves are sherardized and will not rust.

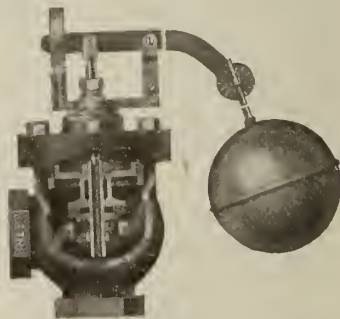


FIG. 214
FLOAT VALVE

Reducing Valves.

Made in two general types—piston and diaphragm. Both may be had in globe and expanded outlet patterns, having screwed ends from ½ to 6 ins., and flanged ends from 2 to 14 ins. Valves Nos. 1, 2 and 3, standard piston type, are constructed for reduction of any initial pressure up to 200 lbs. down to any delivery pressure between 40 lbs. and 1 lb. Valves for air or water and those for greater delivery pressure than 40 lbs. constructed especially for the service.

P & W diaphragm type designed for reduced pressures of 5 lbs. or less. Having rubber diaphragm of large area it is very sensitive, and is used largely on vacuum and low pressure heating systems.

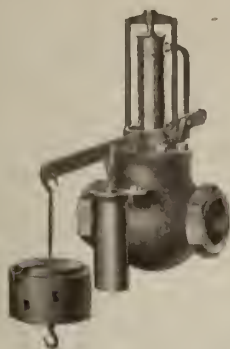


FIG. 203
NO. 2 REGULATOR



FIG. 211
P & W REGULATOR

Globe types
PRICE LIST AND DIMENSIONS

Size, ins.	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2
List price No. 1	\$20	20	22	24	25	30	35	40	50
List price No. 2	\$24	24	26	28	30	35	40	46	56
List price P. & W.	\$30	30	32	35	37	45	60	65	80
Length, f to f, scd., ins.	3 1/4	3 1/4	4	4 1/2	6 1/4	7 1/8	7 1/8	9 1/4	10 3/4
Length, f to f, std. fldg., ins.						7 1/8	7 1/8	9 1/4	10 3/4
Length, f to f, ex. hvy. fldg., ins.						8 3/8	8 3/8	10	11 1/2

Size, ins.	4	4 1/2	5	6	7	8	10	12	14
List price No. 1	\$60	70	75	100	135	175	275	400	500
List price No. 2	\$68	80	85	111	146	187	288	414	516
List price P. & W.	\$100	120	135	175	220	285	360	500	700
Length, f to f, scd., ins.	10 1/4	12	12	13		16 3/4	18 1/2	22	24 1/2
Length, f to f, std. fldg., ins.	10 1/4	12	12	13	14	16 3/4	18 1/2	22	24 1/2
Length, f to f, ex. hvy. fldg., ins.	11 3/4	12 3/4	12 3/4	13 3/4	14 3/4	17 3/4	19 3/4	23 1/2	25 3/4

The No. 1 regulator is the same as the No. 2 except that it is not equipped with an oil dashpot.

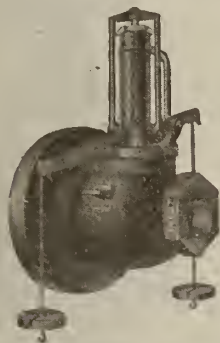


FIG. 205
NO. 3 REGULATOR

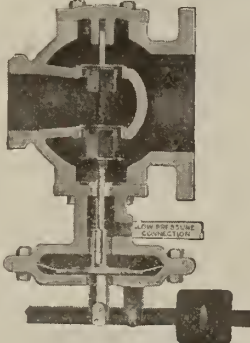


FIG. 210
P & W REGULATOR

Expanded outlet types
PRICE LIST AND DIMENSIONS

Size, ins.	1 1/2x3	2x3	2x4	2 1/2x5	3x5	3x6	3 1/2x7	4x6	4x7	4x8	5x8
List price No. 3	\$40	45	50	65	75	85	100	110	125	135	155
List price P. & W.	\$50	55	60	70	85	100	115	130	145	160	170
Length, f to f, ins.	7 1/4	8	8	9	9 3/4	10	10	10 3/4	10	12 1/2	12

Size, ins.	5x9	5x10	6x8	6x10	6x12	8x10	8x14	8x16	10x16	10x20
List price No. 3	\$175	195	220	250	280	325	360	400	450	500
List price P. & W.	\$185	200	230	270	300	350	400	425	450	500
Length, f to f, ins.	15	15	13	17 1/2	17 1/2	16 3/4	20 1/2	20 1/2	18 1/2	18 1/2

Sizes 2x4 and less have screwed ends; 2 1/2x5 to 3x6 have inlet screwed and outlet flanged; 3 1/2x7 and larger have both ends flanged.

Condensation Receiver and Pump Governor.

Intended to receive the returns from a heating system and serve as automatic governor to a pump returning condensation to boiler. May also be used to maintain constant water level in a tank. Has open cast iron float, and is made in five sizes having capacities to handle from 5,000 to 40,000 sq. ft. of radiation.

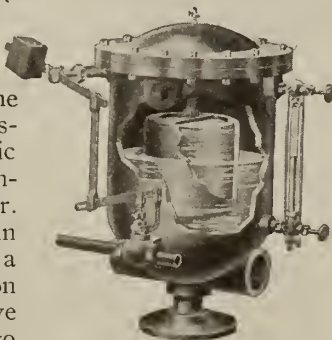


FIG. 242
CONDENSATION RECEIVER AND PUMP GOVERNOR

Improved Water Control Valve.

Globe and angle patterns—screwed and flanged ends. For any working pressure up to 200 lbs. Constructed same as float valve, but equipped with straight lever and counterweight. Acts exactly the same as a balanced valve. Having single seat, it is tight when closed. Has renewable composition disc. Inner valve operated entirely by inlet pressure. Adapted for use as float operated water inlet valve on feed water heaters.

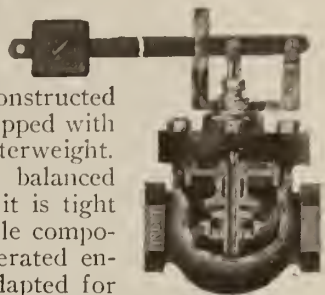


FIG. 216
WATER CONTROL VALVE

Steam Trap.

A general service trap. Has double cone shaped balanced valves, operated by high pressure seamless copper float. Will work on any pressure between 0 and 200 lbs. Valves and seats are renewable, and are made of Tobin bronze. Equipment includes self-contained by-pass valve and an air cock. It is tapped so that a gage glass may be attached if wanted.

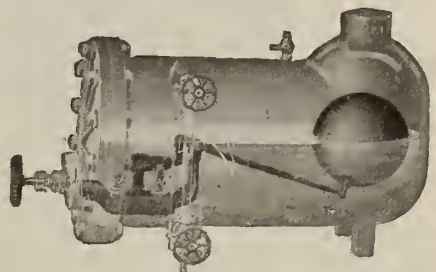


FIG. 240. STEAM TRAP

Exhaust Relief Valves.

For use on exhaust line of condensing engine. While vacuum is maintained they are closed and are airtight. If for any reason vacuum is lost, they open immediately and allow engine to exhaust into atmosphere. Made in horizontal, vertical and angle patterns, and in sizes from 6 to 48 ins., with standard flanged ends.

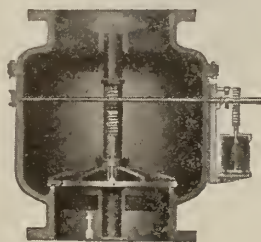


FIG. 224
VERTICAL EXHAUST RELIEF VALVE



FIG. 223
HORIZONTAL EXHAUST RELIEF VALVE

PRICE LIST AND DIMENSIONS

Size, ins.	6	7	8	10	12	14	16	18
List price	\$100	150	170	270	335	415	500	584
Length, f to f, hor., ins.	16	16	20	24	29	32	36 3/4	39 3/4
Length, f to f, ver., ins.	14	14	16	16 1/2	21	24	26	27

Size, ins.	20	22	24	26	28	30	36
List price	\$670	917	1170	1420	1600	2000	3000
Length, f to f, hor., ins.	43 1/4	38	38	48	48	47	66
Length, f to f, ver., ins.	36	39	42	44 1/2	48	52	49

Special Valves.

This company has facilities for making special valves for any service and in all sizes, and invites inquiries. Complete line of standard specialties is shown in catalogue No. 9, which will be gladly sent on request.

JULIAN D'ESTE COMPANY

Manufacturer of Engineering Specialties

26 Canal Street
BOSTON, MASS.

NEW YORK, N. Y., 83 Barclay Street

CHICAGO, ILL., 174 North Market Street

Products.

CURTIS ENGINEERING SPECIALTIES, which include:
REGULATORS: Damper, Temperature, Water, Air, Steam and Pump Pressures, Balanced Valve, Steering Engine.

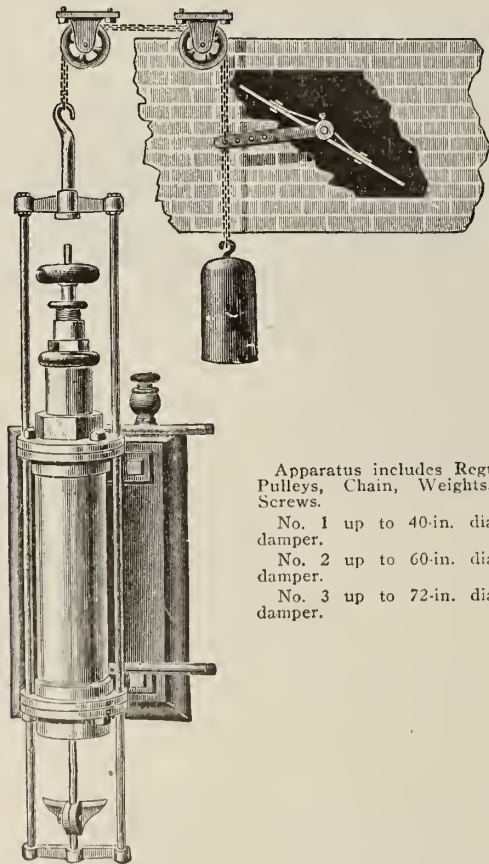
EXPANSION TRAPS; RETURN STEAM TRAPS; BALANCED STEAM TRAPS; BALL COCKS.

Curtis Damper Regulator.

The regulator consists of a gunmetal cylinder, within which is a piston fitted with water packing. The piston rod is connected by a chain to the lever of the damper, on which hangs a weight sufficient to over-haul the piston and open the damper, regardless of any ordinary friction.

When the rising pressure reaches the point of lifting the given load, it permits steam to enter the space over the piston, which slowly pushes it down and closes the damper. Falling pressure at length closes the valve, pressure then passing from top to bottom of the piston, which allows the weight to settle and open the damper.

This regulator is guaranteed to change the damper in either direction on a minimum variation of pressure. It is also a guaranteed fuel saver over the best hand regulation.

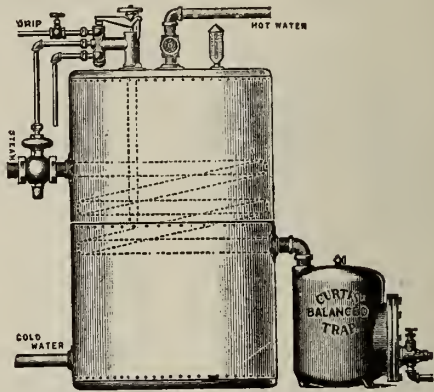


Apparatus includes Regulator, Pulleys, Chain, Weights, and Screws.
No. 1 up to 40-in. diameter damper.
No. 2 up to 60-in. diameter damper.
No. 3 up to 72-in. diameter damper.

CURTIS IMPROVED DAMPER REGULATOR

Curtis Temperature Regulator.

Will control any temperature from 0° to 300°. Easily adapted to steam or hot water boilers, or to tanks for heating water for hotels, baths, or restaurants. One degree change of temperature produces sufficient movement to do the work. Power is unlimited.



CURTIS TEMPERATURE REGULATOR

Sizes from 1 to 8 in.

Curtis Water Pressure Regulator.

For pulp and paper mills, hotels, public buildings, and residences.

Warranted to maintain the pressure desired, with perfect uniformity, in spite of any and all fluctuations in the outside pressure.

This regulator obviates the wear and tear caused by water-hammer and high pressure on all plumbing fixtures and fittings.



WATER PRESSURE REGULATOR

DATA, CURTIS WATER PRESSURE REGULATOR

Size, in.	1/2	3/4	1	1 1/4	1 1/2	2
Height over all, in.	14 1/2	15	15	15 1/2	15 1/2	15 1/2
Diam. diaphragm, in.	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2
Face to face, in.	4 3/4	5 1/2	5 1/2	6 1/2	6 1/2	6 1/2
Diam. flanges, in.	*	*	*	*	*	*
Net weight, lbs.	18	21 1/2	21 1/2	22 3/4		

*Screwed.

Size, in.	2 1/2	3	4	5	6
Height over all, in.	17	17 1/2	24	27	29
Diam. diaphragm, in.	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2
Face to face, in.	7 1/2	10	11 3/4	13 1/2	15
Diam. flanges, in.	*	7 1/2	9	10	11
Net weight, lbs.	34 3/4	57	110	175	200

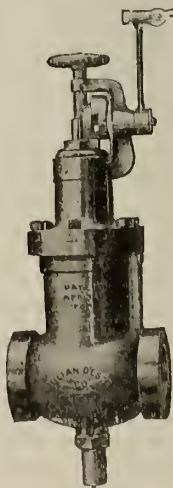
*Screwed.

Steering Engine Regulator for Marine Service.

This regulator prevents racing of the engine, and gives regularly and more quickly the desired speed of change in the rudder from amidships to either extreme port or starboard position. It is also a material aid to the pilot in controlling the ship.

All-bronze; screwed ends.

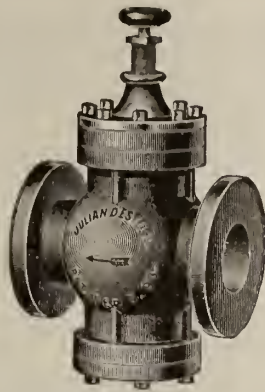
Sizes, 1/2, 3/4, 1, 1 1/4, 1 1/2 and 2 in.



STEERING ENGINE REGULATOR

Improved Steam Pressure Regulator.

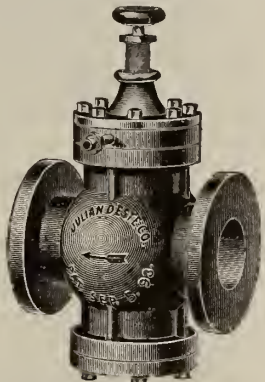
Made entirely of metal; a lock valve and very sensitive. It has no levers, weights, projections, glands or packing. There is no drip or leak of steam or water, and all that passes into it passes through it. Suitable for boiler pressures up to 200 lbs.



IMPROVED STEAM PRESSURE REGULATOR
For sizes, etc., see table below

Improved Pump Pressure Regulator.

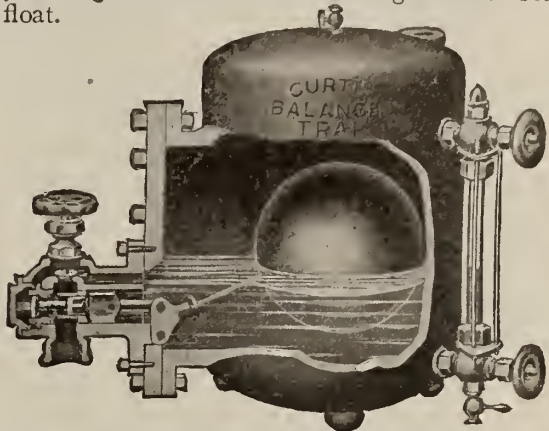
For hydraulic and air pressure, an adaptation of the pressure regulator to the peculiar requirements of a pump pressure regulator. Accomplished by connecting the chamber under the diaphragm to the pipe or tank in which the water pressure is to be controlled, so that any change of pressure in the pipe or tank operates on the diaphragm and closes, or opens, the valve placed in the steam pipe of the pump.



IMPROVED PUMP PRESSURE REGULATOR
For sizes, etc., see table below

Curtis Balanced Steam Trap.

For all manufacturers having vacuum pans in use, for those having a large amount of steam and heavy condensation to contend with, this trap is a valuable aid, working, as it does, without starts or stops which occasion jarring and straining. It is made of close grained cast iron, and is amply strong to withstand 200 lbs. pressure. It allows for the removal of both valve and float by taking off cover plate at the side. The trap is fitted for a glass water gage that does away with guess work in maintaining a water seal for the float.



CURTIS BALANCED STEAM TRAP										
Trap No.	000	00	0	1	2	2½	3	4	5	6
Top to bottom, in. .	11	12	13	14½	15½	17	18	20½	22	22
Front of valve to back of trap, in. .	13½	16½	17½	18½	19½	20¾	22	23½	28	28½
Diam. trap, in. . . .	8	9½	10½	11	12	12½	13½	14½	16½	16½
Diam. cover, in. . . .	8½	9	9	12	12	12	13	13	13½	13½
Outlet and inlet, in. .	½	½	½	¾	1	1¼	1½	2	3	4
Outlet to bottom of trap, in.	0	1¾	1¾	2	1¾	1½	2	1¾	3½	1
Float, in.	5	6	8	8	8	8	8	8	8	8
Weight, lbs.	50	75	82	112	145	168	189	230	385	410

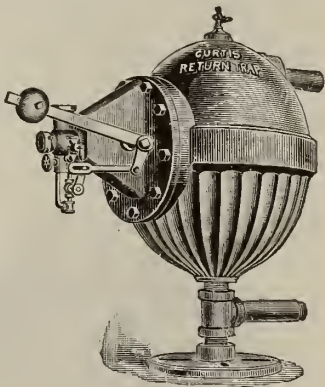
DATA, IMPROVED STEAM AND PUMP PRESSURE REGULATORS

Size, in.	Bronze Body			Iron Body									
	1	1¼	1½	2	2½	3	4	5	6	7	8	10	12
Face to face, in. .	4½	4½	4¾	6¼	8¾	10½	11¼	12¾	14½	16½	18½	21	24
*Diam. flanges, in. .	**	**	**	**	7½	8½	10	11	12½	14	15	17½	20½
Diam. globe, in. . .	2¾	2¾	3	5¼	6¾	7½	8¼	8¾	10½	12¾	15	17½	20
Diam. cover, in. . .	3½	3½	3½	4½	5	6	6¾	7¼	8½	10½	12½	14	16
Center of pipe to bottom, in. . . .	2½	2½	2¾	3¾	4½	4¾	5½	5¾	6½	7½	8¾	10	11¼
Center of pipe to top, in.	7½	7½	7¾	10¾	11¾	12¼	12¾	13½	14¾	16	19½	21¼	23
Net weight, lbs. . . .	10½	11	12	33	64	105	145	167	247	355	490	750	.....

*All flanges standard for extra heavy pressure. ** Screwed.

Curtis Return Steam Trap.

Takes the water from the condensing surface, whether the returns are above or below the water level, and returns pure distilled water into the boiler at a temperature always above 212°, and often as high as 275°. It will effect a saving in fuel over any steam pump performing the same service.



RETURN STEAM TRAP

DATA, CURTIS RETURN STEAM TRAP

Trap No.	1	2	3
Ft. of 1-in. pipe trap will drain	4,000 to 5,000	8,000 to 10,000	15,000 to 20,000
Steam pipe, in. . . .	1	1	1½
Inlet pipe, in.	1	1¼	1½
*Outlet pipe, in. . . .	1¼	1½	2

*In all cases, middle pipe is the outlet.

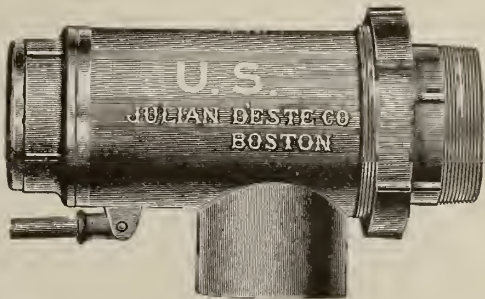
Curtis Expansion Trap.

A practical adaptation of old principles, by means of which the slight difference of temperature between steam and water condensed from it completely controls the valve. When the expansion vessel is in contact with steam it instantly closes the valve, and when water covers it the valve immediately opens and the water discharges, whether at a low or a high pressure of steam.

They are set to deliver at 212°, but can be adjusted to lower or higher temperatures.

U. S. Ball Cock.

Full sized area; valve is balanced; will not hammer even under pulsation of a pump; perfectly noiseless. Renewable seat of bronze metal. Good in any place for high or low pressure.



U. S. BALL COCK, 4-INCH
Sizes ½ to 4 in.

C. A. DUNHAM COMPANY

Manufacturers of Specialties for the Dunham System of Heating

1710 Fisher Building
CHICAGO, ILL.

FACTORIES: MARSHALLTOWN, IOWA; TORONTO, ONT., CAN.

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GLASGOW, SCOTLAND, 60-64 Robertson Street
TOKYO, JAPAN, Central P. O. Box 68

Products.

Specialties for use in connection with the DUNHAM SYSTEM of HEATING, known according to its several adaptable forms as the DUNHAM VACUUM SYSTEM and the DUNHAM RETURN SYSTEM. Both two-pipe systems; and the DUNHAM AIR LINE SYSTEM.

These Specialties are: The Dunham Radiator Trap; Dunham Packless Radiator Valve; Dunham Blast Trap; Dunham Medium Pressure Trap; Dunham Return Trap; Dunham Reducing Pressure Valve; Dunham Oil Separator; Dunham Strainer; Dunham Air Vent; Dunham Vacuum Pump Governor; Dunham Air Line Valve; Thompson Air Line Vacuum Pump.

Dunham Heating Service.

It is three-fold:

Organization;
Service;
Product.

The DUNHAM
HEATING SERVICE

THE COMPANY—The Company, and the organization within it, is strong, the largest engaged exclusively in the manufacture of heating specialties and systems.

SERVICE—This is the Company's strong point. With 35 Branch and Division Offices throughout the United States and Canada, and two complete factories, efficiency service can be rendered. Our Service Departments, with their trained engineers, are at all times ready to co-operate with consulting engineers, architects, and contractors, to furnish special details and information instructive as to the best way of installing and using the Dunham products.

THE DUNHAM PRODUCTS—They are the leaders of their kind, made of the highest grades of suitable materials, by especially trained workmen, in clean, sanitary, well ventilated buildings. They are sold through

the responsible heating trade. Each article will be briefly described.

Dunham Radiator Trap.

The simplicity of the Dunham Radiator Trap is very apparent. It comprises a body, a cover, and thermostatic disc which is secured in the cover. There are no loose parts, no sliding contacts, nothing to gum up, and no guide or pin to obstruct the valve opening. There is a flat valve and seat with liberal valve opening. The position and design of the valve is such that it is self-cleaning. The action of the disc is positive, and the valve seats squarely, like a globe valve, the tightest of all types of valves, and one presenting little opportunity for uneven wear. The body is standardized, also the cover and disc, thus giving the further advantages of interchangeable parts.

The function of the Dunham Radiator Trap is to conserve heat, and thus fuel, by keeping radiation and

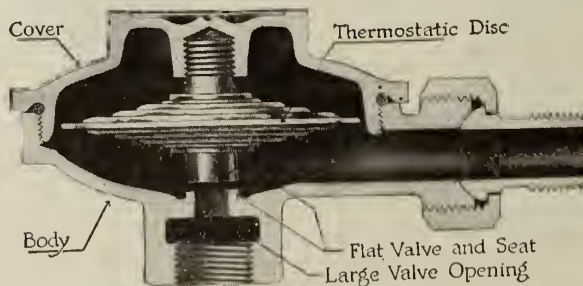


FIG. 1. DUNHAM RADIATOR TRAP

pipng at the point of maximum efficiency. To do this the working part of the trap, the Dunham Thermostatic Disc, must be and always is fully exposed to the actual

Continued on next page

conditions within the radiator, and it therefore responds instantly to any change taking place therein, automatically releasing air and water of condensation and closing to prevent waste of unused steam. It not only saves steam but clears the space which should be occupied by steam from air and water—enemies of high efficiency.

This trap was the first of its kind to be a commercial success, and it has maintained its leadership since 1903. It has therefore stood the test of time.

It is made in 5 sizes, and for steam pressures not to exceed 10 lbs. gage.

The No. 1 and No. 2 traps are for use principally on radiators; No. 3 for large radiators, for pipe coils, and dripping piping; No. 4 and No. 5 for large pipe coils, and dripping steam mains. To determine trap capacity for pipe coils reduce actual surface of coil to equivalent square feet of direct cast iron radiation, the unit in which all traps are rated, by multiplying by 1¼.



FIG. 2. DUNHAM NO. 4 AND NO. 5 TRAP

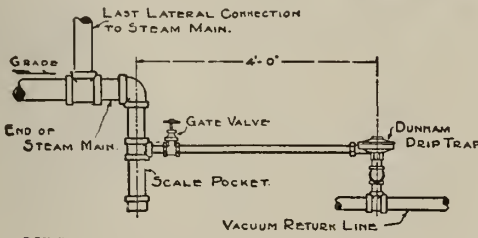


FIG. 3. METHOD OF DRAINING END OF STEAM MAIN IN DUNHAM VACUUM SYSTEM

TABLE A—DUNHAM RADIATOR TRAPS

Size	Pipe connection	Capacity, direct radiation
No. 1	½ in.	100 sq. ft.
No. 2	¾ in.	350 sq. ft.
No. 3	1 in.	450 sq. ft.
No. 4	1 ¼ in.	1500 sq. ft.
No. 5	2 in.	3000 sq. ft.

Nos. 1, 2, and 3 traps made in angle, straightway, right-hand, and left-hand pattern—all made in brass and bronze; Nos. 4 and 5 in angle and straightway pattern only and made of iron.

Dunham Blast Trap.

In design and appearance the No. 6 and No. 7 Dunham Blast Traps are essentially the same as the No. 4 and No. 5 radiator traps, illustrated above. They are designed only for draining blast heating coils. In selecting

capacities be sure and reduce blast coil radiation to equivalent direct radiation by multiplying the actual surface of coil by a factor ranging from 6 to 10, depending upon temperature, velocity and volume of air blown over coils.

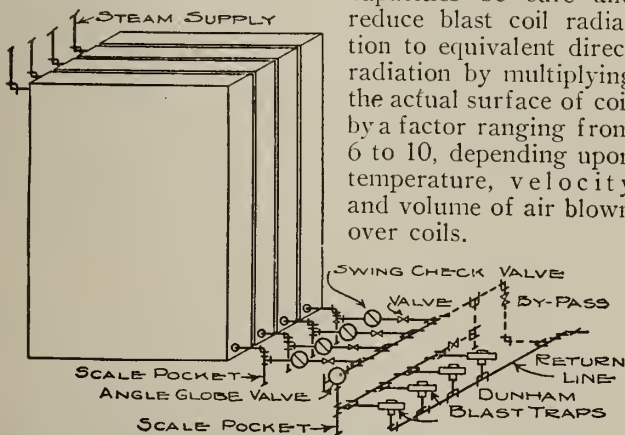


FIG. 4. METHOD OF APPLYING DUNHAM BLAST TRAPS

The No. 8 Dunham Blast Trap is intended for handling large quantities of condensation, and is especially adapted for blast coil work. It combines the Dunham

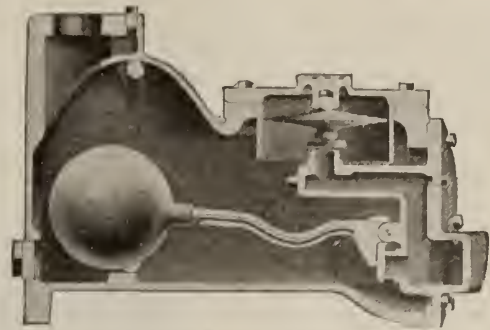


FIG. 5. DUNHAM BLAST TRAP NO. 8

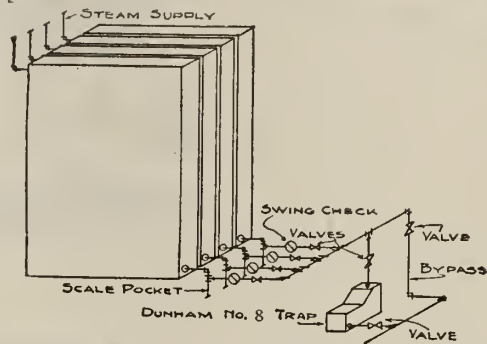


FIG. 6. METHOD OF APPLYING DUNHAM BLAST TRAP NO. 8

TABLE B—DUNHAM BLAST TRAPS

Size	Pipe connection	Capacity, direct radiation	Weight
*No. 6	¾ in.	1500 sq. ft.	12½ lbs.
*No. 7	1 in.	3000 sq. ft.	21 lbs.
No. 8	2 in.	12000 sq. ft.	75 lbs.

*Made in angle and straightway patterns. Made only for pressures up to 10 lbs.

thermostatic principle with the float; it has a double valve and large connections.

Dunham Air Line Valve.

The principle of operation is identical, and design similar, to the Dunham Radiator Trap. Its efficiency is high, and service in connection with air line systems invaluable. Can be furnished with either ⅛-in. or ¼-in. radiator connection. Air piping is required in connection with its use.

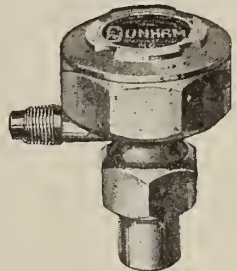


FIG. 7. DUNHAM AIR LINE VALVE

Dunham Return Trap.

The Dunham Return Trap is used to separate the air and water discharged into the dry return piping by the Dunham Radiator Traps, to release the air, and to automatically return the water to the boiler without regard to the pressure carried in boiler or system.

It is a simple, positive acting device, with large valve areas, designed especially for high efficiencies at low heating pressures. Its working parts are protected from dust and dirt, and yet are easily accessible without removing any piping connections.

Dunham Packless Radiator Valve.

This is a bona-fide packless radiator valve and not dependent upon springs and packing rings. The Dunham disc

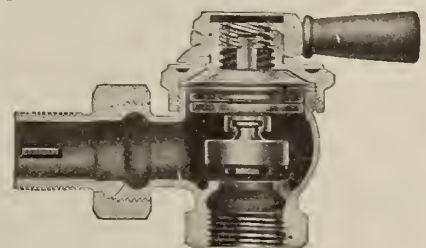


FIG. 8. DUNHAM PACKLESS RADIATOR VALVE

makes this possible. It has a low bonnet and stem and unusual lines, making it attractive in appearance. The valve can be opened or closed in seven-eighths of a turn. It is made only in the angle pattern for use in a top radiator connection. Sizes $\frac{1}{2}$, $\frac{3}{4}$, 1 and $1\frac{1}{4}$ in.

Packless radiator valves are required in all vacuum heating work.

Dunham Reducing Pressure Valve.

This product is so well known and universally accepted that no comment is needed. This valve is made only in standard weight for a pressure range of 125 lbs. down on high side, to 10 lbs. and atmosphere on low side, in straight and expanded outlet patterns.

Dunham Vacuum Pump Governor.

The function of this governor is to control the steam to a steam driven vacuum pump to operate same so as to maintain a certain vacuum in the suction piping. It is used in maintaining a predetermined amount of vacuum in the return piping of a vacuum heating system. Made in all pipe sizes from $\frac{1}{2}$ in. to 2 in., inclusive.

Dunham Medium Pressure Trap, "D" Style.

This embodies the principle so successfully used in the Dunham Radiator Trap, and is just as simple and satisfactory. It is used almost exclusively in hospitals and kitchens for dripping sterilizers and steam cooking apparatus, where steam is used at a pressure not less than 10 lbs. or more than 50 lbs. gage.

Install at least 4 ft. of connecting piping between the point to be dripped and the trap.

TABLE C—DUNHAM MEDIUM PRESSURE TRAPS, "D" STYLE

Size	Pipe connection	Capacity, water per hour	Weight
No. 13	$\frac{1}{2}$ in.	100 lbs.	4 lbs.
No. 14	$\frac{3}{4}$ in.	200 lbs.	15 lbs.
No. 15	1 in.	400 lbs.	25 lbs.

Always state operating pressure when ordering.

Dunham Air Vent.

This device is for the purpose of venting air from water that is under pressure.

It is particularly adapted to heating work where the vacuum pump is discharging water of condensation directly back to the boiler.

Capacity for 5000 sq. ft. of radiation.

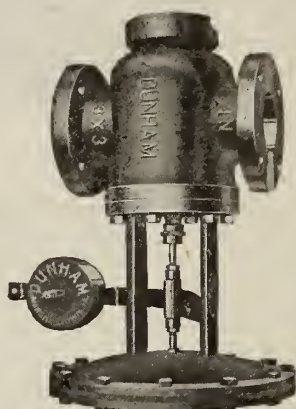


FIG. 9. DUNHAM REDUCING PRESSURE VALVE, STRAIGHT PATTERN



FIG. 10. DUNHAM VACUUM PUMP GOVERNOR

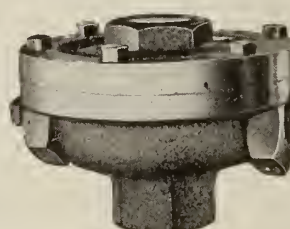


FIG. 11. DUNHAM "D" STYLE MEDIUM PRESSURE TRAP



FIG. 12. DUNHAM AIR VENT

Dunham Oil Separator.

The Dunham Separator made for oil separator service is very efficient.

Where exhaust steam is used for heating purposes the heating efficiency of the steam is materially increased by the use of a good oil separator. In fact, with exhaust steam, the use of an oil separator is imperative in best practice.

The Dunham Separator is made in all sizes from $1\frac{1}{2}$ to 10 in., in horizontal pattern only, with flanged ends.

Dunham Strainer.

A strainer is a necessity in protecting the vacuum pump from dirt and scale which otherwise might get into it and cause considerable damage. The Dunham Strainer with its large brass screen basket for catching and holding the dirt, and easily accessible for cleaning, at once commends itself for this purpose. It is made in all sizes from 2 to 6 in.; the 2-, $2\frac{1}{2}$ - and 3-in. sizes, with either screw or flanged ends; larger sizes flanged ends only.

The Dunham Vacuum System.

Since 1903 the Dunham Vacuum System has been a leader and it still stands at the front, easily maintaining its position because of the remarkable success as well as the high efficiency of the Dunham Radiator Trap and allied Dunham specialties.

Simplicity is the leading note of Dunham design. There is the system of steam mains and piping to supply all radiation, and the return piping to carry away the air and water of condensation. Steam may be supplied direct from boiler plant, or through reducing valve where boiler pressure is too high (over 10 lbs. gage) for direct service, or exhaust steam may be used supplemented by live steam through a reducing valve.

The returns all converge and grade to the suction inlet of a vacuum pump, which may be either steam or motor driven, automatically controlled, and which may also act as a boiler feed pump. Where exhaust steam is used or where boiler pressure exceeds 20 lbs., the discharge from the vacuum pump should go to a freely vented automatic receiver of a boiler feed pump, the vacuum pump not being used directly to feed the boiler.

How to SPECIFY—Specify the Dunham Vacuum System using Dunham Packless Radiator Valves and Dunham Radiator Traps in the supply and return connection to and from each radiator (use hot water type radiation, preferably No. 3, No. 4 or No. 5 Dunham Trap for dripping mains, No. 6, No. 7 or No. 8 Dunham Blast Trap for all blast coils, Dunham Reducing Pressure Valve for reducing steam pressure, or automatically supple-

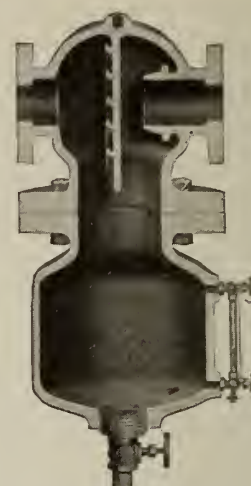


FIG. 13. DUNHAM OIL SEPARATOR

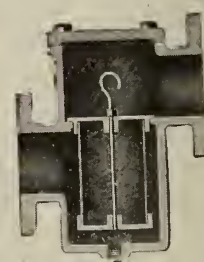


FIG. 14. DUNHAM STRAINER

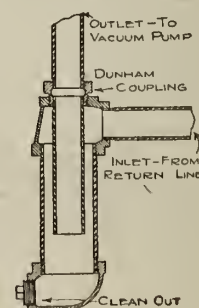


FIG. 15. CONSTRUCTION OF LIFT IN A VACUUM RETURN LINE

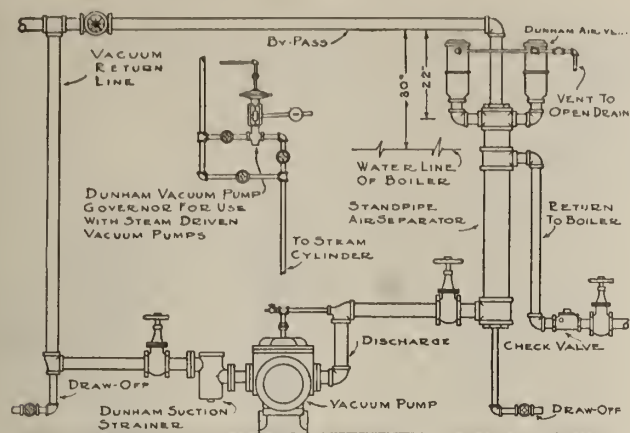


FIG. 16. METHOD OF DISCHARGING DIRECT FROM VACUUM PUMP INTO BOILER

menting exhaust steam, Dunham Oil Separator for removing oil and making exhaust steam suitable for efficient heating, Dunham Strainer for keeping dirt and scale from vacuum pump, Dunham Vacuum Pump Governor for automatically starting and stopping the steam driven vacuum pump to maintain desired amount of vacuum in return piping, and Dunham Air Vent for releasing air from the system; each and all to be installed in accordance with instructions and standard detail drawings to be supplied by the C. A. DUNHAM COMPANY.

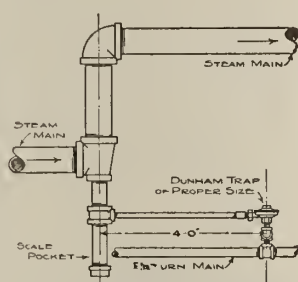


FIG. 17. METHOD OF DRIPPING RISE IN STEAM MAIN, DUNHAM VACUUM SYSTEM

The Dunham Return System.

No design for steam heating can be more simple or more easy in operation than this, and coupled with it is the opportunity for high efficiency. Steam is conducted through one system of piping from the boiler to the radiator, where it is retained by Dunham Radiator Traps until it has given off its heat. Then, as water, it passes through the traps, together with the air, and both water and air are conducted through another set of piping back to the Dunham Return Trap, which, independent of the boiler pressure, automatically releases the air out of the system and returns the water to the boiler.

The feature of a positive return under varying steam pressures makes this Dunham System particularly adaptable to apartment houses, small hotels and medium sized commercial buildings, schools and churches. Above all, however, this system makes possible the modernizing of old one-pipe and two-pipe gravity flow systems, materially increasing their efficiency by the introduction of

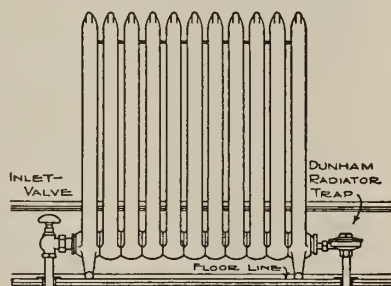


FIG. 18. BOTTOM SUPPLY CONNECTION TO RADIATOR

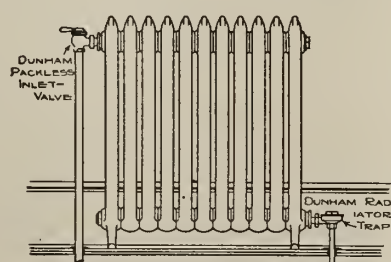


FIG. 19. TOP SUPPLY CONNECTION TO RADIATOR

the Dunham Radiator Trap at each radiator, insuring a positive circulation without loss of steam, and permitting the removal of all sputtering, leaking air valves which are such trouble makers in these old heating jobs. During these days when conservation of fuel is of such great importance, this system presents the greatest opportunity for the most efficient and effective use of steam for heating purposes, and therefore will be a fuel saver.

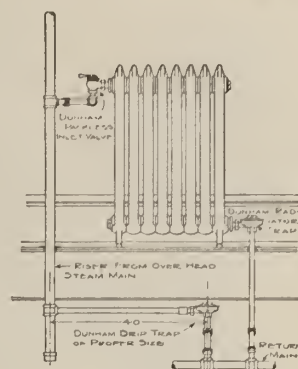


FIG. 20. METHOD OF DRAINING BOTTOM OF STEAM RISER IN AN OVER-HEAD SYSTEM

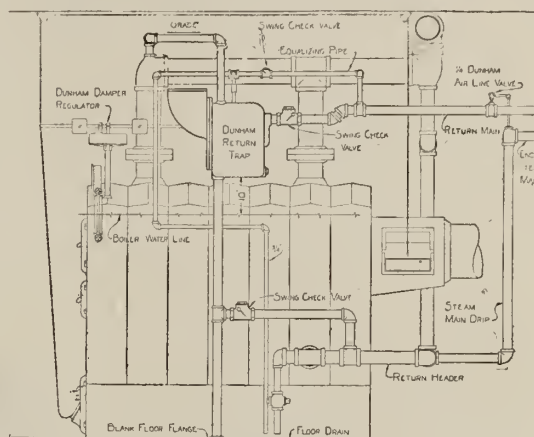


FIG. 21. METHOD OF INSTALLING DUNHAM RETURN TRAP

How to SPECIFY—Specify the Dunham Return System using Dunham Packless Radiator Valves (except in old jobs where inlet connections are at the bottom of radiators) and Dunham Radiator Traps in supply and return connections to and from each radiator, and Dunham Return Trap for releasing air and returning water to the boiler; each and all to be installed in accordance with instructions and standard detail drawings to be supplied by the C. A. DUNHAM COMPANY.

Dunham Air Line System.

This is a one-pipe steam system, using a Dunham Air Line Valve on each radiator in place of the usual sputtering air valve, with a system of air line piping which may discharge the air by gravity, or be attached to a Thompson air line vacuum pump. This system is particularly adaptable in making old one-pipe heating systems more efficient. Easily and cheaply installed, and insures quick removal of air from radiators.

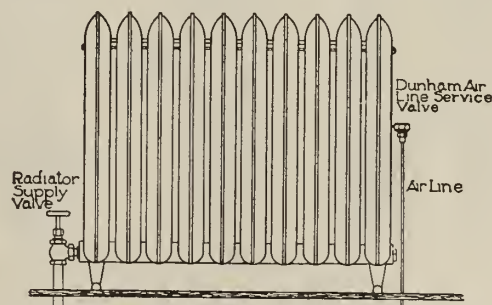


FIG. 22. TYPICAL RADIATOR CONNECTIONS, DUNHAM AIR LINE SYSTEM

Bulletins.

Bulletins with detailed information covering all products, including roughing in dimensions, will be supplied on request.

THE FISHER GOVERNOR CO.

Dependable Power Plant Specialties

5-11 Linn Street

MARSHALLTOWN, IOWA

Products.

PUMP GOVERNORS; AUTOMATIC CHECK and FLOAT VALVES; REDUCING VALVES; PRESSURE REGULATORS; SPRING CONTROLLED DIAPHRAGM REGULATORS; STEAM TRAPS; AUTOMATIC RELIEF, BALANCED LEVER and FLOAT VALVES.

Back Pressure and Atmospheric Relief Valves.
For Oil Field Specialties, see page 443.

Fisher Regular Pump Governors (Patented).

TYPE No. 1—For use on pumps for water works, hydraulic elevators, fire, boiler feed, railroads, mines, air compressors, etc.

They automatically start or stop a pump working under pressure and maintain a uniform pressure on discharge side at all times. Simply constructed, easy to operate, automatic and economical.

Seats and valves made from Fisher special hard phosphor bronze. Particular attention given to construction and testing before shipping.

TYPE No. 2—Special extension cylinder handles pressures of 500 to 1500 lbs. without impairing sensitiveness to variation in discharge.

TYPE No. 3—Maintains guaranteed pressures from 1500 to 10,000 lbs., or capacity of pump.

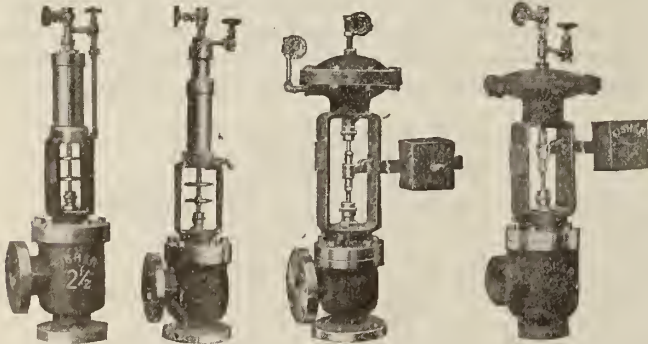
TYPE No. 4—Maintains constant over-pressure or excess pressure in feed line at all times, regardless of variation in boiler pressure. Durable, because not complex. For use where exacting duty and closest regulation are required.

TYPE No. 5—For use on fuel oil and other low pressure pumps pumping liquids, air or gas. It insures steady flow of oil at burners, controlling pump so as to permit only the slightest variation in pressure. Unequalled for sensitiveness on extremely low pressures. Not recommended for pressures in excess of 40 lbs.

State pump discharge pressure to be maintained and nature of service.



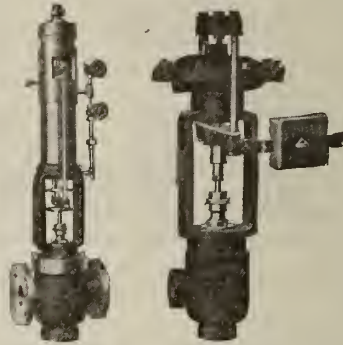
PUMP GOVERNOR
Type No. 3
Hydraulic pressure, 1500 to 10,000 lbs.



Type No. 1 Capacity 10 to 500 lbs.
Type No. 2 Capacity 500 to 1500 lbs.
Type No. 4 Maintains constant excess pressure
Type No. 5 For low pressure pumps
PUMP GOVERNORS

TYPE No. 6—For controlling pumps discharging into open elevated tanks to maintain a certain water level. In addition to gravity or water level control, pump is controlled by discharge pressures, governor being actuated from both sources. Use of float valve and other apparatus for tank control overcome.

TYPE No. 8—Used on all types of steam operated vacuum pumps used with vacuum heating systems, and where a certain number of inches of vacuum must be maintained. Diaphragm and lever mechanism can be swiveled and turned in any direction desired. Also made spring controlled for marine service.



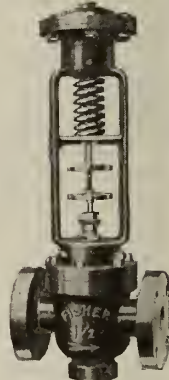
Type No. 6 Gravity
Type No. 8 For vacuum pumps
PUMP GOVERNORS

Fisher Spring Controlled Diaphragm Regulator.

TYPE No. 55—For controlling steam driven pumps operating on closed systems, particularly adapted to low pressure pumps. For fuel oil pumps, when information is given, a specially constructed diaphragm is furnished.

Can be used as pressure reducing valve in any position. If used in vertical line, furnished with pilot guide.

Made globe and angle bodies.



TYPE NO. 55
DIAPHRAGM
REGULATOR

SIZES AND LIST PRICES OF PUMP GOVERNORS NOS. 1, 4, 5 AND 55

Size, in.	SCREWED		Size, in.	STANDARD FLANGED		EX. HEAVY FLANGED	
	Angle	Globe		Angle	Globe	Angle	Globe
3/8	\$25.00	25.00	1	\$35.00	\$37.50	\$36.00	\$38.50
1/2	25.00	25.00	1 1/4	40.00	42.50	41.00	43.50
3/4	27.50	27.50	1 1/2	45.00	47.50	46.00	48.50
1	30.00	30.00	2	50.00	52.50	52.00	54.50
1 1/4	35.00	35.00	2 1/2	60.00	63.00	62.50	65.00
1 1/2	42.50	42.50	3	75.00	78.50	78.00	81.50
2	50.00	50.00	3 1/2	87.50	90.00	92.00	94.50
2 1/2	58.00	58.00	4	100.00	105.00	105.00	110.00
3	70.00	70.00	4 1/2	112.50	117.50	120.00	125.00
3 1/2	82.50	82.50	5	125.00	130.00	135.00	140.00
...	...	...	6	150.00	160.00	165.00	175.00
...	...	...	*7	187.50	197.50	205.00	217.50
...	...	...	*8	225.00	235.00	245.00	260.00
...	...	...	*10	275.00	275.00	295.00	295.00
...	...	...	*12	450.00	450.00	470.00	470.00

*Governors Nos. 1, 5 and 55 only.

Fisher Float Valves.

TYPE No. 17—Designed to automatically control the flow of fluids into open tanks or reservoirs to maintain a predetermined level. Action of this valve controlled by seamless copper float, directly connected to lever by an adjustable stem.

Made in both angle and globe types. All valves tested. Standard valves suitable for cold water or air pressures ranging up to 200 lbs. If valves are to be used for hot water, steam, oil or other service, information to this effect should accompany order.



TYPE NO. 17
FLOAT VALVE

Fisher Automatic Check and Float Tank Valves.

TYPE No. 15—For use on open and elevated tanks or gravity systems. Construction enables water to be pumped into or drawn from tank through the same pipe.

This combined float and check saves the trouble and expense of a more complicated installation. Fire pressure can be carried on mains with full tank.



TYPE NO. 15
AUTOMATIC
CHECK AND FLOAT
TANK VALVE

Fisher Steam Trap.

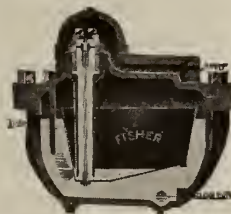
TYPE No. 33—Fitted with monel metal valve and non-rust bearings. Has a large capacity, for all services and for all pipe sizes.

Fully accessible in all parts. Intermittent discharge, eliminating wire-drawing of seats. Suitable for any pressure by changing valve and seats. Heavily built throughout. Every trap subjected to heavy and severe hydrostatic test.

Ribbed heavily, insuring strength. Readily covered with asbestos. Two wearing parts only; those easily renewed; economical maintenance.

Reliable design; uniform distribution of metal and strain; contraction and expansion in service will not affect joints.

Area of open hinge bucket is large, giving great pulling power. Possible to use a larger valve than with any other construction.



TYPE NO. 33
STEAM TRAP

DATA, NO. 33 STEAM TRAPS

Number.....	A	B	C	D	E	F	H
Size of pipe connection, in.	1 1/2	3/4	1	1 1/4	1 1/2	2	3
Capacity in lbs. of water per hr.	1000	1710	2140	4600	5700	7900	14000
Capacity in sq. ft. of radiation.	3000	5130	6420	13800	17100	23033	52000
Capacity of lin. ft. of 1-in. pipe.	9000	15390	19260	41400	51300	69100	156000
App. shipping wt., lbs.	54	70	95	118	178	284	426
List prices.....	\$25.00	30.00	40.00	55.00	70.00	100.00	175.00

Fisher Balanced Lever Valves.

TYPE No. 7—Under sole control of lever, outside force operating that lever. It remains unaffected by pressure. Can be used in connection with steam, air, gas, water or other fluids. Especially adapted for feed water heaters, tank feeding, quick opening throttling valves, condensation tanks or hot wells in any situation requiring a lever valve that closes tight when valve seats. Also used as a thermostatic or chronometer governor valve.



TYPE NO. 7
BALANCED LEVER
VALVE

Fisher Reducing Valves.

TYPE No. 10—Responds quickly to sudden draw on service pressure. For use with steam, air, water, gas or oil. Takes initial power plant pressure, and in one reduction attains the lower pressure desired. Never chatters, sticks, nor allows the low pressure to build up.

Being diaphragm and lever actuated type is more sensitive than spring actuated valves.

Made in vertical and inverted types.

TYPE No. 11-A—Suitable for all low pressure and vacuum systems of steam heating. An increased outlet allows for quick expansion of steam after its passage of valve from high pressure side. It is so nearly balanced that lower reducing range is atmospheric pressure or even below.

Made in vertical and inverted types. The large variety of outlet sizes stocked in this valve makes it convenient and economical to the contractor or engineer.

TYPE No. 12—Fisher piston type high pressure reducing valve. Cylinders are provided with a special packed piston, which places this valve in a class by itself. Handles pressures from 50 to 400 lbs. on the reduced side of the valve. Sensitive reduction is guaranteed. Valve can be varied 30 lbs. or more either way from set fixed point. Also stocked in vertical with angle or globe bodies, and with increased outlet bodies, either vertical or inverted.

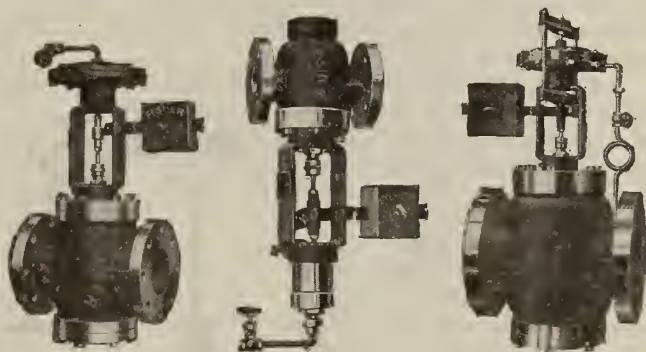


TYPE NO. 11-A
INCREASED OUTLET
REDUCING VALVE

Fisher Automatic Relief Valves.

TYPE No. 14—Generally recommended for service in main where it is necessary to relieve excess pressure into a branch line; on lines connecting high pressure boilers to low pressure boilers, or any service where a desired pressure is to be maintained and excess pressure above that point relieved.

Absolutely automatic, opening precisely at the working pressure and closing promptly after relieving the excess pressure above the fixed working point.



TYPE NO. 10
REDUCING VALVE

TYPE NO. 12
PISTON TYPE HIGH
PRESSURE REDUC-
ING VALVE

TYPE NO. 14
AUTOMATIC RELIEF
VALVE

DATA, VALVES NOS. 10, 12 AND 14

SCREWED					STANDARD FLANGED					EX. HEAVY FLANGED			
Angle		Globe		Size, in.	Angle		Globe		Size, in.	Angle		Globe	
List price	App. wt., lbs.	List price	App. wt., lbs.		List price	App. wt., lbs.	List price	App. wt., lbs.		List price	App. wt., lbs.	List price	App. wt., lbs.
1/4	\$27.50	25	1	\$35.00	113	\$35.00	113	1	\$36.00	117	\$36.00	117
3/8	30	27.50	30	1 1/4	40.00	114	40.00	114	41.00	119	41.00	119
1/2	25.00	36	27.50	36	1 1/2	45.00	125	45.00	125	46.00	132	46.00
3/4	27.50	37	28.50	37	2	50.00	136	55.00	136	52.00	147	57.00
1	30.00	107	32.50	107	2 1/2	60.00	158	65.00	158	62.50	168	67.50
1 1/4	35.00	110	37.50	110	3	75.00	170	80.00	170	78.00	181	83.00
1 1/2	42.50	120	45.00	120	3 1/2	87.50	190	90.00	190	92.00	208	94.50
2	50.00	129	52.50	129	4	100.00	205	110.00	205	105.00	224	115.00
2 1/2	58.00	147	60.00	147	4 1/2	112.50	223	122.50	223	120.00	248	125.00
3	70.00	160	72.50	160	5	125.00	245	135.00	245	135.00	273	145.00
3 1/2	82.50	170	85.00	170	6	150.00	266	150.00	266	165.00	304	165.00
.....	7	187.50	297	187.50	297	205.00	347	205.00
.....	8	225.00	377	225.00	377	245.00	437	245.00
.....	10	275.00	557	275.00	557	295.00	627	295.00
.....	12	450.00	691	450.00	691	470.00	766	470.00
.....	14	.....	.....	600.00	1007	.....	630.00	1128
.....	16	.....	.....	800.00	1360	.....	850.00	1512

* Valves Nos. 10 and 12 only.

THE CHAPLIN-FULTON MFG. CO.

Manufacturers of Steam Specialties

28-34 Penn Avenue
PITTSBURGH, PA.

Products.

VIGILANT FEED WATER REGULATOR; FULTON PUMP GOVERNOR; FULTON TANK GOVERNOR; FULTON STEAM REDUCING VALVE; FULTON EJECTOR.

Bingham Gage Cock; Fulton High Pressure or Reducing Regulators, Fulton Low Pressure Regulators, Fulton House Service Regulators; Fulton Duplex Sensitive Gas Governors, Fulton Gas Fuel Boiler Governors, for steam boilers, using natural or artificial gas for fuel; Fulton Gas Relief Valves, for natural gas gasoline plants; Fulton Back, or Check Pressure Regulators, for natural or artificial gas; Fulton Water Regulators.

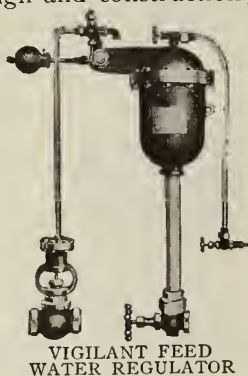
Vigilant Feed Water Regulator.

OBJECT—Object is to automatically supply to steam boiler exact amount of water that is being converted into steam, thereby maintaining constant water level.

SCOPE—Adaptable to any size or style of boiler, independent or in batteries.

ADVANTAGES—(1) Insures dry steam for engine and better lubrication. (2) Safeguards against accident to boiler from low water. (3) Great economizer of coal, greatest efficiency of boiler when heating surface and steam space are maximum. Steady and constant feeding of boiler allows water to be heated to highest degree. Saving of fuel over hand fed boiler from 6% to 15%. (4) Prevents priming by keeping water level at middle gage. (5) Lessens repairs to boilers from leaky joints due to contraction and expansion of tubes caused by sudden changes of temperature by hand fed boilers. (6) Insures most uniform operation of feed pumps, heaters, etc.

FEATURES—Simplicity in design and construction; all working parts in plain view. No complicated system of levers, floats or diaphragms. Positive in action. Impossible to clog with scale or mud (valves either shut or open). Uses small amount of steam for an instant only when stopping feed. Can be cut out without interrupting feeding of boiler. Regulates feed water within a ¼-in. rise and fall. One man can attend to 40 boilers equipped with regulators.



VIGILANT FEED
WATER REGULATOR

STYLE AND SIZE—Two styles of Vigilant feed water regulators are manufactured: one with a small condenser supplying pure water for use through valves, the other without condenser.

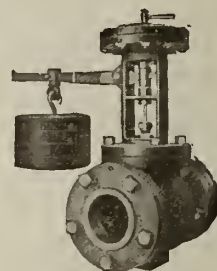
Diameter of chamber, 9½ ins. at flanges. Distance from top of chamber to bottom, 15½ ins.; from side of flanges to end of weighted lever, 23 ins.

Fulton Tank Governor.

Fulton tank governor, placed in steam line to pump, maintains a water level at any desired height with but little variation in tanks, standpipes, reservoirs, water towers, etc., or maintains a pressure in water mains at any desired head. May be used in same manner for pumping oil, acid, or any liquid it is desired to maintain at uniform head.

When forcing liquids through heaters, filters, clarifiers or other obstructions, connection to diaphragm must be made in line or tank in which uniform pressure is to be maintained.

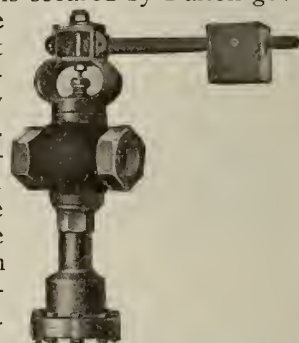
Simple in construction; automatic in action. All valves have cast iron bodies and valves unless otherwise ordered. Valves under 3 ins. have screwed end. In ordering, state fully purpose desired, whether used on steam, gas or water pipes, and whether on pumps or mains. Give pressure of said steam, gas or water, and pressure or head which it is desired to maintain.



FULTON TANK
GOVERNOR
Sizes, 3 ins. and up

Fulton Boiler Feed Pump Governor.

Automatic regulation of pump in accordance with changing boiler requirements is secured by Fulton governor. Fix excess pressure in feed line at 10 lbs., and at 10 lbs. the difference will remain, regardless of how boiler pressure fluctuates. Since boiler pressure is carried on one side of piston and pump pressure on the other, only small difference in pressure between them has to be balanced by governor weight and lever, a marked contrast to the immense springs, etc., often employed.

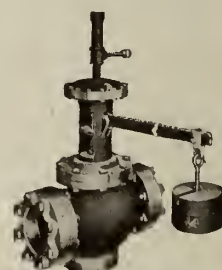


FULTON BOILER FEED
PUMP GOVERNOR, PISTON
TYPE
Also made with diaphragm

Fulton Steam Reducing Valve.

Valves, 3 ins. and larger, have flanged ends with companion flanges bolted on; are also provided with a trap so that live steam does not come in contact with diaphragm.

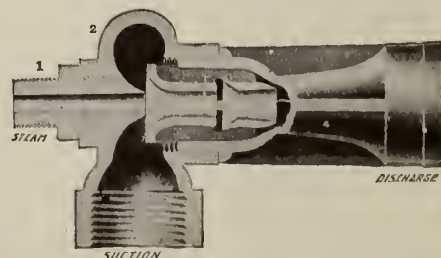
Lever is balanced on a knife edged fulcrum and supports valve stem by means of a toggle connection which reduces friction and insures quick response to slightest change of load.



FULTON STEAM
REDUCING VALVE

Fulton Patent Ejector.

Two types. Triple acting jet pump requires one-half the steam other jet pumps require. Will lift 15 ft. and force 30 ft. without loss of efficiency. Working pressure, 80 lbs. Single acting jet pump will lift water 10 ft. and force it 75 ft. with working pressure of 80 lbs.



FULTON PATENT TRIPLE ACTING EJECTOR
Also made in single acting type

WILLIAM S. HAINES & COMPANY

Manufacturers of Steam Heating Specialties

Twelfth and Buttonwood Streets
PHILADELPHIA, PA.

Products.

HAINES VACUUM HEATING SYSTEMS and AUTOMATIC VAPOR SYSTEMS, consisting of Vento Automatic Valves and Traps, Automatic Air Traps, Graduated Supply Valves, Suction Strainers, Safety Valves, Vacuum Pump Governors, Damper Regulators, Low Pressure Gages, and all Specialties used in the systems.

Vacuum Systems of Steam Heating.

This company believes that the engineer and architect are sufficiently familiar with the principle, operation and general piping arrangement of this system to make it unnecessary to detail them here. It is generally conceded that a vacuum system of steam heating, properly installed and equipped, is the most efficient and economical heating system that can be used in connection with large buildings of any description.

Vacuum systems of heating, however, have not always proved successful, due not to any fault in the principle of the system, but almost entirely to poorly constructed automatic valves; in fact, the automatic valve is so important a feature that, regardless of all other perfections, any system of vacuum heating would be a failure without an equipment of positive and reliable automatic valves.

Vento Automatic Valves and Traps.

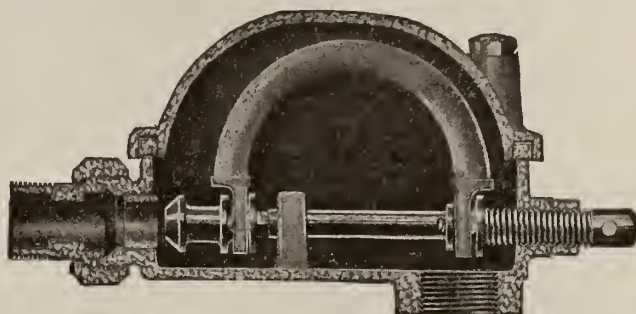
This company is the sole manufacturer of the Vento automatic valves and traps (four illustrated herewith), in all of which the operating power consists of the Haines specially designed thermostatic tube. This member is not new or untried, as the company has been using it in connection with its automatic valves and traps for 24 years, and during this entire period the principle of the thermostatic tube has not been changed a particle.

CONSTRUCTION—The Vento automatic valves and traps are all constructed on one principle, with some slight difference in design to meet different conditions. In all cases the operating power consists of a specially designed Haines thermostatic tube mounted vertically on a horizontal valve motion. The thermostatic tube has forked or bifurcated ends made to fit a groove in the valve head at one end and a groove in the guide stem at the opposite end. The guide stem is set permanent, so that the movement or travel of the tube is confined to the opposite end in such a way as to automatically open and close the valve. To eliminate friction and remove any possible chance of the valve sticking, the hole in the valve stem is round, whereas the end of the guide stem on which it is mounted is square, which insures a free and perfect movement.

The valve mechanism in all the Vento automatic valves and traps is mounted horizontally. This permits scale and foreign matter to drop clear of the valve and seat at each operation; and as the construction of the thermostatic tube is such as permits a long range of movement, the chances of the valve fouling

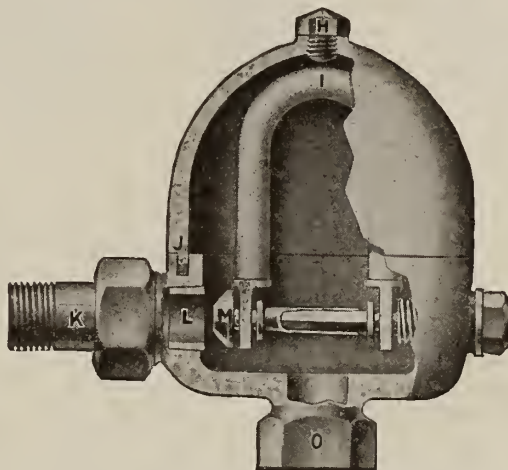
with scale or foreign matter is reduced to a minimum.

GUARANTEE—The Vento automatic valves, when used in connection with vacuum or vapor heating systems, are guaranteed absolutely for a period of 5 years; that is, should any of the valve parts become defective through usage during said period, all such will be replaced with new ones free of cost.



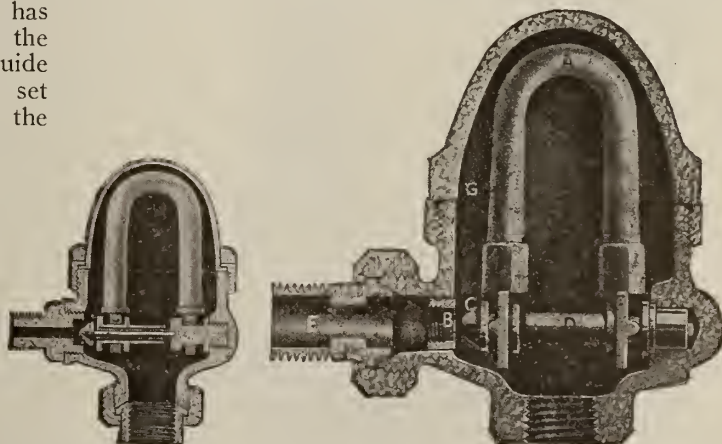
VENTO BLAST COIL TRAP

In addition to all classes of blast coil work, it can be used with any class of work employing from 1 to 50 lbs. pressure



VENTO (1911) TYPE RETURN LINE VALVE

Recommended for all coil work and drip points with low pressure heating. Controls extra large valve area



VENTO AIR LINE VALVE

VENTO RETURN LINE VALVE
Recommended for use with cast radiation with low steam, not exceeding 10 lbs.

JOHNSON SERVICE COMPANY

Temperature Regulation and Humidity Control

MILWAUKEE, WIS.

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BOSTON, MASS., 35 Hartford Street
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 CHICAGO, ILL., 177 North Dearborn Street
 CINCINNATI, OHIO, 405 Gwynne Building
 CLEVELAND, OHIO, 719 St. Clair Avenue, N.E.
 DENVER, COLO., 517 Boston Building
 DETROIT, MICH., 20 Montcalm Street, West
 INDIANAPOLIS, IND., 111 Pembroke Arcade
 KANSAS CITY, MO., 411 East Tenth Street
 MILWAUKEE, WIS., 149 Michigan Street

LOS ANGELES, CAL., 707 Trust and Savings Bank Building
 MINNEAPOLIS, MINN., 308 Third Avenue, South
 NEW YORK, N. Y., 18 East Twenty-eighth Street
 PHILADELPHIA, PA., 1521 Sansom Street
 PITTSBURGH, PA., Century Building
 PORTLAND, ORE., 410 Railway Exchange Building
 SAN FRANCISCO, CAL., 314 Rialto Building
 SEATTLE, WASH., 843 Henry Building
 ST. LOUIS, MO., 14 North Twelfth Street

CANADIAN REPRESENTATIVE

JOHNSON TEMPERATURE REGULATING COMPANY OF CANADA, LIMITED

OFFICES

CALGARY, ALTA, 605 Second Street, West
 VANCOUVER, B. C., 1160 Seymour Street

TORONTO, ONT., 118 Adelaide Street, West
 WINNIPEG, MAN., 259 Stanley Street

MONTREAL, QUE.

Products and Services.

Manufacturers of THERMOSTATS and Other APPARATUS for the CONTROL of TEMPERATURE and HUMIDITY, including:

Pneumatic Room and Insertion Thermostats and Humidostats.

Electric Room and Insertion Thermostats and Humidostats.

"Sylphon" Metal Diaphragm and Rubber Diaphragm Valves.

Low Pressure, Limited Capacity, Electric Air Compressors.

Low Pressure, Limited Capacity, Hydraulic Air Compressors.

Air and Water Reducing Valves.

Pneumatic Switches or Push Buttons.

ENGINEERS and CONTRACTORS for the CONTROL of TEMPERATURE or HUMIDITY for any purpose and over every range used in manufacturing purposes or buildings, furnishing and installing:

Temperature Controlling Apparatus for any and all kinds of heating and ventilating systems.

Temperature Controlling Apparatus for any industrial process requiring the medium of heat.

Control of Humidity in industrial processes requiring artificial humidity.

Temperature Control of hot water tanks and all liquids.

Control of Temperatures of refrigerating and cold storage plants.

Thermostatic Control of electric motors on automatic refrigerating.

Specific Applications of Temperature Control.

Bake ovens for enamels, japans, etc.

Core drying ovens.

Drying room for paint, varnish, patent leather, etc.

Storage room for tobacco, rubber or similar goods.

Cold storage rooms, fur vaults, etc.

Canning machinery, cookers, exhausters, processors.

Corn and oats drying apparatus.

Fruit drying apparatus.

Johnson Positive Acting Metal Diaphragm Thermostat.

The only thermostat on the market provided with positive snap action for closing and opening the radiator valve quickly, positively and fully, which is necessary with steam heat.

INDICATOR AND CUT-OFF—

It is the only thermostat having an indicator which shows at a glance whether the thermostat has the heat turned on or off. A cut-off is provided for shutting the heat off permanently when desired.

Johnson Graduated Acting Thermostat.

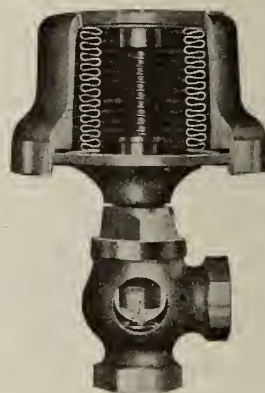
For controlling the temperature of rooms heated by steam, hot blast or hot air furnaces. It controls a mixing damper located at the plenum chamber. The damper, which is furnished, together with the thermostat, etc., is operated by a diaphragm damper motor, connected with the thermostat in such way that the damper blades will automatically assume the correct intermediate position necessary to deliver the right mixture of hot and tempered air to the room and to maintain a constant and proper temperature therein.

Johnson Electric Room Thermostat.

This thermostat is designed and adapted for use in connection with an electric switch, for the control of temperature in electrically heated rooms; for the regulation of temperature in small refrigerators cooled by electrically driven ice machines; for the control of electrically driven centrifugal pumps used for cooling or heating purposes; for the control of motor driven heating, cooling or ventilating fans such as are used in fur vaults, etc.

Johnson Electric Insertion Thermostat.

For insertion in brine systems of electrically driven ice machines, to regulate the temperature of brine by the control of the motor; for insertion through wall of refrigerator, to regulate temperature of cooled space by the control of motor; for regulation of temperature in electrically heated



"SYLPHON" METAL DIAPHRAGM RADIATOR VALVE



POSITIVE THERMOSTAT
Showing inside mechanism

water system or tank, by control of heater; for regulation of temperature in electrically heated compartment, by control of the heater.



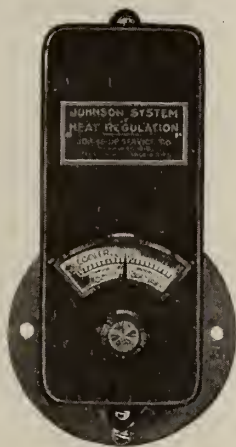
ELECTRIC INSERTION THERMOSTAT

Johnson Pneumatic Insertion Thermostat.

Designed to control temperatures within closed air chambers or ducts. The body of thermostat is a dust-proof case containing the two working parts and extending outside the chamber.

This thermostat is made either positive or graduated acting.

APPLICATIONS — Adaptable for use in bake ovens for enamels, japans, etc.; drying rooms for paints, varnishes, patent leather, etc.; storage rooms for tobacco, rubber or similar goods; sterilizers or pasteurizers; cold storage rooms, fur vaults, etc.; refrigerator machine control; humidity control for air washers; flue gas temperature control; hot blast heating plants; combination tempered ventilation and hot blast systems; greenhouses, turkish bath rooms, etc.; tempered ventilation for buildings.



PNEUMATIC INSERTION THERMOSTAT

Johnson Calibrated Thermostat.

This is an especially high grade insertion thermostat for use where it is desired to change frequently the adjustment to operate at different temperatures. It is operated by compressed air at 15 lbs. per sq. in., and used to control temperatures of liquids and air by automatically opening and closing a diaphragm valve or damper. Graduations made to meet requirements, limited to a total range of 60° and to minimum space of 2½°.

CALIBRATED THERMOSTAT
Graduated-acting pneumatic type

Pressure Reducing Valves.

No. 1—This valve will meet the most exacting service requirements. Being small, well proportioned and having a reasonably large range of action, it is especially

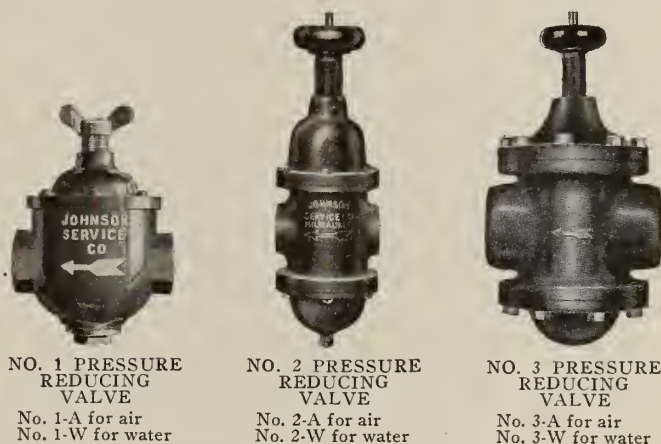
suited for small compressed air or hydraulic machinery. When desired, this valve is provided with a cut-out handle which permits high pressure to instantly pass through the valve without reduction.

This valve is tight when closed, will not let pressure creep up on the low pressure side, and allows free passage of air or water without causing appreciable drop in pressure on low pressure side when valve is subjected to sudden and heavy service.

The materials used are the very best considering durability and utility.

No. 2—Larger and heavier than No. 1 valve; has more parts and therefore costs more. Has a more finished adjusting screw provided with black japanned wood palm piece. Also provided with extra catch bowl at the bottom, with drain plug for catching and removing dirt from valve. In all other respects description of No. 1 valve applies to No. 2.

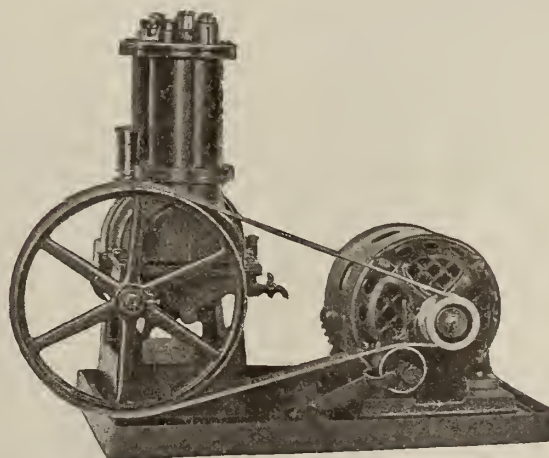
No. 3—A positive shut-off valve, identical in design and construction with No. 2 valve, but built heavier and for larger pipe sizes. Cap screws replace round headed screws on No. 2 valve.

NO. 1 PRESSURE
REDUCING
VALVE
No. 1-A for air
No. 1-W for waterNO. 2 PRESSURE
REDUCING
VALVE
No. 2-A for air
No. 2-W for waterNO. 3 PRESSURE
REDUCING
VALVE
No. 3-A for air
No. 3-W for water

Time Valve Control.

Simple device for automatically and periodically opening and closing a diaphragm valve.

Has many applications, such as periodically flushing of toilets, etc. Being simpler and more powerful in action, it is much superior to float tanks. Eight-day clock valve mechanism operates diaphragm valve on water supply by means of compressed air. Valve may be operated from 1 to 4 times per hour and for periods of 15 seconds to 5 minutes.

ELECTRIC AIR COMPRESSOR FOR OPERATING JOHNSON
THERMOSTATS

RUSSELL B. HOBSON

Condensation Return System

WEST NEW BRIGHTON, N. Y.

NEW YORK OFFICE, 120 Broadway

Products.

The HOLLY GRAVITY CONDENSATION RETURN SYSTEM.

The Holly Gravity Return System.

To pump or trap condensation at 300° to 400° Fahr. and the corresponding pressures without waste of steam or labor of upkeep is a difficult matter except with the Holly gravity return system. This system provides a low dry pocket, pulling the condensation out of every part of the steam piping or apparatus, and throwing it back into the boilers so rapidly that it enters almost at the full boiler temperature.

All full pressure drips are closed up with the boilers to which all condensation and entrained water is made to flow continuously, and steam leakage eliminated.

Being devoid of mechanism it is not subject to be out of order, and remains always at 100% as installed.

The Holly system is applicable also to the drainage of high pressure heating apparatus.

The Holly system is tireless. It is the watch dog of the power plant, and whether there is little or much to

do, it stands ready to perform at its full capacity of many thousand pounds per hour.

This company, while equipping some of the very best types of new power plants, finds a fruitful field in old plants, many of which are being brought up to date by the Holly system.

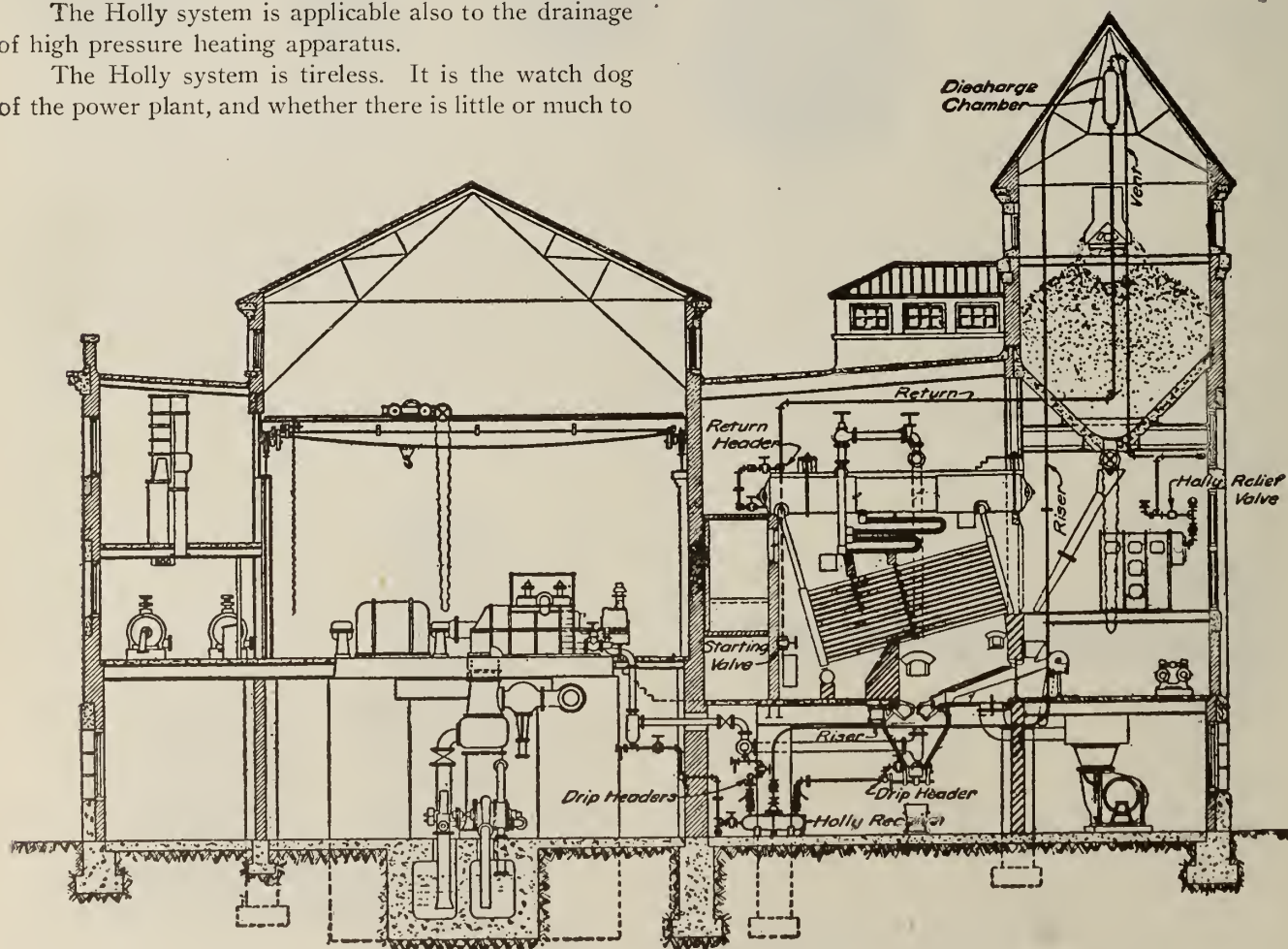
Why not install the Holly system at first, and prevent the possibility of leakage and of loss?

References and Quotations.

Let us furnish references and quotations.

Service.

Upon receipt of order, the working diagram for the steamfitter is prepared, thus insuring the proper attention to detail essential for perfect service.



TYPICAL ELEVATION OF HOLLY GRAVITY RETURN SYSTEM

KIELEY & MUELLER, INC.

Steam, Water, Air and Gas Specialties

34-38 West 13th Street
NEW YORK, N. Y.

AGENTS AND BRANCH OFFICES IN PRINCIPAL CITIES

Products.

KIELEY SPECIALTIES for use in connection with Power, Heating and Plumbing Installations: STEAM PRESSURE REGULATING VALVES of various patterns; BOILER and PUMP GOVERNORS; STEAM TRAPS.

Also, Water, Air and Gas Pressure Regulating Valves, Boiler Stop and Check Valves, Damper Regulators, Water Columns, High Pressure Pilot Regulating Valves, Pilot Automatic Relief Valves for steam, Swivel Automatic Piston Actuated Float Valves for cold water, Altitude and Altitude Relief Valves, Back Pressure and Atmospheric Relief Valves, Automatic Vacuum Water Jet Controllers, Steam Valve and Hot Water Temperature Controllers, Exhaust Heads, Steam Separators, Oil and Grease Extractors, Feed Water Heaters, Air and Grease Traps, Return Steam Traps and Boiler Feeders, Water Feeders, Water Line Traps or Governors, Strainers for Regulating Valves for steam, water, air or gas.

Kieley Specialties and Services.

The superiority of Kieley specialties lies in the construction and design. All material used is of the highest standard; each casting is carefully made and finished; all joints and parts are carefully made with jigs and dies; all parts are interchangeable.

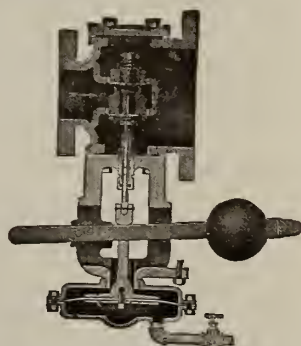
An engineering department is maintained, comprising a staff of competent engineers, selected from all branches of the profession who are familiar with the working details of power and heating plants. The knowledge and experience of these engineers are at the service of engineers and architects; co-operation in working out plans or making suggestions for the solution of difficult problems will be gladly given.

Special 98 Vacuum Pressure Regulating Valves.

These regulating valves are suitable for service where close regulation is required.

They should not be used to reduce against a dead end. For such services the single seated valves should be used.

Initial working pressure is 125 lbs. or less. Delivery or reduced pressure, 10 to 0 lbs. Made in all sizes.



KIELEY SPECIAL 98
VACUUM PRESSURE REGULATING VALVE

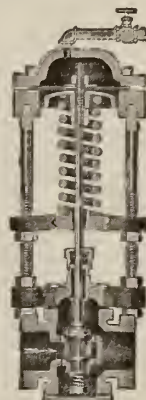


Rockaway Pump Governor.

For automatic control of house pumps, elevator pumps, gas, ammonia and brine pumps, water works pumps, fuel oil pumps, air compressors, boiler feed pumps, railroad tank pumps, automatic sprinkler and refrigerating plants, and any other service requiring automatic control of devices operated by steam, air and water.

Will automatically control the speed of pumps from the pressure in the discharge and will maintain the pressure in discharge within a pound or two of what the pump is set to operate at.

Standard weight for 125 lbs. Extra heavy type for 175 lbs. Made in angle and globe patterns; screwed or flanged ends. Sizes: screwed end, brass body, $\frac{3}{8}$ in. to 2 in. inclusive. Screwed end, iron body, 2 in. to 4 in. Flanged end, iron body, 2 in. to 4 in.



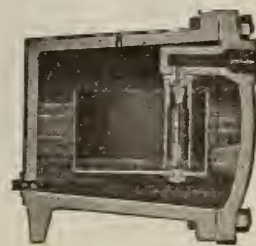
KIELEY
ROCKAWAY
PUMP
GOVERNOR

Standard Steam Trap, High and Low Pressure.

Positively non-collapsible floats and unusually large valve openings are provided, secured by Kieley peculiar method of construction, viz:

Floats being suspended and attached at extreme end, close to point at which valve stem is pivoted, afford a leverage sufficiently effective to overcome a higher resisting pressure, and discharging through a larger valve opening against a greater force than has ever been obtained in steam traps of pot or open float construction. Valves are perfectly steamtight and, further, are protected by water seal.

The few wearing parts are of standard gage and are interchangeable; obtained at a minimum of cost; easily and readily placed in position without breaking a single pipe connection. By-pass arrangements are an important feature and a desirable improvement. Made in all sizes from $\frac{3}{4}$ in. to 3 in., and suitable for all pressures and services. Simplicity, accessibility, large capacity, and satisfactory results are assured when Kieley steam traps are used.



KIELEY STANDARD
STEAM TRAP HIGH
AND LOW PRESSURE

KITTS MANUFACTURING CO.

Steam Specialties

1921 West Seneca Street
OSWEGO, N. Y.

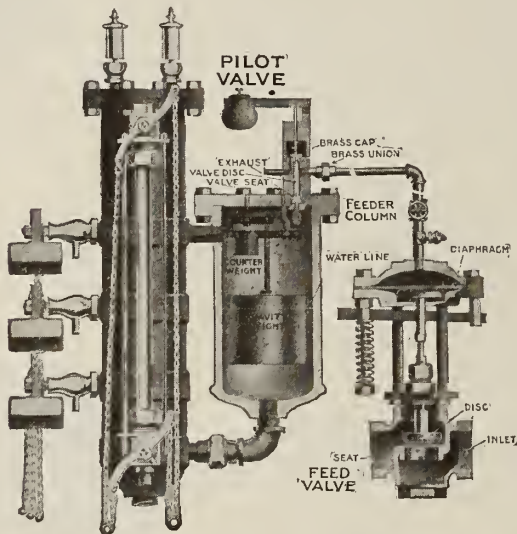
Products.

SAFETY FEED WATER REGULATORS; T. C. STEAM TRAPS; REDUCING VALVES; FAN ENGINE REGULATORS; EXCESS PUMP GOVERNORS; HYDRAULIC DAMPER REGULATORS; SINGLE BOILER FEEDER and WATER SUPPLY GOVERNORS.

Also, Vacuum Pressure Reducing Valves, Vacuum Pump Governors, Vacuum Traps, Bucket Steam Traps, Safety Water Columns, Pump Pressure Regulators, Altitude Governors, Low Pressure Boiler Feeders, Air Regulators.

Kitts Safety Feed Water Regulator.

An economical safety device which maintains a constant water level in boilers and effects big savings in coal bills. Simple, durable and absolutely reliable. It insures the greatest possible efficiency, furnishes dry steam to engines and pumps and prevents strain on boilers due to unnatural expansion and contraction because it maintains a constant water level. Furnished with or without the high and low alarm water column.



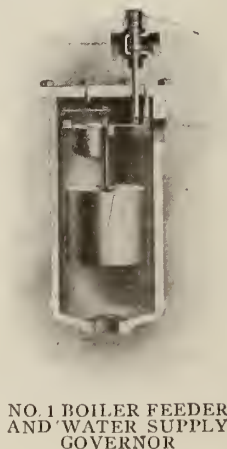
KITTS SAFETY FEED WATER REGULATOR

Single Boiler Feeder and Water Supply Governor.

No. 1—Used to perfectly control boiler feed pump and water line in a single boiler installation. Valve closes as water rises. The valve and all wearing parts are of bronze or brass, the casting and cover of cast iron.

No. 2—A yoke valve which opens as water rises. Used on tank and pump installations of return systems, such as schoolhouse or hospital work.

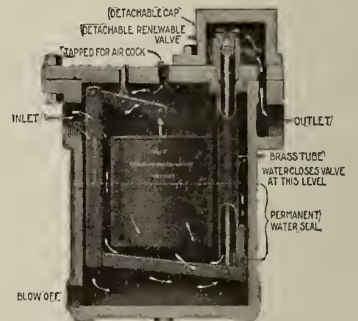
No. 3—A yoke valve which closes as water rises. Used on any



water supply system, especially where make-up water is required on a heating system.

Kitts Twentieth Century Steam Trap.

A powerful trap that operates without a float. It saves all the steam. Seats and disks easily renewable. The trap is water sealed at all times and can not blow steam.



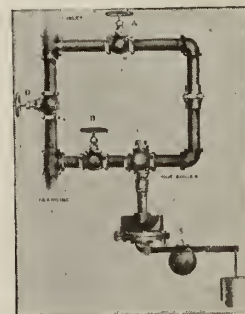
TWENTIETH CENTURY STEAM TRAP

Kitts Steam Pressure Regulating Valves.

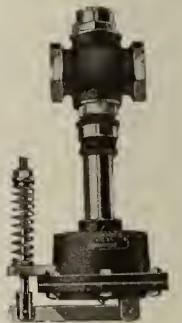
Adapted for every purpose. In extensive use in some of the largest steam heating plants in the United States.

Kitts Fan Engine Regulator.

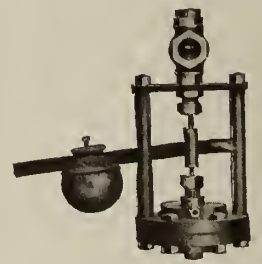
Automatically controls the engine used for forced or induced draft, also automatic stoker systems. Built on steel points and very sensitive in operation. For pressures above 125 lbs., a phosphor bronze reinforcement is furnished in addition to the rubber diaphragm.



FAN ENGINE REGULATOR



SPRING TYPE REDUCING VALVE



EXCESS PUMP GOVERNOR

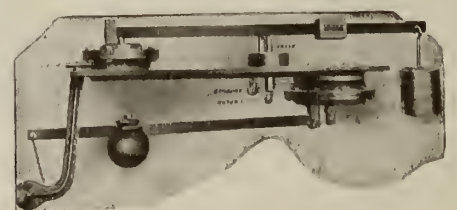
Kitts Excess Pump Governor.

It makes a feed pump deliver a steady, sure supply of feed water, under automatic control, regardless of the variation in steam pressure at the throttle. There is no other pump governor with such a perfect control.

Kitts Improved Hydraulic Damper Regulator.

Will control dampers on a variation of 1-lb. steam pressure. Built for hard service.

A powerful, durable machine.



HYDRAULIC DAMPER REGULATOR

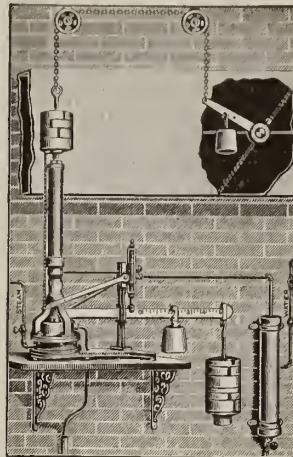
LOCKE REGULATOR CO.

Manufacturers of Steam Appliances
SALEM, MASS.

Products.

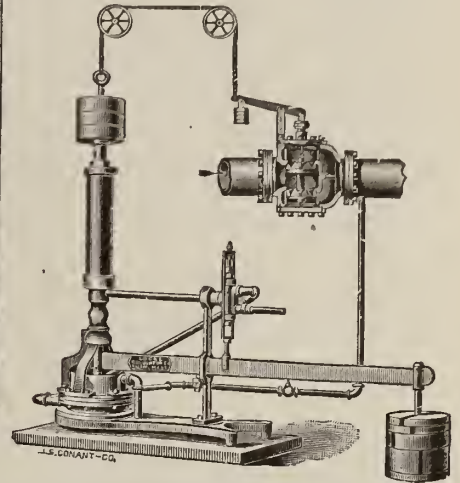
"LOCKE" REGULATORS: Hydraulic Damper and Combination Pressure Types; "LOCKE" VALVES: Non-return Stop, Balance, Reducing; "LOCKE" AUTOMATIC ENGINE STOPS of various types; "LOCKE" SPEED LIMITS; "BOARDMAN" FIRE PUMP GOVERNORS.

Also, "Locke" Steam Pressure and Boiler Feed Pump Regulators; "Beats All" Hydraulic Pump Governors; Valves: Auxiliary Electric, By-pass Water Relief, Vacuum Breaker, Differential, Exhaust Relief, Atmospheric Relief, Automatic Safety Shut-off, Renewable Disk Globe, Check, Closed Circuit, etc; Steam Separators; Test and Charging Boards, etc.



IMPROVED "LOCKE" HYDRAULIC DAMPER REGULATOR

Hydraulic regulator actuated by water pressure, admitted through valve to damper operating motor; valve is made to open and close by fluctuation of boiler pressure as it acts under diaphragm, moving weighted lever to which spindle to valve is attached. Cut-off attachment prevents full stroke of damper



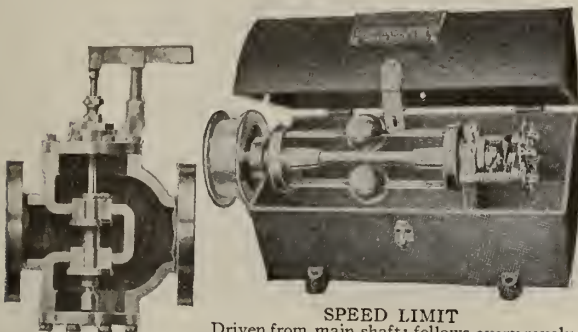
"LOCKE" COMBINATION PRESSURE REGULATOR

Indispensable for controlling large valves at slightest variation of pressure.

Especially adapted for: regulating steam to digestors, controlling blower engines for forced draft, sugar refineries, etc.

No amount of resistance caused by dirt or friction will interfere with its close regulation.

Guaranteed to operate within 1/2 lb. variation



"LOCKE" BALANCE VALVE

Sizes: 1, 1 1/4, 1 1/2, 2, 2 1/2, 3, 3 1/2, 4, 5, 6, 7, 8, 10 and 12 ins.

Prices range from \$9.00 to \$286.00

SPEED LIMIT
Driven from main shaft; follows every revolution of engine; if speed be above normal it makes electric contact, shutting off steam from engine



DOUBLE LEVER REDUCING VALVE

Constructed to operate levers and weights for high reduced pressures, or with a single lever for light reduced pressures; inverted diaphragm eliminates stuffing box around valve rod.

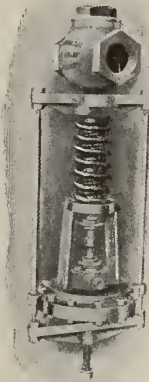
State, in ordering, use of valve, initial and reduced pressures.



"LOCKE" "BEATS ALL" REDUCING VALVE

SIZES AND PRICES "LOCKE" "BEATS ALL" REDUCING VALVE

Size, ins.	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Length of valve, ins.	3	3	3 1/2	4 1/4	5	5 3/4	6 1/2	7 1/2
Price	\$15.00	18.00	22.00	28.00	35.00	44.00	57.00	72.00



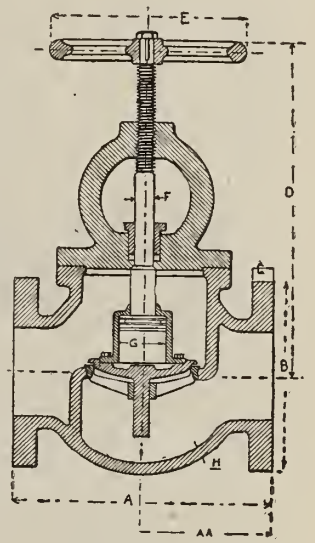
"BOARDMAN" FIRE PUMP GOVERNOR

Listed by Underwriters' Laboratories, Inc., among improved devices

DIMENSIONS OF GLOBE AND ANGLE VALVES, INS.

	4	4 1/2	5	6
A	14	15	15 3/4	17 1/2
AA	7	7 1/2	7 7/8	8 3/4
B	10	10 1/2	11	12 1/2
C	1 1/4	1 3/8	1 3/8	1 7/16
D	14	15	17	19
E	13	13	13	16
F	1 1/4	1 1/4	1 3/8	1 1/2
G	3 1/2	3 1/2	3 1/2	3 1/2
H	1 1/8	1 1/8	1 1/8	1 1/8

	7	8	9	10
A	19 1/4	21	23	25
AA	9 5/8	10 1/2	11 1/2	12 1/2
B	14	15	16 1/4	17 1/2
C	1 1/2	1 5/8	1 3/4	1 7/8
D	21	23	24	26
E	16	16	20	20
F	1 1/2	1 5/8	1 5/8	1 3/4
G	3 1/2	3 1/2	4 3/8	4 3/8
H	1 1/8	1 1/8	1 1/8	1



GLOBE STOP VALVE

Automatic; noiseless. Accomplished by holding valve 1/4-in. from its base, at same time shutting off steam completely. Note valve seat below G



Large Combined Throttle Type
Opened or closed at will, shutting down engine when speed increases above normal

Independent Type
Installed in supply pipe between throttle valve and main steam header

"LOCKE" AUTOMATIC ENGINE STOP VALVES

McDONOUGH AUTOMATIC REGULATOR CO.

Manufacturers of Modern Power Plant Specialties

708 Grand River Avenue
DETROIT, MICH.

Products.

McDONOUGH SYSTEM of CONTROLLING FUEL, AIR and WATER, which includes Damper Regulators, Stoker Regulators, Steam Pressure Recording Gauges, Boiler Feed Regulators, Pump Governors, also other Boiler and Engine Room Appliances.

McDonough System.

Controls automatically all the factors—fuel, air, water—which enter into the generation of steam. Operates without expense or attention, gives perfect regulation and is an immense fuel saver.

Damper Regulators.

McDonough regulator is a result of 26 years' experience in the manufacture and installation of fuel saving devices in steam plants, representing almost every industry where steam is generated.

The most complete and reliable regulator of its kind and an indispensable addition to a steam boiler. In many plants it is equal to an assistant fireman.

CONSTRUCTION—The regulator combines in a single unit a damper and stoker engine or motor speed regulator, a steam pressure gauge, a water gauge, a signal lamp showing open position of dampers and a low steam alarm bell. One regulator controls any num-

ber of boilers, and simultaneously with the closing and opening of the dampers will decrease and increase the speed of stokers, so that the proper amount of coal will be supplied as required.

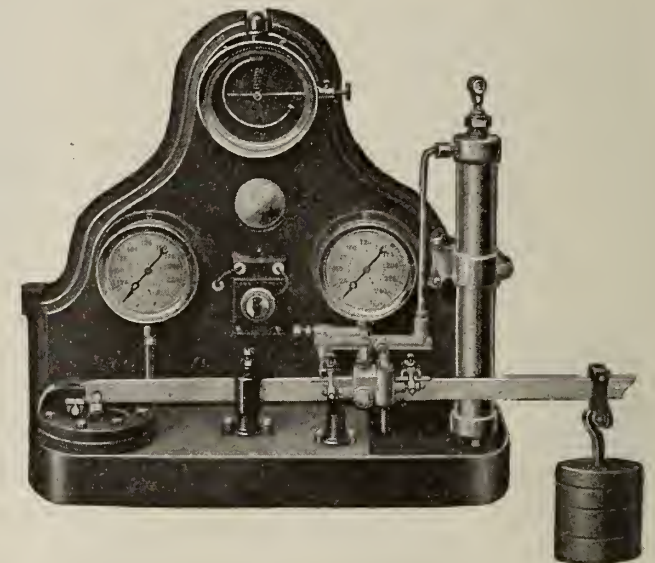
Regulator can be used for governing gas or fuel oil supply systems. Its action is positive and regulation within $\frac{1}{2}$ lb.

ADVANTAGES—This damper regulator maintains a uniform steam pressure, regulates speed of stoker engines, stoker motors, induced and forced draft engines, gas supply, oil supply, etc.

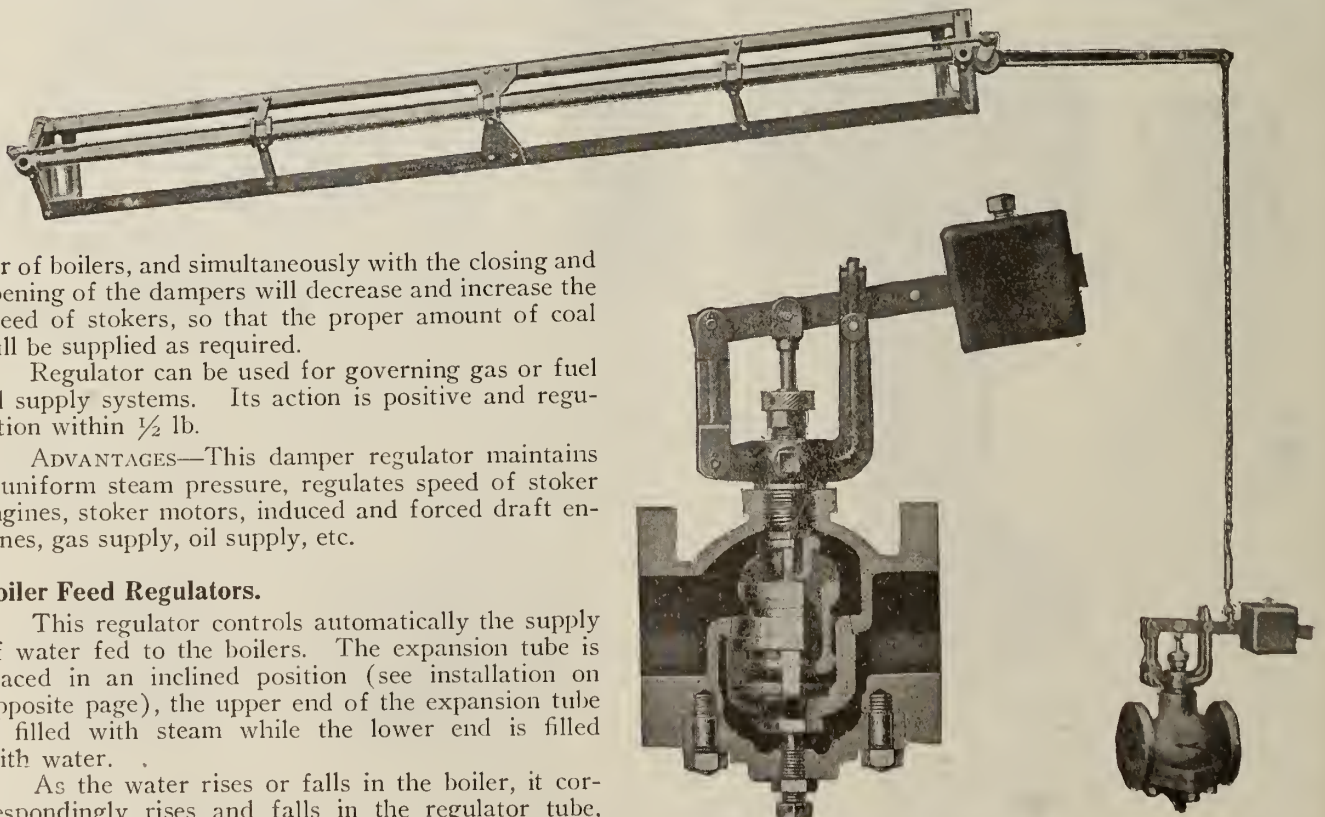
Boiler Feed Regulators.

This regulator controls automatically the supply of water fed to the boilers. The expansion tube is placed in an inclined position (see installation on opposite page), the upper end of the expansion tube is filled with steam while the lower end is filled with water.

As the water rises or falls in the boiler, it correspondingly rises and falls in the regulator tube, causing it to contract or expand and this motion is



McDONOUGH DAMPER AND STOKER REGULATOR



McDONOUGH BOILER FEED WATER REGULATOR AND FEED VALVE

POINTS OF SUPERIORITY—Valve and cage, easily accessible—easily removable through opening at bottom of valve.

Valve seats being beveled, prevent leakage—hold tight on banked fires—100% efficient in regulation.

Note liberal amount of metal for regrinding—the valve will give excellent service and outlast life of boiler; replace parts are unnecessary.

THERMOSTATIC TUBE STRUCTURE—Tube structure prevents vertical or sidewise buckling.

Lever operates valve from either steam or water end of tube.

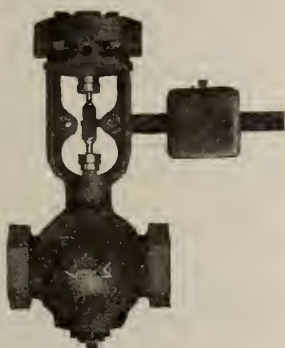
Radial slots at either end of tube permit incline of regulator after installation.

ADVANTAGES—Through the operation of McDonough regulator, pressure variation at heavy loads is less, quality of steam is drier, degree of superheat more uniform and greatly increased economy and efficiency is obtained in a boiler plant.

Pump Governors.

DIFFERENTIAL TYPE—The McDonough governor (differential type) is particularly designed for automatic regulation of reciprocating or turbine driven feed water pumps. It maintains any differential pressure desired in the pump discharge pipe over the boiler pressure.

Cap opening in the bottom of governor body for quick and easy removal of valve parts.



McDONOUGH DIFFERENTIAL TYPE PUMP GOVERNOR

Valve and cage of same construction as shown in valve on preceding page.

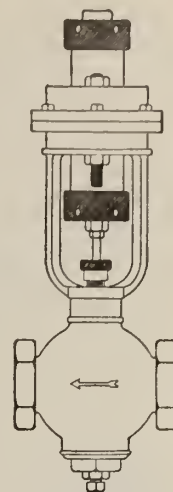
One adjustment only—by moving weight on lever arm.

Built in every size required.

CONSTANT PRESSURE TYPE—The McDonough governor constant pressure type is especially adapted for service on pumps which operate under excessive and changing steam pressure, while a constant pressure must be maintained in the discharge pipe from pump.

The same valuable features, bevel seat valve and cage, quick access to valve parts are used as in the pump governor, differential type.

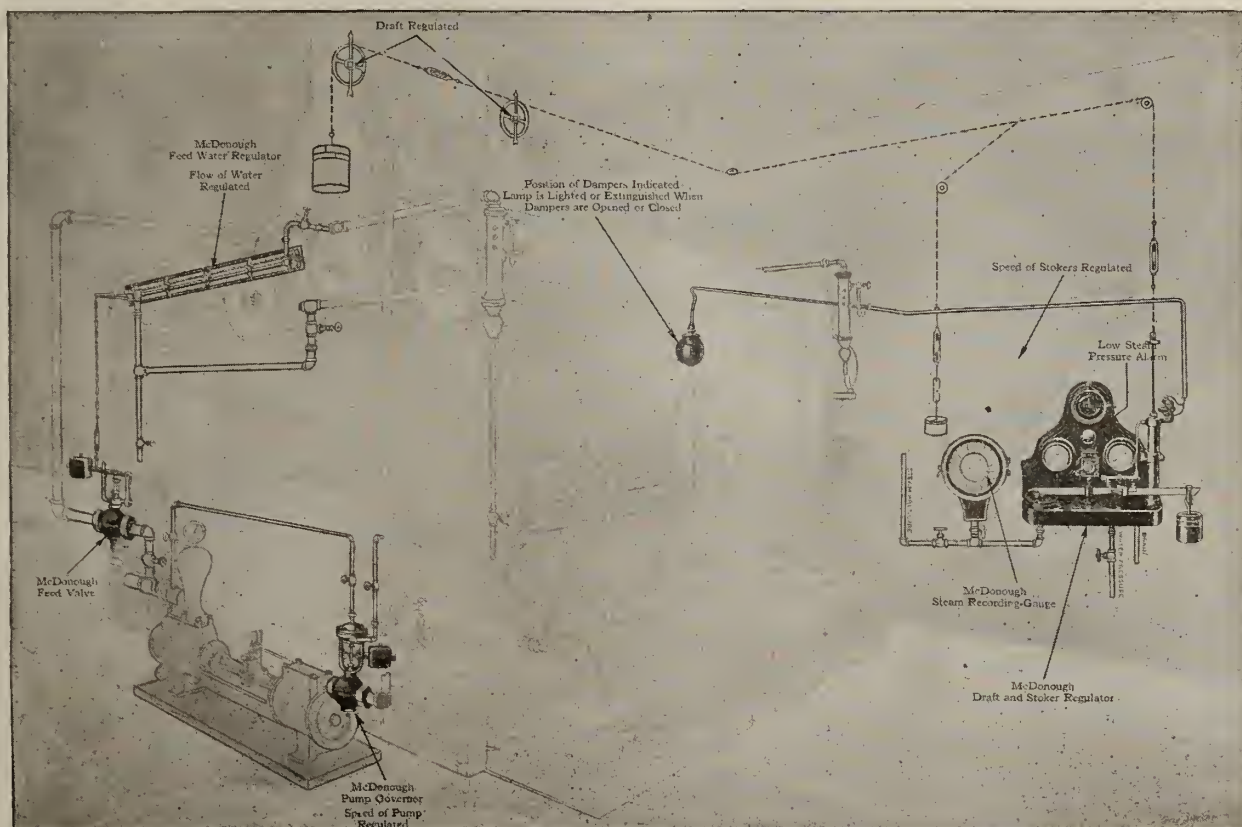
Built in every size required.



McDONOUGH CONSTANT PRESSURE TYPE PUMP GOVERNOR

Representative Purchasers of McDonough Regulators.

Carnegie Steel Co., Pittsburgh, Pa.
 Willys-Overland Co., Toledo, Ohio
 American Sheet and Tin Plate Co., Pittsburgh, Pa.
 Republic Iron and Steel Co., Youngstown, Ohio
 Edison Electric Co., Tiffin, Ohio
 University of Michigan, Ann Arbor, Mich.
 Middletown Gas and Electric Co., Middletown, Ohio
 American Rolling Mills, Middletown, Ohio
 French Paper Co., Niles, Mich.
 Detroit Stove Works, Detroit, Mich.
 Andrews Steel Co., Newport, Ky.
 Presto-Lite Co., Indianapolis, Ind.
 Clearfield Bituminous Coal Corporation, Rossiter, Pa.
 Denby Motor Truck Co., Detroit, Mich.
 King Paper Co., Kalamazoo, Mich.
 Liberty Steel Co., Warren, Ohio
 Pittsburgh Steel Co., Monessen, Pa.
 National Milling Co., Toledo, Ohio
 Wheat Paper Co., Elkhart, Ind.



"McDONOUGH SYSTEM" FOR THE AUTOMATIC REGULATION OF AIR, FUEL AND WATER

MASON REGULATOR CO.

Pressure Regulating Appliances

BOSTON, MASS.

Products.

REDUCING VALVES and PRESSURE REGULATORS for Steam, Water and Air; STEAM PUMP PRESSURE REGULATORS and SPEED GOVERNORS; BALANCED and FLOAT VALVES; HORIZONTAL PRESSURE CONTROLLING DEVICES; HYDRAULIC DAMPER REGULATORS; STRAINERS.

Reducing Valves.

Reduce and maintain an even pressure of steam or air regardless of the variation of the initial pressure or of the volume of steam or air required. Automatically reduce boiler pressure for steam heating systems of all types (vacuum systems included), central heating plants, engines, paper machines, slashers, dye kettles and all situations where it is desirable to use a lower pressure than that on the boiler.

Furnished in the auxiliary operated, lever and other types. All-bronze for initial pressures of 300 lbs., and iron body for pressures up to 180 lbs.

DIMENSIONS, WEIGHTS AND PRICES

STANDARD REDUCING VALVES

Size, ins.	Distance center to top, ins.	Distance center to bottom, ins.	Length over all, ins.	Weight, lbs.	Price list
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ALL-BRONZE, UNION ENDS TAPPED FOR STANDARD W. I. P.

1/2	7 1/2	4 3/4	5 3/4	6	\$18
3/4	7 1/2	4 3/4	5 3/4	6	18
1	10	5	7	11	22
1 1/4	11	6	8	16	28
1 1/2	11 3/4	7 1/2	9	23	35
2	12	9 3/8	11 1/4	42	44

IRON BODY, FLANGED

2 1/2	12	9 1/2	8 3/4	70	\$57
3	14	10 1/2	10 1/4	109	72
3 1/2	14	11 1/2	12	162	85
4	15	13 3/8	14	188	100
5	15 1/2	13 3/8	15 1/2	255	135
6	16 1/2	16	17 3/8	395	180
8	17 1/2	18 1/2	21	655	250
10	19 1/2	21 1/4	25 3/4	1400	350

LEVER STYLE REDUCING VALVES

ALL-BRONZE BODY

Size, ins.	1/2	3/4	1	1 1/4	1 1/2
Weight, lbs.	43	44	45	50	52
Price list	\$25	25	28	33	35

IRON BODY

Size, ins.	2	2 1/2	3	3 1/2	4
Weight, lbs.	85	112	150	195	240
Price list	\$44	57	72	85	100

Steam Pump Pressure Regulators.

Designed for fire, boiler feed, air and water works pumps, or any class of pumping machinery where it is necessary to maintain constant pressure. They are placed in the steam supply pipe to the pump, and connected by a 1/4-in. pipe to the discharge system, thereby exactly regulating the amount of steam to the requirements of the pump, and automatically maintaining a uniform discharge pressure regardless of any variation of steam pressure or demand on the pump.

The key style regulator is provided with a dashpot, which positively prevents it from chattering or pounding when sudden changes occur in the discharge pressure. It is fitted with union connections threaded for standard wrought iron pipe. As regularly furnished, it is suitable for steam pressures up to 250 lbs. and discharge pressures between 20 and 140 lbs.

No. 55 regulator has been designed for closed systems, such as are used in supplying domestic service or larger pressure systems for office and factory buildings up to 150 lbs.

SIZES, WEIGHTS AND PRICES STEAM PUMP PRESSURE REGULATORS

ALL-BRONZE BODY

Size, ins.	1/2	3/4	1	1 1/4	1 1/2	2
Weight, lbs.	9	9	15	19	29	48
Price list	\$20	20	25	30	42	55

IRON BODY

Size, ins.	2 1/2	3	3 1/2	4
Weight, lbs.	74	115	167	212
Price list	\$68	85	100	115

NO. 55 BRONZE BODY

Size, ins.	1/2	3/4	1	1 1/4	1 1/2
Weight, lbs.	21	22	23	26	26
Price list	\$18	18	22	28	35

NO. 55 IRON BODY

Size, ins.	2	2 1/2	3	3 1/2	4
Weight, lbs.	62	94	127	172	220
Price list	\$44	57	72	85	100

Steam Pump Speed Governor.

This governor is to the direct acting steam pump what the ordinary ball governor is to the steam engine. It derives its motion from some reciprocating part of the pump and controls a balanced valve placed in the steam pipe, thereby exactly regulating the amount of steam to the requirements of the pump, and automatically maintaining uniform speed, regardless of any variation of steam or load.

Suitable for controlling either duplex or single acting pumps, as well as flywheel pumps and other classes of pumping machinery.

SIZES AND PRICES PUMP GOVERNORS

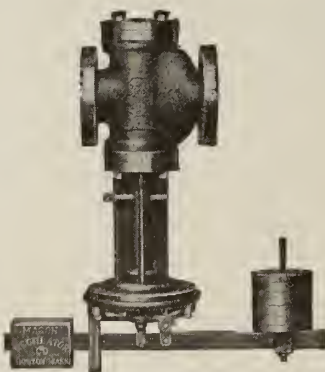
Size	Size Balanced Valves	List Price
No. 1	1/2 in. to 2 ins.	\$45
No. 2	2 1/2 ins. to 4 ins.	60
No. 3	4 1/2 ins. and larger	80



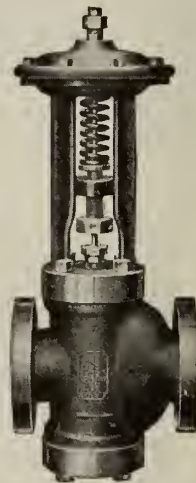
KEY STYLE
STEAM PUMP PRESSURE
REGULATOR



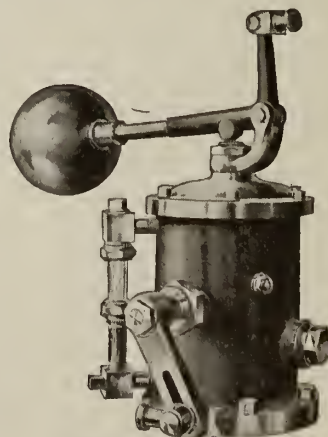
STANDARD REDUCING
VALVE



REDUCING VALVE,
LEVER STYLE



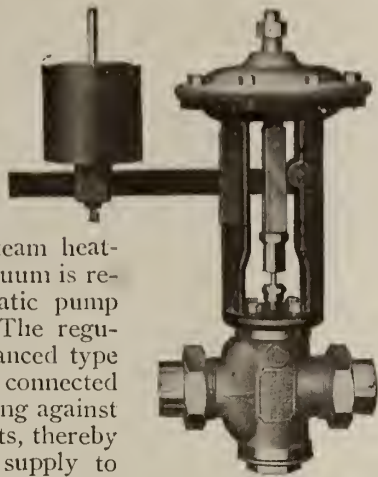
NO. 55 STEAM PUMP
PRESSURE REGULATOR



STEAM PUMP SPEED
GOVERNOR

Steam Vacuum Pump Regulator.

Designed to control steam operated vacuum pumps so as to maintain a uniform vacuum on the system. They are particularly adapted to vacuum systems of steam heating where a steady vacuum is required and an automatic pump control is desirable. The regulator consists of a balanced type of double seated valve connected to a diaphragm operating against the action of the weights, thereby regulating the steam supply to the pumps. Suitable for steam pressures up to 180 lbs. and adjustable for any desired vacuum.



STEAM VACUUM PUMP REGULATOR

SIZES AND PRICES STEAM VACUUM PUMP REGULATOR

Size, ins. List price	BRONZE BODY, UNION ENDS					IRON BODY, FLANGED		
	1½	¾	1	1¼	1½	2	2½	3
	\$25	25	28	33	35	44	57	72

Horizontal Pressure Controlling Device and Belt Shifter.

This device in its various modifications is used for controlling power and electrically driven pumps of all types and classes of service. It can be supplied for vacuums and pressures ranging from 0 to 3,000 lbs. operating in connection with variable speed rheostats, clutches, throwing belts, etc.; cylinder can be either vertical or horizontal, and can be furnished in various diameters and lengths of stroke as may be required.

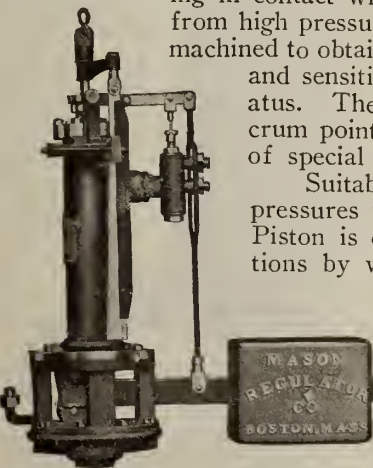


HORIZONTAL PRESSURE CONTROL

20 to 200 lbs. \$75 200 to 3000 lbs. \$100
For compensating device, add . . . 12
For varying device, add 35
For slowing device, add 20

Hydraulic Damper Regulator.

The design of the compensating device, which is positive in its action, insures the closest possible regulation. The operating cylinder as well as all parts coming in contact with the water are made from high pressure bronze and carefully machined to obtain the greatest durability and sensitive action of the apparatus. The knife edges and fulcrum points of the lever are also of special construction.



HYDRAULIC DAMPER REGULATOR

Suitable for controlling boiler pressures from 1 or 2 to 200 lbs. Piston is operated in both directions by water pressure, permitting use of rod connections to overhead shafting, which is desirable in the larger installations where a number of flue dampers are to be operated in unison.

SIZES AND PRICES HYDRAULIC DAMPER REGULATOR	
No. 4, with operating cylinder 2¼-in. diameter by 10-in. stroke, complete with sediment chamber, bracket, 25 ft. of chain and weights.	\$60
No. 5, with operating cylinder 3-in. diameter by 10-in. stroke.	72
No. 6, with operating cylinder 4-in. diameter by 10-in. stroke.	88
No. 8, with operating cylinder 5-in. diameter by 10-in. stroke.	110

Balanced and Float Valves.

Used to control pumps, engines and the like, by means of tank floats or cords to distant points, and also in connection with various devices for the control of water to receivers, open heaters and other similar devices. They are made in both the double seated or disk and piston type, with weight and lever or float attachment. Regularly furnished extra heavy, suitable for pressures up to 200 lbs.

DIMENSIONS, WEIGHTS AND PRICES BALANCED VALVES

Size, ins.	Distance center to top, ins.	Distance center to bottom, ins.	Length over all, ins.	Weight, lbs.	Price list
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ALL-BRONZE, WITH YOKE AND LEVER, UNION ENDS

1½	6 1/16	2 1/8	5 1/2	6	\$5.50
¾	6 5/8	2 3/4	6	7	6.50
1	6 1/8	2 5/8	6 3/8	9	8.00
1¼	9 1/8	2 1/8	7 1/2	14	9.00
1½	10 1/8	3 3/8	8 3/8	17	10.50

IRON BODY, YOKE AND LEVER, FLANGED

2	12 7/8	5 1/8	8 5/8	55	13.00
2½	14 3/8	6 1/8	11 1/8	86	19.50
3	15 1/8	7	12 1/2	128	25.00
3½	17 1/8	8	13 5/8	176	31.00
4	20 3/8	8 3/8	15 3/4	205	37.00
4½	21 3/8	9 1/8	17	265	55.00
5	23	9 1/8	18 1/4	315	75.00
6	26 7/8	11 1/8	20 1/2	430	103.00
8	29 1/8	14 1/4	25 1/2	830	160.00
10	34 3/8	17 1/4	30 1/4	1275	200.00
12	38 3/4	20	36	1950	286.00

ALL-BRONZE WITH VALVE STEM GUIDES

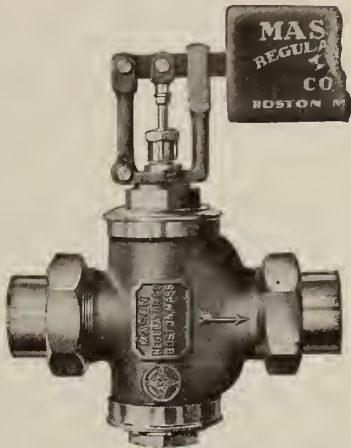
1½	5 7/8	2 1/8	5 1/2	5.50
¾	6 1/8	2 3/4	6	6.50
1	7 1/8	2 5/8	6 3/8	8.00
1¼	7 7/8	2 1/8	7 1/2	9.00
1½	9 1/8	3 3/8	8 3/8	10.50

IRON BODY, VALVE STEM GUIDES, FLANGED

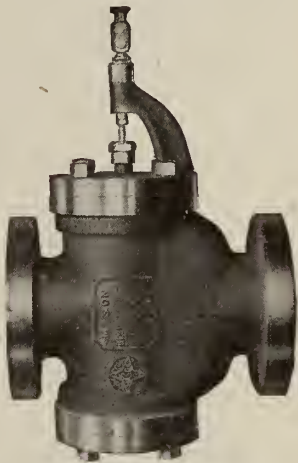
2	11 1/2	5 5/8	8 5/8	45	13.00
2½	12 3/4	6 1/8	11 1/2	76	19.50
3	14 3/4	7	12 1/2	110	25.00
3½	15 3/4	8	13 5/8	155	31.00
4	16 3/8	8 3/8	15 3/4	200	37.00
4½	18 1/8	9 1/8	17	255	55.00
5	20 1/8	9 1/8	18 1/4	285	75.00
6	22 5/8	11 1/8	20 1/2	420	103.00
8	28	14 1/4	25 1/2	800	160.00
10	30 1/4	17 1/2	30 1/4	1250	200.00
12	38 3/4	20	36	1900	286.00

Strainers.

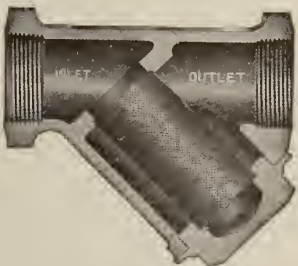
For use on steam or air lines to prevent sediment, scale, bits of packing or other foreign material passing into the reducing valve or other pressure regulator installed on the line, assuring the user of continuous service. Constructed not to reduce the volume of steam or air passing through them, yet are compact and self-cleaning without removing them from the line.



All-bronze, with Yoke and Lever



Iron Body, with Valve Stem Guide
BALANCED VALVES



STRAINER
Sizes, ½ in. to 6 ins.

MONASH-YOUNKER CO.

Manufacturers of High Grade Air Valves and Steam Specialties

CHICAGO, ILL.

NEW YORK, N. Y.

Products.

Manufacturers of HIGH GRADE AIR VALVES and STEAM SPECIALTIES.

Trade-mark.

Trade-mark stands for 30 years of quality and service.

It guarantees to the engineer or architect a reliable article for his client.

Monash No. 6 Four-way Drain Automatic Air Valve.

Made with a hexagon shaped base and has a 5-year guarantee stamped on the shell of the valve.

It is the only valve made with a special air tube, which conducts the air from the radiator to the top of the valve, permitting its escape through the outlet; which also equalizes the air pressure in valve—an all important feature in a perfect working automatic air valve.

It is the only valve that has a four-way drain extending from the body of the valve into the radiator, draining off the water of condensation, preventing flooding of floors and damage to ceilings below.

It is made with a locked shield and has a special key for adjusting, making it foolproof.

We recommend our Monash leakless, packless radiator supply valve in conjunction with the above valve.

How TO SPECIFY—Each radiator to have a Monash No. 6 four-way drain guaranteed automatic steam air valve and a Monash No. 119 leakless, packless radiator supply valve attached.

Monash No. 7 Vacuum Four-way Drain Automatic Air Valve.

Consists of a composition disc, which seats itself over the air outlet end of the valve closing against in-



gress of air, thus creating a perfect vacuum in the radiator, providing the supply valve is leakless and packless and of

a well-known make and is known as Monash, which can be supplied by us. A radiator thus equipped will retain the heat for hours after fire has been banked. This means reduction in fuel bills.

The interior construction of this valve is the same as No. 6, shown on this page.

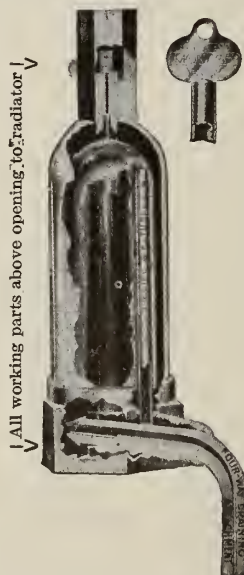
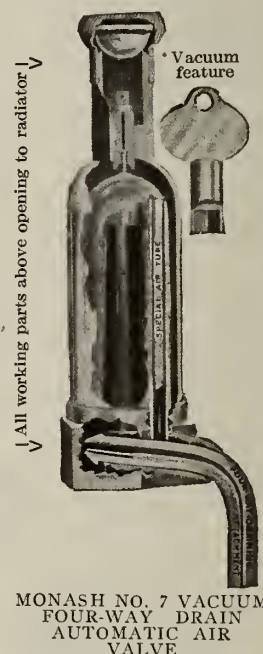
How TO SPECIFY—Each radiator or coil to have a Monash No. 7 vacuum four-way drain automatic air valve and Monash No. 119 leakless, packless, radiator supply valve attached.

Mo Va Co No. 1 Non-adjustable Syphon Thermo-static Automatic Air Valve.

Sensitive and quick in action. Opens instantly to let out air from steam radiators. Has sealed metal float with volatile liquid. Syphon is removable—an improvement over all others. Base and nipple are all in one cast. No soldered or sweated nipples to come apart.

Passes all air but not steam. No adjusting necessary. Every loop steam hot. Guaranteed to give results.

How TO SPECIFY—Each radiator to have a Monash Mo Va Co No. 1 non-adjustable syphon thermo-static automatic air valve and a Monash No. 119 leakless, packless radiator supply valve attached.



MONASH NO. 6 FOUR-WAY DRAIN AUTOMATIC AIR VALVE.
Patent No. 756,383



MO VA CO NO. 1 NON-ADJUSTABLE SYPHON THERMO-STATIC AUTOMATIC AIR VALVE

Monash No. 2 Liquid Thermostatic Diaphragm Automatic Air Valve for Drip and Air Line Systems.

Can be used with or without pump. Non-adjustable. No air bound radiators, no steam passing into air lines. Rapid and positive in action. Nipple connection to radiator, $\frac{1}{8}$ in. Air line connection, $\frac{1}{4}$ in.

How to SPECIFY—Each radiator or coil to have a Monash No. 2 liquid thermostatic air valve and a Monash No. 119 leakless, packless radiator supply valve attached.



MONASH NO. 2 LIQUID THERMOSTATIC DIAPHRAGM AUTOMATIC AIR VALVE

Monash Valve Holder.

This valve holder prevents valve from being turned or removed from radiator and is especially adapted for use in schools and all classes of public buildings. Illustration shows manner of fastening valve to radiator with Monash valve holder, used only with locked shield valves.



MONASH VALVE HOLDER



MONASH VALVE HOLDER INSTALLED

How to SPECIFY—Each radiator to be equipped with a Monash No. 6 four-way drain air valve and a Monash valve holder to prevent removal of valve from radiator.

Monash No. 9 Hot Water Automatic Air Valve.

On the market 20 years. Is the only *safe* and *reliable* hot water air valve on the market. It will automatically vent a hot water radiator. Requires no attention.

How to SPECIFY—Each radiator to have a Monash No. 9 hot water automatic air valve attached.

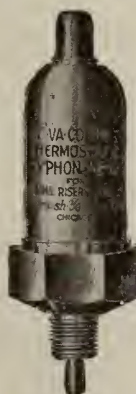


MONASH NO. 9 HOT WATER AUTOMATIC AIR VALVE

Mo Va Co No. 3 Non-adjustable Syphon Quick Vent Thermostatic Float Air Valve.

Made especially for quick venting mains, risers, Vento stacks and blast coils. Stops both steam and water. Made with $\frac{1}{4}$ -in. connections.

How to SPECIFY—Attach to each ——— a Monash Mo Va Co No. 3 non-adjustable syphon quick vent thermostatic float air valve.



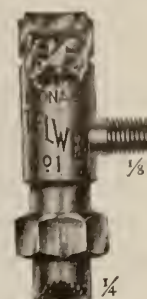
MO VA CO NO. 3 VALVE

Monash Telwen No. 1 Drip Line Automatic Air Valve.

Used in connection with Monash steam exhauster, Paul or other air line systems of vacuum heating.

The Telwen feature "tells when" valve is properly adjusted, saving time and work due to careless adjustment. Compensating spring seat prevents buckling or bending of expansion member by undue pressure.

The Monash Telwen No. 3 is made identically the same with connections to the radiator $\frac{1}{4}$ in., and $\frac{3}{8}$ in. to air line.



MONASH TELWEN NO. 1 DRIP LINE AUTOMATIC AIR VALVE

How to SPECIFY—Each radiator or coil to have a Monash Telwen No. 1, $\frac{1}{8}$ by $\frac{1}{4}$ in. (or Telwen No. 3) automatic steam air valve attached.

Monash No. 13 Trap.

A small and simple steam trap especially made for use on steam heating coils, heaters, steam jackets or other places where a small amount of condensation is to be removed without waste of steam.

Is perfectly automatic and, when properly adjusted, remains open as long as water escapes, closing when steam strikes expansion post.

Made with $\frac{3}{8}$ -in. connections and not recommended for use on pressure over 80 lbs.



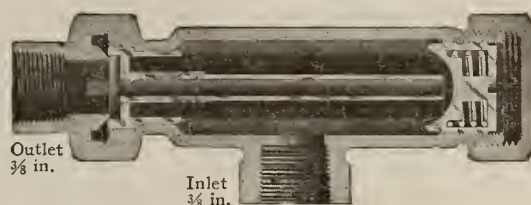
MONASH NO. 13 TRAP

How to SPECIFY—Each steam main to be equipped at proper point with a Monash No. 13 trap, $\frac{3}{8}$ -in. connection.

Monash Telwen No. 7 Automatic Steam Main Vent.

This valve is a large and powerful expansion air vent made for the purpose of relieving steam mains or risers of air as it accumulates, thereby permitting free circulation of steam.

The Telwen feature in the valve enables one to see at a glance whether or not the screw binds. Once ad-



MONASH TELWEN NO. 7 AUTOMATIC STEAM MAIN VENT

justed, this valve will operate on high as well as low pressure.

It is 8 in. long, threaded for either $\frac{1}{2}$ -in. or $\frac{3}{4}$ -in. pipe connection.

How to SPECIFY—The end of each steam main to have a Monash No. 7 Telwen automatic steam main vent attached, $\frac{3}{4}$ -in. connection.

To Specifying Engineers and Architects.
We do not make plans or specifications.
We leave that to the engineers and architects.

Monash No. 40 Thermostatic Return Line Valve.

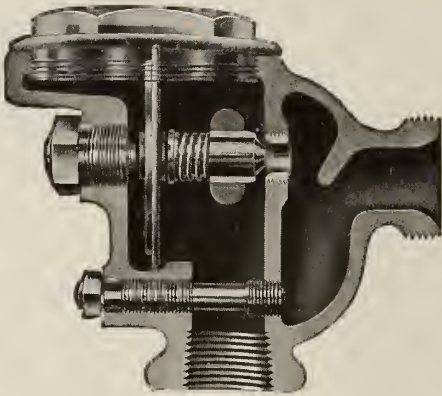
This valve is *unlike* any other, as it has a by-pass or clean-out feature. Therefore engineers and architects who wish a valve with these features should specify the Monash No. 40 *alone*.

If, however, the above features (by-pass and clean-out) are not required, then specify our No. 50 or Class C-10 thermostatic valves *without* by-pass or clean-out alongside with other well-known thermostatic return line valves.

Thermostatic diaphragm in the No. 40 and No. 50 valve is not attached to cover or body and is always out of steam chamber. It is simply dropped into the valve—an added feature not found in the construction of any other make.

This valve No. 40 is attached to many thousands of radiators and coils in mills, factories and commercial buildings where a perfect circulation of steam is obtained.

Can be installed by any heating contractor or engineer and guaranteed to give perfect results.
Catalogue on request.



MONASH NO. 40 THERMOSTATIC RETURN LINE VALVE

How to SPECIFY—Each radiator or coil to have a Monash No. 40 thermostatic vacuum guaranteed return line valve with clean-out feature and a Monash No. 119 leakless, packless radiator supply valve attached.

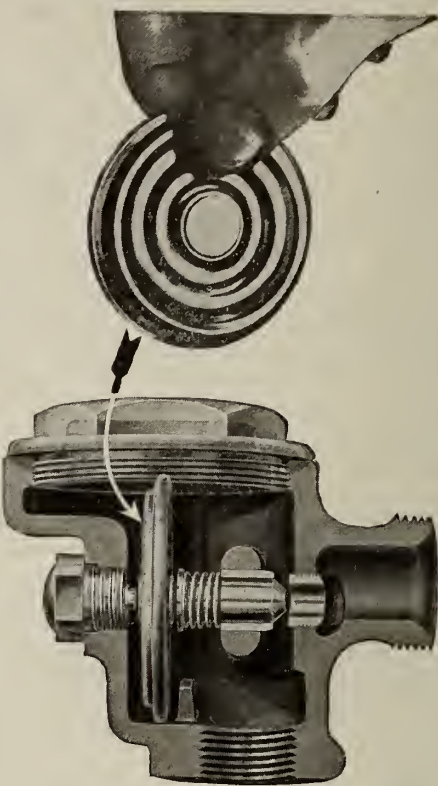
DATA, MONASH AIR VALVES

No.	Size, in.	Capacity of direct radiation	Lbs. water per hour
Class C	1½	250	75
No. 50	1½	350	108
No. 40	1½	350	108
No. 42	¾	1500	475
No. 44	1	5000	1566

Monash No. 50 Thermostatic Return Line Valve.

Is identical in construction as the No. 40, with the exception of clean-out feature and may be specified alongside with other well-known thermostatic return line valves. The diaphragm dropped into valve does the work.

How to SPECIFY—Each radiator or coil to have a Monash No. 50 thermostatic vacuum guaranteed return line valve and a Monash No. 119 leakless, packless radiator supply valve attached.



MONASH NO. 50 THERMOSTATIC RETURN LINE VALVE

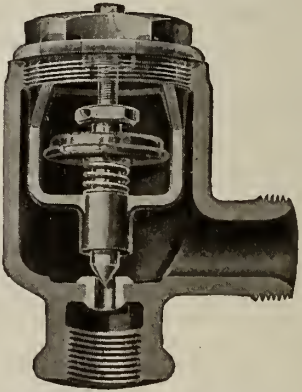
Monash Class C No. 10 Thermostatic Return Valve for Vacuum, Vapor and Graduated Heating Systems.

Is being used with great success in offices, apartments, hotels, hospitals, schools, banks, churches, clubs, commercial buildings, residences, etc.

3300 of these valves have been giving perfect service in the Continental National Bank Building, Chicago, since the winter of 1914, and not a single replacement of any part or piece of the valve has been required. So say the owners.

The Monash leakless and packless radiator supply valves are recommended for vacuum, vapor or graduated heating systems.

How to SPECIFY—Each radiator or coil to have a Monash Class C No. 10 thermostatic vacuum guaranteed return line valve and a Monash No. 131 graduated radiator supply valve attached.



MONASH CLASS C NO. 10 THERMOSTATIC RETURN VALVE FOR VACUUM, VAPOR AND GRADUATED HEATING SYSTEMS

NORTHERN EQUIPMENT COMPANY

System of Feed Water Control

MAIN OFFICE AND WORKS

115 West 11th Street

ERIE, PA.

BRANCHES IN ALL PRINCIPAL CITIES

Products.

COPEs SYSTEM of FEED WATER CONTROL;
COPEs FEED WATER REGULATORS; COPEs STEAM
PUMP GOVERNORS.



TRADE-MARK

Purpose.

Scientific control of the boiler feed and permanent mechanical performance. The system is a combination of the Copes boiler feed water regulator and the Copes steam pump governor.

Method.

The regulator feeds continuously as long as there is a load on the boiler. On heavy loads it automatically drops the water level so as to increase the steaming capacity. On light loads it automatically raises the water level, and saves the furnace heat which would otherwise be wasted. On steady loads, it maintains a constant water level.

The governor maintains a fixed excess in the feed line above boiler pressure. As the pressure varies, the feed pressure varies correspondingly. The same governor, with a change in connections, will give a fixed constant pressure.

Construction.

A glance at the illustrations shows the simplicity of construction. The regulator—a straight heavy tube, a straight lever, a heavy iron base, and a very rugged balanced valve that is practically frictionless. The governor—a cylinder and piston, a frame, and a balanced valve. Simple. Direct. Positive. No boiling liquids. No adjustments or repairs required after cutting into service. Practically no repairs. Many have been operating daily for over 20 years.

Results.

Gives higher overload capacity. Removes unreliable human element from water control.

Eliminates danger while new employees are being "broken in."

Saves fuel: 4% to 8% or more.

Even distribution of load between boilers.

Smooth rate of feed: more legible steam and water meter charts.

Smaller feed lines and valves.

More even load on feed pump.

Dry steam since the water level can not exceed a predetermined level and because the level is a minimum for greatest loads.

Higher superheat because water is not carried over into superheater tubes.

Where Used.

Wherever power boiler are used.

In 90% of the plants where power is generated for sale at a profit. Copes regulators and governors reduce costs and hence increase profits in those plants.

In 98% of the large modern central steam power plants. In practically every steel mill in the United States. In over 90% of the modern power plants in the anthracite coal field. In every industry where boilers are used. On Heine, Stirling, B&W, Erie City, Rust, Wickes, Manning, Badenhausen, Cahall, Bigelow-Hornsby, Nagle, Edge Moor, Keeler, Springfield, Geary, Ladd, Casey-Hedges, Vogt, Union, and other makes of boilers. On boilers under all conditions of load and climate. On boilers aggregating a total of over 8,000,000 h.p. and varying in size from 50 to 2400 h.p.—mostly over 200 h.p.



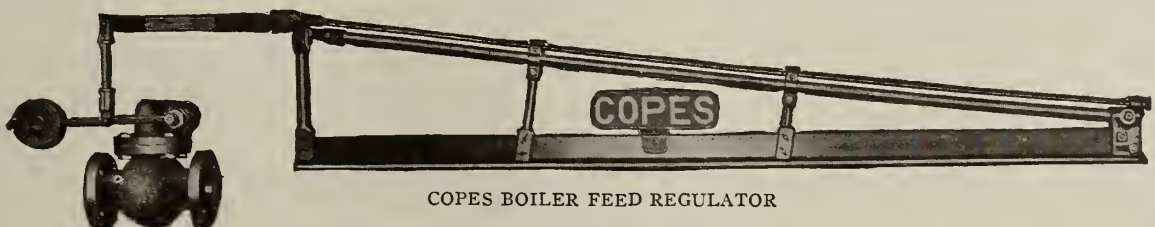
COPEs STEAM PUMP
GOVERNOR

The Best Proof.

The fact that there are more Copes regulators in successful daily operation than all other makes combined certainly is proof of the superiority of the Copes system.

Catalogues, etc.

Ask for complete catalogue, specifications, quotations, charts, test data, etc. Give this company all boiler conditions in detail.



COPEs BOILER FEED REGULATOR

THE POWERS REGULATOR CO.

Manufacturers of Automatic Temperature Controlling Apparatus

GENERAL OFFICES AND FACTORY

2131 Mallers Building
CHICAGO, ILL.

GENERAL EASTERN OFFICES

931 Architects Building
NEW YORK, N. Y.

BRANCHES

BOSTON, MASS., The Federal Street Building
CINCINNATI, OHIO, Gerke Building
DETROIT, MICH., Kerr Building
CLEVELAND, OHIO, 8001 Whitehorn Avenue

SEATTLE, WASH., Alaska Building
KANSAS CITY, MO., Reliance Building
SALT LAKE CITY, UTAH, Walker Bank Building
LOS ANGELES, CAL., 908 Hill Street

THE CANADIAN POWERS REGULATOR CO., LTD., TORONTO, CAN., WITH BRANCHES AT MONTREAL, WINNIPEG, AND CALGARY

Products.

APPLIANCES for the Automatic Regulation of Heating and Cooling Mediums and similar general purposes, all the result of years of research and experience in this one line of temperature control, and covered by the Powers guaranty of perfect workmanship and efficiency.

Variety and Adaptability.

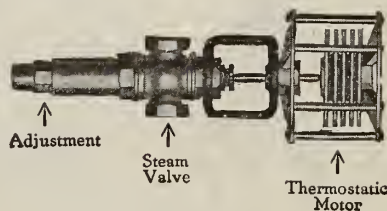
The specialties here shown are quite flexible in their adaptation to different temperature controlling requirements, and offer a variety designed to cover the field. New problems, however, are welcomed, and correspondence invited.

Air Temperature Control.

No. 16 REGULATOR—For control of temperature in dry rooms, kilns, warming ovens, varnish rooms, etc.

Self-contained, requires no air or water pressure for operation.

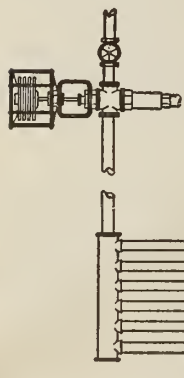
The thermo-static element consists of a pile of thermo-sensitive disks arranged in an open cage, so that a great amount of sensitive surface is exposed to the air to be controlled.



NO. 16 REGULATOR

This regulator having several forms and a great variety of applications, it is important that size of apartment, temperature required, nature of product treated, description of process, pressure of steam, and other facts bearing upon the operation should be fully stated, when ordering.

Ordinarily furnished with spring style of adjustment which may be locked and sealed, or exposed with wheel for manual operation. Bulletin 146.



TYPE OF INSTALLATION IN DRY ROOM, KILN, ETC.

PRICE LIST NO. 16 REGULATOR

Standard Machine, with Low Pressure Valve, Direct or Reversed, and Spring Adjustment, either Open or Sealed

Size, ins.	1/2	3/4	1	1 1/4	1 1/2	2
Price.....	\$60.00	65.00	70.00	75.00	80.00	90.00

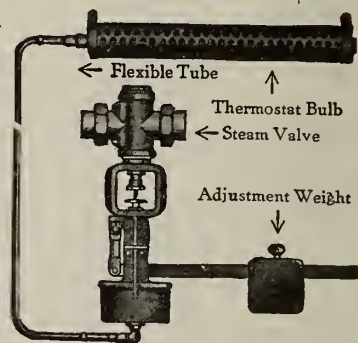
Add for lever weight adjustment \$3.00, net.

No. 15 REGULATOR—

For control of atmospheric temperatures where thermostatic bulb must be located some distance from steam valve. Particularly adapted to lumber kilns, smoke houses, textile and leather drying processes, grain and vegetable dryers, etc.

Entirely self-contained, of rugged construction, built for hard wear and long life; no perishable rubber diaphragms; exceedingly sensitive; control within 1° or 2° may be expected.

Adjustment for different temperatures is accomplished by changing the position of the lever weight, which can be locked when proper location is determined. Bulletin 138.



NO. 15 REGULATOR

PRICE LIST NO. 15 REGULATOR

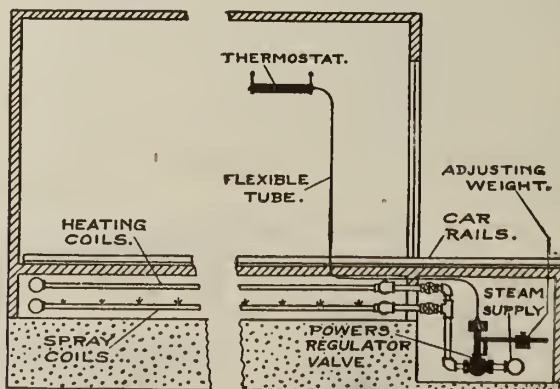
Size of valve, ins. ...	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2
Shipping weight, lbs.	50	50	55	60	65	70	90
Price.....	\$60.00	65.00	70.00	75.00	80.00	90.00	95.00

Size of valve, ins. ...	3	3 1/2	4	5	6	8
Shipping weight, lbs	100	125	140	160	190	330
Price.....	\$100.00	110.00	120.00	175.00	200.00	250.00

Always specify desired operating temperature, and state fully the purpose for which regulator is to be used.

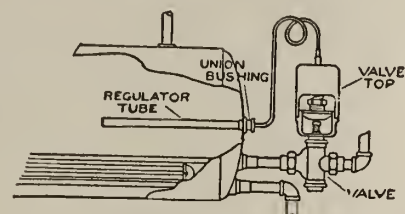
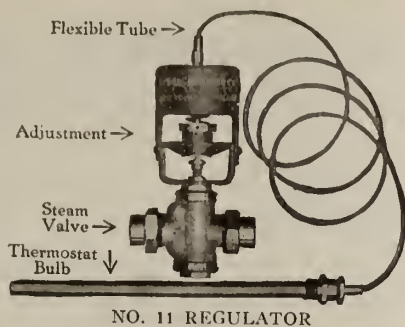
Valves to 1 1/4 ins. inclusive have bronze bodies, with unions. The 2 to 3 ins. inclusive have iron bodies screwed; larger than 3 ins., iron bodies flanged, with standard drilling. Companion flanges and bolts furnished extra when desired.

Standard flexible tube length, 8 ft.; additional length, 30¢ per ft., net. Reversed valves for control of cooling mediums will be furnished at a slight extra charge.



TYPICAL INSTALLATION NO. 15 REGULATOR IN A LUMBER KILN

No. 11 REGULATOR—Controls temperature of liquids of all kinds under all conditions. Self-contained, requiring no water or other auxiliary operating power. All-metal. Of great durability, guaranteed accurate and positive in action. Very easily installed. Largely used on hot water tanks and heaters, glue heaters, paraffin and grease tanks, etc. Bulletins 129, 138 and 139.



INSTALLATION NO. 11 REGULATOR IN HOT WATER HEATER

PRICE LIST NO. 11 REGULATOR COMPLETE WITH VALVE

Size of valve, in.	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2
Price	\$60.00	65.00	70.00	75.00	80.00	90.00	95.00

Size of valve, in.	3	3 1/2	4	5	6	8
Price	\$100.00	110.00	120.00	175.00	200.00	250.00

Screwed union valves up to 1 1/4 in. inclusive. 2 in., 2 1/2 in. and 3 in., screwed iron body; larger sizes iron body flanged. Standard flexible tube length, 8 ft.; additional length, 30¢ per ft., net. Bulb lengths, 20 to 24 in., requiring 1-in. and 1 1/4-in. tapping.

Liquid Temperature Control.

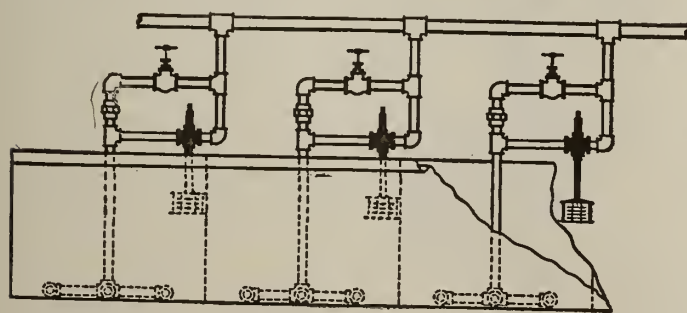
No. 16 REGULATOR—Same as described in first column of preceding page, but provided with an extension neck, giving a standard length of 19 in. from center of valve to bottom of thermostat cage, which length may be varied on specification. In this shape, the No. 16 regulator is used for control of liquids in open vats, for various processes, where it accomplishes wonderful results.

Bulletin 139 treats particularly of this regulator as applied in the meat packing industry. Also see Bulletin 146.

For prices, see preceding page, under No. 16 regulator.



NO. 16 REGULATOR



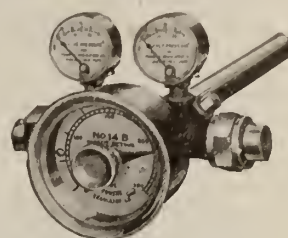
SHOWING USE OF NO. 16 REGULATOR IN HAM COOKING TANKS

No. 14B REGULATOR—Exceedingly accurate and reliable. Sensitive to a fraction of a degree. Uses compressed air as motive power.

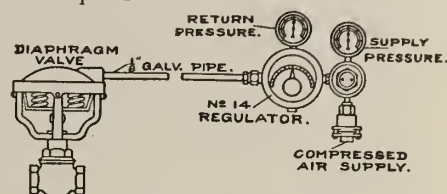
Used in air conditioning and for cold storage rooms, dry kilns, japanning ovens, varnish rooms, pasteurizers, leather dryers, steam cookers, etc.

All brass construction; polished nickel finish. Dials glass covered.

With this regulator may be used either rubber or all-metal diaphragm mounted valves of direct or reversed type and adapted to the control of steam, gas or liquids under any pressure; also diaphragm motors for the operation of dampers where heated air or gases are to be controlled. Bulletin 132.



NO. 14B REGULATOR



SHOWING METHOD OF INSTALLING NO. 14B REGULATOR

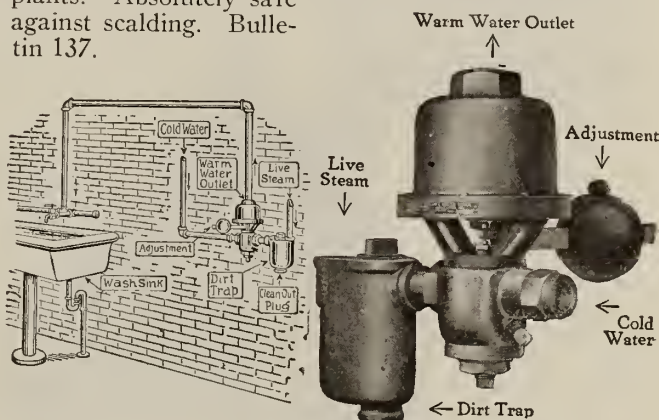
PRICE LIST NO. 14B REGULATOR WITH RUBBER DIAPHRAGM VALVE

Size, in.	1	1 1/4	2	2 1/2	3	4	5	6
Price	\$80.00	85.00	90.00	100.00	105.00	110.00	130.00	160.00

Reversed valves at slight extra charge.

Instantaneous Steam Water Heater.

Thermostatically controlled. For wash sinks, shower baths, etc., in factories, mines, and industrial plants. Absolutely safe against scalding. Bulletin 137.



INSTALLATION IN WASH SINK INSTANTANEOUS STEAM WATER HEATER

PRICE LIST INSTANTANEOUS STEAM WATER HEATER

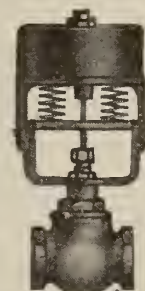
No.	Fittings		Capacity, gals. per min.	Shipping weight, lbs.	Price
	Inlet, in.	Outlet, in.			
1	3/4	1	25	50	\$100.00
2	1	1 1/4	50	60	150.00

All-metal Valves.

Made in all sizes, both single disk and balanced. Direct and reversed acting.

The absolute limit in durability. May be used with the No. 14B regulator in place of the rubber diaphragm valve and adds about 25% to the price.

Very desirable where the valve top is exposed to high temperatures. Bulletin 144.



ALL-METAL VALVE

PLANT ENGINEERING & EQUIPMENT CO., INC.

Manufacturers of Steam Traps and Condensation Meters

MAIN OFFICE
192 Broadway
NEW YORK, N. Y.

BRANCH OFFICES

BIRMINGHAM, ALA., 113 Hawkins Street, South
LITTLE ROCK, ARK., 211 East Markham Street
SAN FRANCISCO, CAL., 58 Sutter Street
BRIDGEPORT, CONN., 53 John Street
CHICAGO, ILL., 30 North Michigan Boulevard
NEW ORLEANS, LA., 821 Union Street
BALTIMORE, MD., 311 South Charles Street
BOSTON, MASS., 10 High Street
DETROIT, MICH., 814 Penobscot Building
MINNEAPOLIS, MINN., 423 5th Street, South
KANSAS CITY, MO., 312 Elmhurst Building
OMAHA, NEBR., 504 First National Bank Building

LYNDHURST, N. J., 56 Ridge Road
ROCHESTER, N. Y., 119 East Main Street
TROY, N. Y., 422 River Street
ASHEVILLE, N. C., P. O. Box 667
CINCINNATI, OHIO, 3621 Columbia Avenue
CLEVELAND, OHIO, 629 Euclid Avenue
PITTSBURGH, PA., 1204 Hartje Building
PHILADELPHIA, PA., 527 Commercial Trust Building
SALT LAKE CITY, UTAH, 17 Exchange Place
ROANOKE, VA., 1225 Clarke Avenue
KINGSTON, JAMAICA, Kingston Industrial Works
ST. JOHNS, N. B., CANADA, P. O. Box 1053

HAVANA, CUBA, Victor G. Mendoza Co., Cuba No. 3
WORKS: BROOKLYN, N. Y., 189 Prospect Avenue

Products.

CORLISS VALVE STEAM TRAPS.

MASON CONDENSATION METERS.

Atlas Reducing Valves and Regulating Devices;
Trane Thermetal Radiator Traps; Turbine Pumps;
Centrifugal Pumps; Reciprocating Pumps; Air Com-
pressors; Peandeco Boiler Compound and other Plant
Equipment; Peeco Strainers.

Corliss Valve Steam Trap.

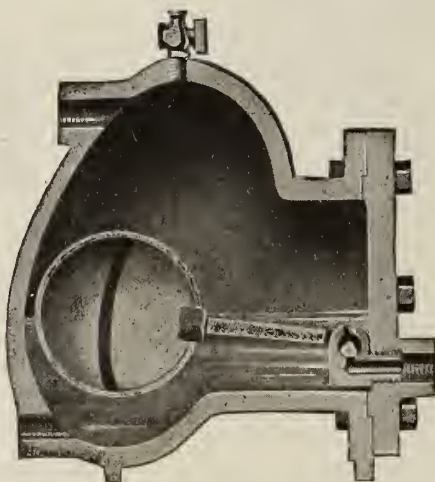
Built for pressures up to 300 lbs., except the
Junior which is limited to service of less than
125 lbs. For
every condensa-
tion removal
service.

State oper-
ating pressure
when ordering.

GUARANTEE
—The Corliss
valve steam trap
under ordinary
operating condi-
tions will give
satisfactory
service for 5
years.

A steam trap
that holds tight,
for 2 years, more
than earns its
cost.

The only
steam trap
equipped with a
wear compen-
sating valve or
backed by a
manufacturer's
guarantee of
definite service.



SECTIONAL VIEW CORLISS VALVE
STEAM TRAP



CORLISS TRAP VALVE

Mason Condensation Meter.

The operating cost of any steam using product can
only be figured on the condensation basis, whereby
steam condensation losses due to shutdowns using more
steam if wet and less steam if dry are all accurately
accounted for.

The accurate measurement of live steam is impos-
sible except
where density re-
mains constant.

An impor-
tant feature of
this meter is its
ability to meas-
ure vapor to a
maximum pres-
sure of about 5
ozs., which is es-
pecially valuable
in measuring
condensation in
atmospheric or
vapor heating
systems.

A unit out-
fit of Mason con-
densation meter
with Corliss
valve steam
traps is less ex-
pensive than
tilting traps
with stroke coun-
ter (dump in-
dicator).



MASON CONDENSATION METER
Adaptable to usual requirements

Capacity per hour, 10 to 2400 lbs. (constant flow)
Extreme length, 20 in.; width, 15 in.; height,
18 in.; shipping weight, 160 lbs.

Bulletins and Information.

Bulletins on steam traps, pumps, air compressors
and other plant equipment sent on request. Full infor-
mation may be obtained at any of the above mentioned
branch offices.

DATA, CORLISS VALVE STEAM TRAP

Pipe connections, in.	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5
Trap number	Junior	0	1	2	3	4	5	6	7	8	10
Capacity, water per hour, lbs.	500	1000	3000	4600	6200	9000	12000	15000	20000	25000	35000
Capacity, sq. ft. of radiating surface	1500	3000	9000	13800	18600	27000	36000	45000	60000	75000	105000
Shipping weight, lbs.	22	45	65	85	105	130	175	215	300	350	400
Price, f.o.b. New York	\$15.00	20.00	25.00	32.00	42.00	55.00	75.00	90.00	130.00	165.00	220.00

Note capacities when comparing prices with other makes. Discounts on request. State operating pressure when ordering.

THE RELIANCE GAUGE COLUMN CO.

Manufacturers of Reliance Steam Specialties and Cleveland Clutches

5914 Carnegie Avenue
CLEVELAND, OHIO

Products.

RELIANCE SAFETY WATER COLUMNS.

STEAM TRAPS.

SEAMLESS FLOATS.

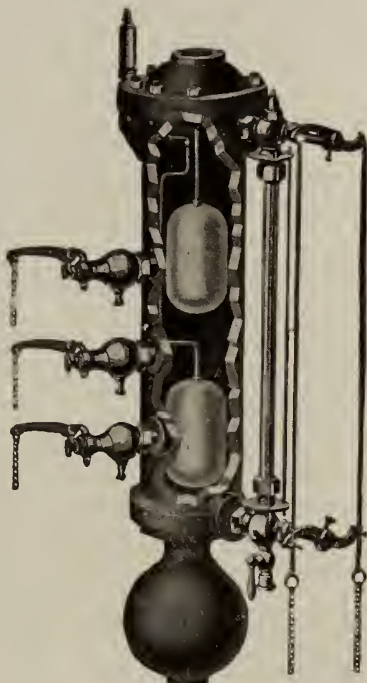
FRICTION CLUTCHES.

Also Quick Closing Water Gauges and Lever Gauge Cocks.

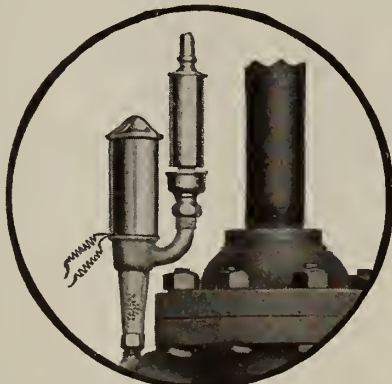
Reliance Safety Water Columns.

The Reliance is the original safety alarm water column. It has been the standard for 30 years and meets all codes and laws.

The whistle gives a warning when the water level falls to the lower gauge cock or rises to the upper gauge cock. Reliance columns are made in two styles, the low alarm only and the combined high and low alarm. A Reliance seamless copper float operates each valve. The valves and levers are located above the water line away from sediment and scale which falls to the sediment chamber at the bottom where it can be blown out.



SECTIONAL VIEW OF RELIANCE COMBINED HIGH AND LOW ALARM



RELIANCE ELECTRIC ALARM

A Reliance electric alarm can be used in place of or in addition to the whistle. It can be connected to ring a bell, light a lamp or record on a chart when the water level is too high or too low. It gives a silent alarm for hospitals, hotels or schools.

Reliance Seamless Floats.

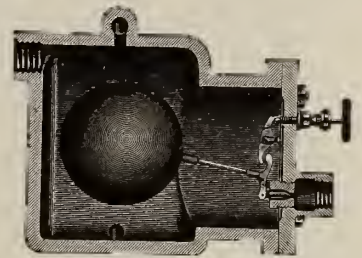
Reliance floats are seamless and made by our perfected processes. They are designed to give maximum strength and buoyancy with long life. They are made to fit any special requirements.



RELIANCE SEAMLESS FLOATS

Reliance Steam Traps.

The Reliance trap is operated by a Reliance seamless copper float that causes the valve to discharge in proportion to the inflow. It operates without unnecessary noise or hammering. All parts are easily accessible and free from complication or difficult adjustments.



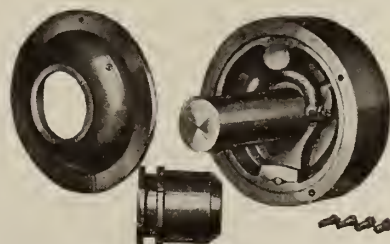
SECTIONAL VIEW RELIANCE STEAM TRAP

Cleveland Friction Clutch.

The Cleveland clutch and cut-off coupling is an enclosed type with expanding ring. It is readily accessible and easily adjusted. The pulley is not a part of the clutch and can be changed without changing clutch.



CLEVELAND FRICTION CLUTCH



FRICTION CLUTCH WITH COVER REMOVED

SARCO COMPANY, INC.
Manufacturers of Steam Specialties
Woolworth Building
NEW YORK, N. Y.

BUFFALO, N. Y., 325 Ellicott Square PHILADELPHIA, PA., Drexel Building CLEVELAND, OHIO, Williamson Building
DETROIT, MICH., Majestic Building CHICAGO, ILL., Monadnock Building

Products.

STEAM TRAP SARCO; RADIATOR TRAP SARCO; TEMPERATURE REGULATORS for liquids and atmosphere, for drying ovens and manufacturing processes.
Metallic Gaskets.

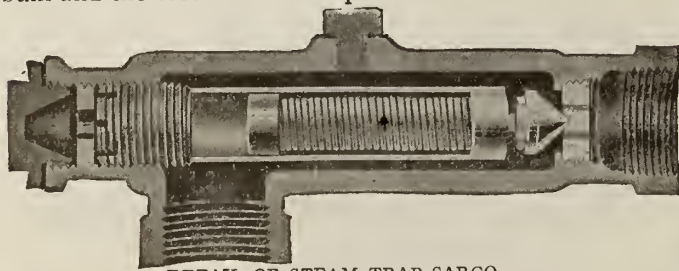
Advantages of Steam Traps and Radiator Traps Sarco.

There is no simpler form of trap manufactured. There is practically nothing to get out of order; no levers, gages, packing, stuffing boxes or trouble causers. The traps can be adjusted instantly, and this company guarantees that, when adjusted, no live steam will be emitted.

Steam Trap Sarco.

Consists of a steam pipe body which can be screwed on anywhere in a steam main or pipe, occupying very little space and taking the place of an elbow or bend. In this body, a Sarco cartridge is inserted, containing an easily expansible fluid operating a spirally corrugated, hermetically sealed tube, to the lower end of which is attached a piston, which carries the valve head.

The trap requires simply to be put into position and the cartridge unscrewed a few turns. When the steam has heated the cartridge, expanding the fluid and forcing out the piston, the cartridge is gently screwed forward, until the valve head meets the seat, closing off the steam. The adjustment can then be locked and the trap works automatically. As soon as water collects, the liquid contracts and the valve opens; the condensation is then ejected by the pressure behind it, and immediately the steam comes into contact with the cartridge there is an expansion, and the trap closes. The Sarco trap works continuously, thus it requires no large storage capacity such as increases the bulk and the cost of other traps.



DETAIL OF STEAM TRAP SARCO

LOW PRESSURE—0 TO 50 LBS.

Size, in.	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
List prices	\$6.00	6.00	9.45	11.25	24.15	30.00	38.70	51.75	60.00

HIGH PRESSURE—50 TO 200 LBS.

Size, in.	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
List prices	\$7.75	7.75	10.35	12.00	28.50	34.50	48.30	60.00	75.00

Radiator Trap Sarco.

A development of the steam trap Sarco. It uses a spirally corrugated tube of large diameter, which, with the outer case, forms the expansion chamber, containing a volatile liquid. The inside of diaphragm is directly exposed to steam or vapor, insuring quick action. Slight



change of temperature within the trap, due to condensation collecting in same, gives a wide open movement of the valve.

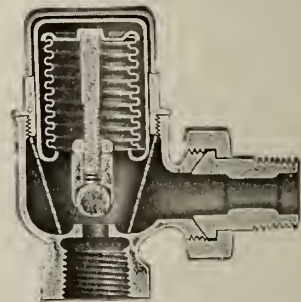
The Sarco is provided with a new valve head, which is a bronze metal ball, freely turning in a socket, insuring a perfect seat and offering a wearing surface many times greater than that of any other type of valve on the market.

The new Sarco radiator trap construction also permits the provision of a strainer of ample surface, ten times the area of the discharge opening of the trap itself. This obviates entirely trouble from clogged or leaking valves.

The trap is a factory adjusted trap and requires merely to be connected to the radiator and to a return exhaust line. It will work perfectly on any degree of vacuum and on any steam pressure up to 20 lbs. per sq. in., without strain and without readjustment.

DATA, TYPE "D" RADIATOR TRAP SARCO

Size, in.	3/8	1/2	3/4
Over all length, in.	3 1/2	3 1/2	3 1/2
Center inlet to outlet, in.	1 1/4	1 1/4	1 1/4
Center valve to face inlet, in.	2 1/2	2 1/2	2 1/2
List prices	\$6.00	6.00	7.50



DETAIL OF RADIATOR TRAP SARCO

Sarco Temperature Regulator.

The Sarco temperature regulators are for controlling the temperature of atmosphere and liquids. They use the same thermostatic principle as the well-known steam trap Sarco, that of expansion and contraction of a sensitive liquid hermetically sealed within the elements. They possess many advantages over thermo regulators at present on the market, in as far as they are compact, simple and wholly self-contained, requiring no exterior operating means, such as compressed air, water or electricity.

This form of construction accounts for the success of the Sarco, as it permits a more accurate and constant regulation, reduces installation expense to the lowest possible point, and eliminates maintenance expense, there being no parts to get out of order.

Sarco regulators are made in three standard types: for room temperature control, for dry kiln work and for tank control, operating on any given temperature between 32° and 300° Fahr. All types can be adjusted by user for any temperature 10° Fahr. above or 10° Fahr. below that for which regulator is calibrated.

Prices on application. Sizes of valves, 1/2 in. to 6 in.



SARCO TEMPERATURE REGULATOR

TEMPLETON MANUFACTURING CO.

Manufacturers of Return, Vacuum and Separating Traps

117 Business Street
HYDE PARK, MASS.

Products.

RETURN STEAM TRAPS; VACUUM TRAPS; SEPARATING TRAPS.

Sterling Return Steam Trap.

More efficiently removes condensation from steam systems than any other trap and automatically returns it to the boilers.

Pumps water at a temperature exceeding 212° Fahr. (a steam pump will not), thus preserves all of the heat above 212°, returning a cubic foot of water for every cubic foot of steam. It operates on 90% less power than a steam pump.

DISTINCTIVE FEATURES—Valves and air vent are opened and closed by a rolling weight which travels from one end to the other of a rocker arm. This eliminates all trunnions and hence trunnion troubles, pounding, sticking and leaking.

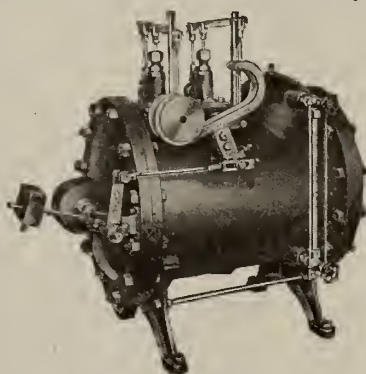
The steam valve can be adjusted to open only when the receiving chamber of the trap is full of water. This gives maximum discharge capacity with minimum space, or it can be adjusted to discharge at any height of water.

While the rising and falling of the rocker arm is actuated by a float, this float is counterbalanced by a weight. This enables the use of a patented, very heavy, strong, indestructible, leakproof, seamless Sterling float, as from this counterbalance the full lifting power of the float is obtained regardless of its weight.

A gauge glass discloses constantly the work going on and gives immediate notice when return system is not functioning properly.

The traps are automatic in action and require little attention. There is no friction. They are noiseless, require no cylinder lubrication, will not race or run away, never become steam bound and air binding is an impossibility. All valves are on top of trap, easily accessible for regulation. No packing except in the valve stem, which is easily accessible for re-packing.

The Sterling vacuum trap automatically sprays cold water throughout the casing of the trap when it is



STERLING RETURN STEAM TRAP

*CAPACITIES OF STERLING RETURN TRAPS

Trap No.	Size water inlet and discharge, in.	Lin. ft. of 1-in. pipe trap will drain	Lbs. water trap will discharge	Gals. water trap will discharge	Sq. ft. radiation trap will drain
51	1	16000	3300	400	5330
52	1½	26000	5300	650	8633
53	1½	34000	7000	850	11300
54	2	42000	8200	1020	14000

*Maximum capacities per hour based on ordinary condensing conditions.

full of steam, condensing the steam and creating a vacuum which pulls condensation from all over the system.

AUTOMATIC OPERATION AS BOILER RETURN—The trap should be placed 4 ft. above the boiler; when it is empty, the vent is open. Either by gravity, or the pressure in the system, or the pressure from another trap acting as a pump, condensation flows into the trap through inlet check valve at bottom of trap. As the trap fills, a large copper float in the trap casing rises. At an adjustable water level, a roller weight on tilting track and connected with the float is carried to the other end of the track, closing the vent and opening steam inlet connecting with boiler pressure. The trap will then return the water directly into the boiler, as the pressure in the trap is equalized with that in the boiler and the water will flow down through outlet check valve into the boiler by gravity. Trap casing is emptied and the float following the water, lowers itself, causing weight to return to other end of track, closing steam inlet and opening vent for another filling and another discharge. Gauge glass shows that receptacle is emptied on each discharge. Trap can then be used as a pump-to-pump condensation from one part of the plant to another and it will operate at about one-tenth the cost of a steam pump.

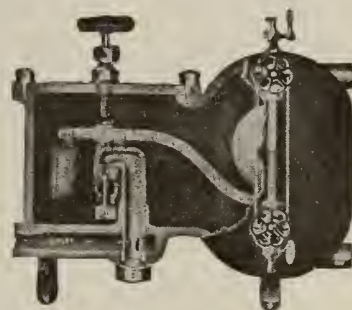
This company maintains a no-charge service department. Write concerning condensation problems.

Sterling Separating Traps.

The only steam trap wherein it is not necessary to break any pipe connection to get *all* parts out of the casing. One operation removes all parts at once.

The Sterling trap operates at any pressure and is equipped with the Sterling indestructible copper float. All parts are interchangeable.

Ingenious combination of counterbalanced float and vertical valve dropping from its seat overcomes the friction found in all other float traps and the obvious result is greater capacity, with elimination of wire drawing in valve, which with seat is of government metal and always under water seal.



STERLING SEPARATING TRAP

CAPACITIES OF STERLING SEPARATING TRAPS

Size No.			Conden- sation, lbs. per hour	Lin. ft. 1-in. pipe	Weight, lbs.	Dimensions, in.
Series 1 0 to 30 lbs. pressure	Series 2 0 to 150 lbs. pressure	Series 3 0 to 225 lbs. pressure				
0	20	31	1200	2400	65	11½ x 12 x 7½
1	21	31	2100	4000	75	13 x 14 x 8½
2	22	32	3500	7000	95	14 x 14½ x 9
3	23	33	5400	12000	110	15 x 17 x 9½
4	24	34	7500	16000	130	16 x 18 x 10
5	25	35	11000	25000	150	18 x 19 x 10½
6	26	36	18000	40000	180	18 x 20 x 12

WARREN WEBSTER & COMPANY

Steam Heating Systems, Feed Water Heaters and Steam Specialties

MAIN OFFICE AND WORKS

CAMDEN, N. J.

OFFICES AND REPRESENTATIVES IN PRINCIPAL CITIES OF UNITED STATES AND CANADA

Products.

SPECIALTIES for WEBSTER SYSTEMS of STEAM HEATING, FEED WATER HEATERS, STEAM and OIL SEPARATORS, and EXPANSION JOINTS.



TRADE-MARK

Webster Vacuum System of Steam Heating.

A method of circulating exhaust or low pressure live steam, or a combination of the two with minimum initial or back pressure, and with entire freedom from waterhammer, air pockets, leaky air valves, and all of the other annoyances which are common with ordinary steam heating systems.

A partial vacuum is mechanically created and maintained by means of exhausting apparatus of suitable design and capacity, which may be steam driven or power driven vacuum pumps.

Condensation from each heating unit is discharged through an automatic Webster radiator trap, which permits the escape of air and water and prevents waste of steam.

A positive acting vacuum pump creates a pressure below atmosphere in the return piping and in the radiators, so that when steam is turned into the system it rapidly flows into the lower pressure until each heating unit is completely filled. The automatic radiator traps then close and prevent further passage of steam until it has done its work of heating and has become condensation, which will freely pass through the automatic trap.

The water of condensation and air flow to the lowest point of the system and are discharged by the vacuum pump to a higher level into the Webster air separating tank, from which the air is vented to atmosphere, while the condensation returns to boiler through boiler feed pump or by such means as may be required due to the particular conditions. Described in Bulletin No. B-500.

Webster Modulation System of Steam Heating.

A highly efficient modern type of low pressure steam heating system suitable where live steam only is used for heating, either direct from heating boilers or with steam supply furnished from outside source.

Quick and efficient circulation of steam is obtained by carrying a differential in pressure between the supply and return piping, and atmospheric pressure or slightly below in return piping, and atmospheric pressure or slightly above in the supply piping.

Initial steam pressure is closely controlled by a Webster damper regulator. Condensation is discharged automatically to the boilers or elsewhere through a Webster modulation vent trap which operates without adjustment or attention. The steam is admitted to each radiator through a Webster modulation valve which permits close modulation of room temperature by simple

hand manipulation. Condensation is discharged and air vented from each radiator through a Webster radiator trap which maintains full heating efficiency of radiation and eliminates all annoyances.

Condensation and air from each radiator are carried into Webster modulation vent trap, where the air is automatically vented, permitting the system under favorable boiler conditions to operate for long periods under partial vacuum, or "vapor," but also, due to its flexibility, permitting higher pressures to be carried in severe weather. The system may be modified to suit particular conditions. Described in Bulletin No. B-600.

Webster Heating Systems for Industrial Plants.

Industrial plants, especially those having available exhaust steam from steam driven power units or auxiliaries, present heating problems, the correct solution of which is vital to economy and efficient operation and requires individual engineering attention.

For industrial work, the Webster vacuum system of steam heating is particularly desirable not only for the saving of exhaust steam, which alone makes this system highly profitable, but also the returns are pure water, which with its contained heat can be fed back to the boilers.

Experience in installation of heating systems in thousands of prominent industrial plants, and the wide adaptability of Webster systems, enables this company to meet any industrial requirements.

The remodeling of old heating systems in industrial plants, to avoid the discomforts, inefficiencies and extravagances that exist where the latest methods and devices are not in use, has also been specialized.

So much has been done of this remodeling that very definite guarantees of saving can be made in advance. The Webster system has been applied to old plants on guarantee to pay for itself within two years—a return of 50% on the investment.

Preliminary investigation and advice involves no expense or obligation.

Webster systems for industrial plants are fully described in Bulletin B-501.

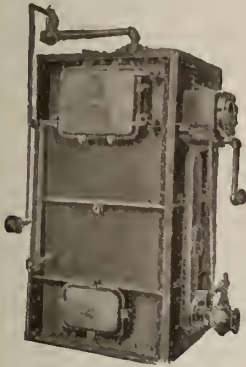
Webster Feed Water Heaters.

Thirty-one years of progressive development as the pioneer builders of the "no thoroughfare" type of open-feed water heaters has made this company the recognized leader in this line, and as to be expected, they build many special types and designs desirable to get greatest benefits under any given plant conditions. Webster heaters will heat the water to within 2° to 5° of the temperature of the exhaust steam.

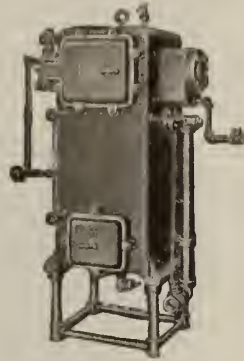
Webster heaters most popular for power plant service only and those especially adapted for heating system requirements are as follows:

Type EB is the standard rectangular pattern for capacity of 300 to 12,000 h.p., combining with the heating function an efficient oil separator, filter and liberal storage capacity. For use in industries where there are intermittent demands for large quantities of hot water, this heater is modified by addition of much larger storage capacity at the bottom. Described in bulletin No. B-102.

Type EBH is exactly the same as the EB, except that the plates are thickened and strengthened for higher back pressures—as, for instance, in a paper mill using higher pressure exhaust steam for drying purposes.



TYPE EB WEBSTER
FEED WATER HEATER

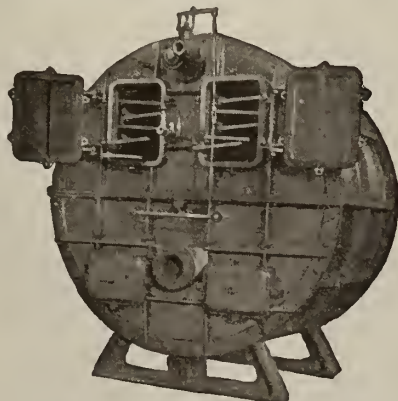


TYPE EF WEBSTER
FEED WATER HEATER

Twin heater units connected to a common exhaust main are recommended for large plants and for those operated continuously. This arrangement avoids piping and control complications and permits one heater to be taken out of service for cleaning while the other remains in use. The twin arrangement also forms an easy method of increasing capacity by the addition of the second heater after the first has become too small for plant needs.

Type EF is for smaller capacities, 50 to 350 h. p., and is similar to Type EB, except that the shell is a one-piece casting and is supported by a framework made from pipe and fittings. Type EG is the same heater modified for power service only. Described in Bulletin No. B-105.

Type ED is of horizontal cylindrical form for 500 to 15,000 h.p. It contains all the essential features of the rectangular types, but has extra large storage capacity for receiving returns from heating or drying system, hot well, etc., and is particularly desirable also where there is less headroom than required for a rectangular heater. Described in Bulletin No. B-104.



TYPE ED WEBSTER FEED WATER HEATER

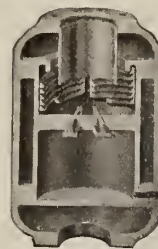
The preference cut-out type is a further development of our EB, ED, EF and EG types through the substitution of an extra large three-way oil separator, by

means of which all the exhaust steam, not merely that going to the heater, is purified from oil. The heater automatically takes what steam it needs, while the rest passes to heating system or to atmosphere. A cut-out valve between the oil separator and the heater permits isolation of the heater for cleaning, etc., without disturbing the flow of steam through the separator. This type is particularly desirable where part of the engine exhaust goes to the heating system.

Inasmuch as the selection of a feed water heater is a matter of careful judgment, the Webster engineering staff is always ready to co-operate with reliable advice to prospective customers.

Webster Steam Separators.

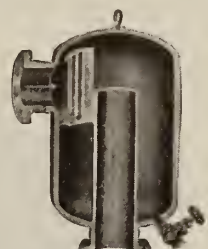
Webster steam separators deliver dry clean steam. Their use permits smaller piping to carry given quantity and flow of steam, avoids excessive condensation and economy losses and dangers to cylinder heads, and permits sliding surfaces to work with less lubrication. Plain and receiver types are made in all desirable sizes up to 12 in. Described in Bulletin No. B-300.



Vertical for 200
lbs. Pressure



Horizontal for
150 lbs.
Pressure



Angle for 150 lbs.
Pressure

WEBSTER STEAM SEPARATORS

Webster Oil Separators.

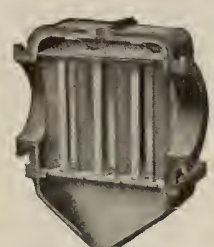
Webster oil separators for purifying exhaust steam are made for horizontal or ascending or descending vertical currents and in sizes up to 24-in. plain and receiver types. The Webster oil separator baffles have been demonstrated to be highly efficient in separation with minimum pressure drop in the flow of steam. Described in Bulletin No. B-400.



Horizontal for
Large Sizes
(8 to 16 in.)



Vertical
Sizes (3 to 16 in.)



Receiver Type
Sizes (8 to 24 in.)

WEBSTER OIL SEPARATORS

Webster Expansion Joints.

Webster expansion joints are made in single and double slip siding sleeve types for high and low pressure and with an anchor footing, the use of which avoids strains of pipe sag with their consequent leakage and adjustment annoyances. Types for the higher pressures are provided with limit bolts. Sizes 2 to 24 in.; pressures up to 200 lbs. per sq. in. Described in Bulletin No. B-1100.



WEBSTER EXPANSION
JOINT

VANCE-VETTER COMPANY

Manufacturers of Steam Traps, Separators and Valves

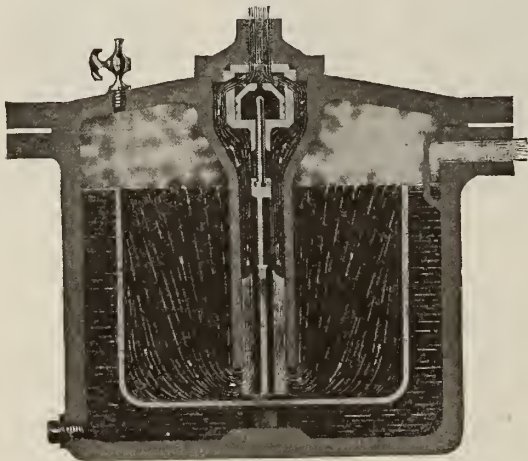
Phipps Building
PITTSBURGH, PA.

Products.

VANCE STEAM TRAPS ; BAUM STEAM and OIL SEPARATORS ; VANCE BLOW-OFF VALVES ; HYDRAULIC OPERATING VALVES.

Vance Steam Trap.

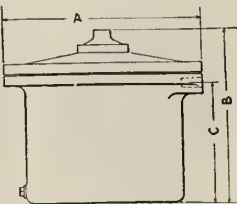
Extra large discharge valve will handle condensation as fast as it can come through inlet pipe. Most traps for pressures of 100 lbs. or over can not get the power to operate a discharge valve larger than about one-sixteenth the area of the inlet.



VALVES OPEN, TRAP DISCHARGING

DIMENSION (INCHES) VANCE STEAM TRAP

No.	Size	A Flange diam.	B Total height	C Base to inlet
1	1/2 or 3/4	12	10 3/4	6 3/4
2	1	13 3/4	12 5/8	8
3	1-1/2	15 3/4	14 3/4	9 1/2
4	1-1/2	17 3/4	16 5/8	10 3/4
5	2	19 1/2	18 7/8	12 1/4
6	2 or 2 1/2	20 1/2	20 7/8	13
7	2 or 2 1/2	22	22 5/8	14 1/4

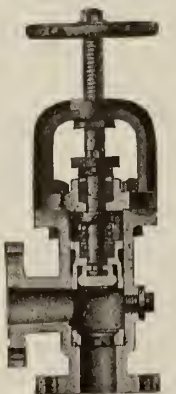


Vance Blow-off Valve.

The double disc arrangement allows the main disc to open and close when there is no flow through the valve.

Can be furnished in angle or straightway, flanged or screwed.

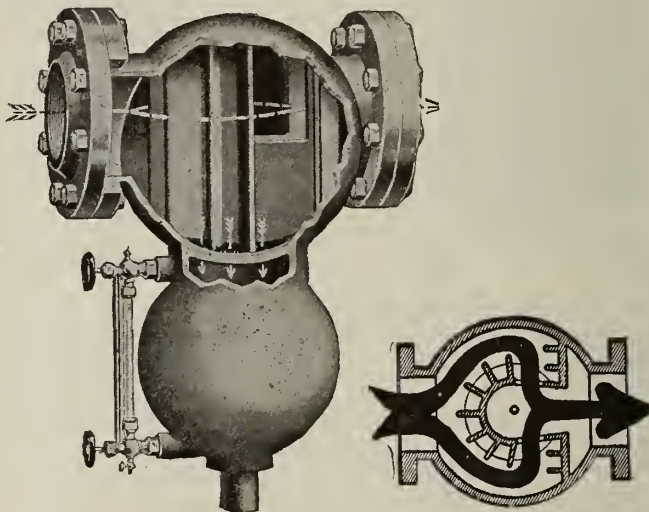
The notable features of this valve are: (1) heavy bronze valve stem; (2) large hand wheel; (3) bronze bushed valve stem guide in bonnet; (4) removable wearing parts which can be replaced at small cost; (5) absolutely tight construction.



VANCE BLOW-OFF VALVE

Baum Steam and Oil Separator.

Baffle plates allow steam, air or gas to pass through in its natural direction and separate all non-elastic matter without reducing the pressure.



BAUM STEAM AND OIL SEPARATOR

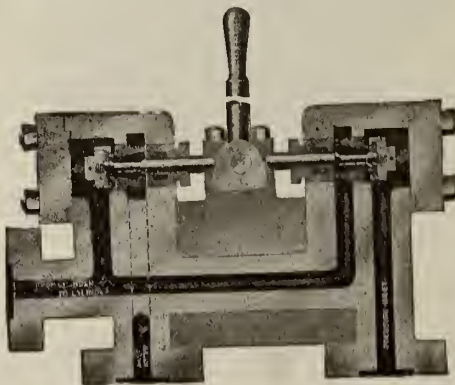
DIMENSIONS (INCHES) HIGH PRESSURE TYPE SEPARATORS

Pipe size	Drip size	A	B	C	D	E	Weight lbs.
2 1/2	1 1/2	10 5/8	7 1/2	8 1/2	3 1/2	14 3/4	100
3	1 1/2	10 7/8	8 1/4	9	4	15 1/4	100
3 1/2	1 1/2	13	9	9 1/2	4 1/2	17 3/4	150
4	3/4	13 1/8	10	10	4 5/8	18	150
4 1/2	3/4	15 3/8	10 1/2	12	4 7/8	20	200
5	1	15 7/8	11	12 1/4	5 1/4	21	200
6	1	18 3/8	12 1/2	14 1/2	5 3/4	21 1/2	300
7	1	22 3/4	14	17 3/4	6 1/2	24 3/8	400
8	1 1/4	24 5/8	15	18	7	26 1/2	600
10	1 1/2	30 1/2	17 1/2	24 5/8	8 3/8	34 3/4	860
12	1 1/2	34 3/4	20	29	9 7/8	41	1250



Harry Woods' Hydraulic Operating Valve.

No leather cups passing over ports. A flat composition disc is employed, which can be renewed in a few minutes, for a few cents, without disconnecting valve or piping.



HYDRAULIC OPERATING VALVE

THE WILLIAMS GAUGE COMPANY

Steam Specialties

PITTSBURGH, PA.

BOSTON, MASS

CHICAGO, ILL.

CINCINNATI, OHIO

ST. LOUIS, MO.

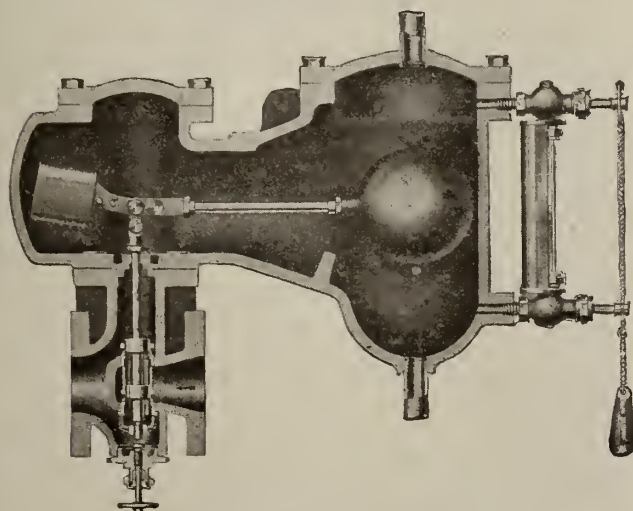
Products.

BOILER FEED CONTROLLERS; PUMP GOVERNORS and SAFETY COLUMNS.

Stets Boiler Feed Controller, Type B.

DESCRIPTION—A spherical displacement body, filled with water, and counterbalanced to ride one-half submerged; possesses all the power of a closed or buoyancy float of same size, and for the high pressures used in latest steam practice has no chance for failure. The Stets Type B controller design includes such a relation between weight of water filled float and weight of counterweight and lever arms as will cause float to ride at its middle line at all times. Float will not lose its water content by evaporation, because condensed steam which forms in upper steam connection to boiler drips into small pan attached to top.

OPERATION—Controller is connected to boiler at water level. Whenever water in boiler rises, the float must rise with it, otherwise it will gain buoyancy in proportion to rise in water level around it, and will no longer balance counterweight. Leverage and weight of counterweight then become effective to push valve steam downward. When water level in boiler falls the float loses buoyancy and gains weight proportional to the fall, and its impulsive power then becomes effective to pull valve stem upward. As leverage is very great and no stuffing box friction on valve stem to prevent gradual movement, a powerful, positive and fine control of valve movement is secured. The valve opening bears a fixed relation to water level. This is accomplished by no other regulator. Controller also eliminates usual water column.



TYPE B BOILER FEED CONTROLLER

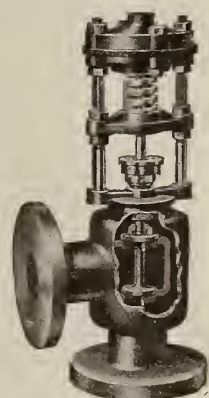
V-PORT VALVE—Valve is of true balanced piston type. One sleeve serves both pistons and has 8 V-ports, 4 at upper and 4 near lower end. By removing jack wheel entire sleeve may be withdrawn without disturbing valve or breaking pipe connections. Valve stem is guided at its extreme ends. These metal guides are in water and consequently lubricated, hence but little friction. There is sufficient inertia in the mass of the float and counterweight to prevent any quick oscillations of water level from adversely affecting valve control.

The result of this design is a rate of feed proportional to boiler water level. This is accomplished with few parts and by powerful and certain means. As all parts are in pressure space the use of a stuffing box is avoided.

Finer control of flow may be obtained with V-port valve than with disc valve. The opening of disc develops a rectangle. As a V-notch weir will measure wide range of flows of water more accurately than a rectangular weir, so will V-port valve control flows far better than a disc valve.

Williams Steam Pump Governor.

This double disc type of governor is of heavy construction to meet the requirements of severe and constant service. The entire absence of weights, cups or pistons permits of very close adjustment, and gives exceptionally smooth operation. The governor is built in either angle or straightway styles of body, with flanged or screwed ends.

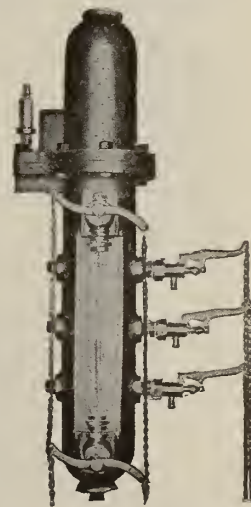


PUMP GOVERNOR

High and Low Safety Alarm Water Columns, Stets Type.

Especially designed for central station and other high pressure plants.

Has heavy pressure compensating float which prevents collapse under any operating steam pressure. Single float of large displacement, but one valve for both high and low alarms instead of two light weight floats with doubled likelihood of trouble.



SAFETY WATER COLUMN

WRIGHT-AUSTIN COMPANY

Manufacturers of Steam Specialties

DETROIT, MICH.

NEW YORK, N. Y.

BRANCH OFFICES

CHICAGO, ILL.

ATLANTA, GA.

REPRESENTATIVES EVERYWHERE

Products.

WRIGHT "EMERGENCY" HIGH PRESSURE and "VICTOR" LOW PRESSURE AUTOMATIC CONTINUOUS FLOW STEAM TRAPS.

WRIGHT "CYCLONE" EXHAUST HEAD.

WRIGHT-AUSTIN CAST IRON EXHAUST HEAD.

WRIGHT SAFETY ALARM WATER COLUMNS.

WRIGHT STRAINERS.

MURRAY AUTOMATIC BOILER FEED REGULATORS and STEAM PUMP GOVERNORS.

AUSTIN STEAM and OIL SEPARATORS.

Also, Air Traps, Valves, etc.

Wright Specialties.

Wright specialties are standard the world over.

"Emergency" steam traps are guaranteed on all steam pressures up to 200 lbs.

"Victor" steam traps operate perfectly in low pressure systems, whether the steam gage registers 0 to 20 lbs.

All Wright products are shipped on trial.

"Cyclone" Exhaust Head.

The Wright "Cyclone" exhaust head prevents the injurious spraying (with the oil and water contained in exhaust steam) of roofs, walls, sidewalks, etc.

The great amount of condensing surface contained in the Wright "Cyclone" exhaust head is a distinct advantage. This is also true of the large passages which permit increased expansion of steam, and of the free outlet which makes this head especially adapted to high speed engines. All back pressure is avoided. Head is made throughout of extra heavy galvanized steel plate, riveted, soldered and thoroughly braced. Drip pipes are made of copper.

The outer shell is heavily coated with a rust resisting paint.



"CYCLONE" EXHAUST HEAD

Cast Iron Exhaust Head.

The Wright-Austin cast iron exhaust head has incorporated in its design all the fundamental principles required for the complete separation of steam from oil and water. The baffles are large in area, affording ample cooling and collecting surface.

Clearance area through the head is several times that of the exhaust pipe. This clear-

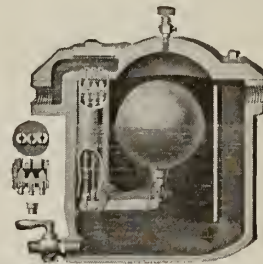


WRIGHT-AUSTIN CAST IRON EXHAUST HEAD
Interior view

ance slows the steam down to the point where separation is possible and provides against any back pressure in the head.

The lines of this exhaust head are harmonious and pleasing, combining exhaust head efficiency with good appearance, a requisite in modern plant practice.

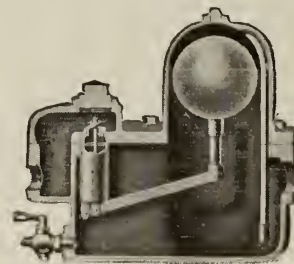
Steam Traps.



WRIGHT "EMERGENCY" 3-VALVE HIGH PRESSURE AUTOMATIC CONTINUOUS FLOW STEAM TRAP

No. of trap	1	2	3	4	5	6	7	8
Size of inlet and outlet, ins.	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Distance inlet to outlet, ins.	11 1/4	12	12 3/4	13 3/4	15 1/4	16 1/2	18	19 1/2
Max. discharge in lbs. per hr.	4400	5600	7000	10400	14400	19200	32000	45500
Intended for sq. ft. of radiating surface.	3000	3700	4600	7800	12600	20100	29000	42000
Lineal ft. 1-in. pipe	9000	11100	13800	23400	37800	60300	87000	126000
Shipping weight, lbs.	70	100	120	140	160	220	260	320
List prices.	\$26.50	28.50	36.00	43.00	60.00	82.00	132.00	150.00

NOTE.—Every trap carefully tested before leaving factory. Liberal discount from list prices.

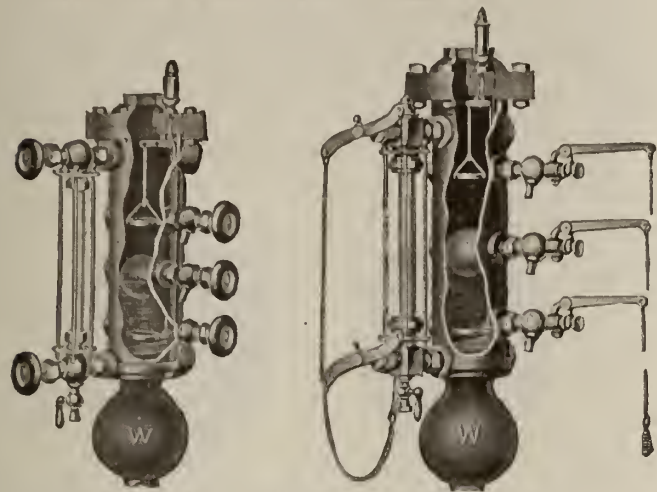


WRIGHT "VICTOR" LOW PRESSURE AUTOMATIC CONTINUOUS FLOW STEAM TRAP

No. of trap	0	1	2	3	4	5	6	7	8
Size of inlet and outlet, ins.	1/2	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Distance inlet to outlet, ins.	9 1/4	12 3/4	14	15 1/2	18	19 1/2	22	23	24
Height of trap over all.	9 1/4	11 1/4	12 1/2	14 1/2	15 1/4	17 1/2	20	21	22
Lbs. discharged per hr., 3 lbs. pressure	1726	3746	6552	9988	18000	24000	30000	48250	63918
Intended for sq. ft. of radiating surface.	1432	3107	5438	8290	14940	19920	24900	40000	53050
Lineal ft., 1-in. pipe	4300	9300	16300	24870	44820	59760	74700	120000	159000
Lineal ft., 1-in. pipe for lumber kilns, greenhouses, etc.	2200	4650	8200	12450	22500	29800	37000	60000	80000
Lineal ft., 1-in. pipe for laundries, brickdriers, brew kettles, etc.	860	1860	3260	5000	9000	12000	15000	24000	32000
Weight, lbs.	45	70	80	100	120	160	200	255	260
List prices.	\$22.00	26.50	28.50	36.00	43.00	60.00	82.00	132.00	150.00

NOTE.—Every trap carefully tested before leaving factory. Liberal discount from list prices.

Wright Safety Alarm Water Columns.



SECTIONAL VIEWS OF WRIGHT IMPROVED SAFETY ALARM WATER COLUMNS

Size of column, ins.	Kind and size of boiler	Variation between alarms	Price list	
			Without water gage and gage cocks	Water gage and gage cocks
COMBINED HIGH AND LOW WATER ALARMS				
1	36" to 54"	6"	\$28.00	On application
5	56" to 72"	8"	30.00	
7	Water tube	12"	35.00	
9	Others determined by	18"	40.00	
11	natural variations of	24"	42.50	
13	water in boiler	30"	45.00	
15	(See note)	36"	50.00	
LOW WATER ALARMS				
2	36" to 54"	.....	\$25.00	On application
6	56" to 72"	.....	28.00	
8	Water tube	.....	35.00	

Subject to discount.

GENERAL DIMENSIONS ALARM WATER COLUMNS

Size of column, ins.	Steam and water connections, ins.	Blow-off, ins.	Water gage, ins.	Gage glass, ins.	Gage cocks		Center of water connection to top of column, ins.	Diam. of column, ins.	L'gth over all, ins.
					Center, ins.	Size, ins.			
1	1	3/4	1 1/2 x 14	5/8 x 12	3	1 1/2	18 1/2	4 1/2	26
5	1 1/4	3/4	3/4 x 18	3/4 x 16	4	3/4	21 1/2	5	30 3/4
7	1 1/2	3/4	3/4 x 21	3/4 x 19	6	3/4	26	5	34 1/4
9	1 1/2	3/4	3/4 x 24	3/4 x 22	9	3/4	30	5	39
11	1 1/2	3/4	3/4 x 30	3/4 x 28	12	3/4	36	5	45
13	1 1/2	3/4	3/4 x 36	*3/4 x 34	10	3/4	42	5	51
15	1 1/2	3/4	3/4 x 42	*3/4 x 40	12	3/4	48	5	57
2	1	3/4	1 1/2 x 14	5/8 x 12	3	1 1/2	18 1/2	4 1/2	26
6	1 1/4	3/4	3/4 x 16	3/4 x 14	4	3/4	20	5	29
8	1 1/2	3/4	3/4 x 21	3/4 x 19	6	3/4	26	5	34 1/4

*Two glasses joined at center with stuffing box. Four gage cocks.

Wright Strainer.

For use on steam or water systems, it prevents sand, scale or vegetable substances from entering steam traps, water pipes, boilers, meters, etc. A special strainer for a special purpose. Very effective where the source of boiler feed is from rivers, lakes, etc., a condition subjecting the boiler to impurities, resulting in scale, etc. Installed in pipe lines leading to steam traps, its use eliminates the possibility of foreign matter obstructing the valves, and, in consequence, interfering with satisfactory operation of traps.

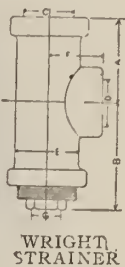
Reference to sectional drawing herewith will demonstrate the simple yet positive action of this filter as applied to a hundred or more varying conditions.

A simple blow-off valve, screwed into the opening in plug and opened occasionally, will serve to keep the filter free from accumulated matter. The strainer

tube is of brass and many times larger in area than "inlet." Strainer tube is easily removed by unscrewing plug to which the tube is attached. Satisfactory operation is guaranteed.

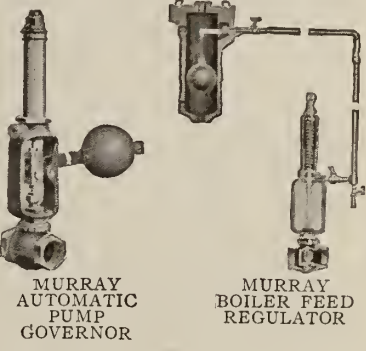
DATA, WRIGHT STRAINER
Adaptable for all pressures up to 250 lbs.

Size	A, ins.	B, ins.	C, ins.	D, ins.	E, ins.	F, ins.	G, ins.	Price
000	3	3 3/4	1 1/2	1 1/2	2 5/8	2 1/8	1 1/2	\$2.00
00	3	3 3/4	3/4	3/4	2 5/8	2 1/8	1 1/2	2.00
0	3	3 3/4	1	1	2 5/8	2 1/8	1 1/2	2.00
1	3	3 3/4	1 1/4	1 1/4	2 5/8	2 1/8	1 1/2	2.50
2	3 1/2	4 1/4	1 1/2	1 1/2	2 5/8	2 1/8	1 1/2	3.00
3	4 3/8	5 1/4	2	2	4 1/8	2 1/8	3/4	5.00
4	5	6 1/4	2 1/2	2 1/2	4 1/8	3 3/8	3/4	7.00
5	6	7 1/2	3	3	6	3 3/8	3/4	9.00



Murray Automatic Boiler Feed Regulator and Automatic Pump Governor.

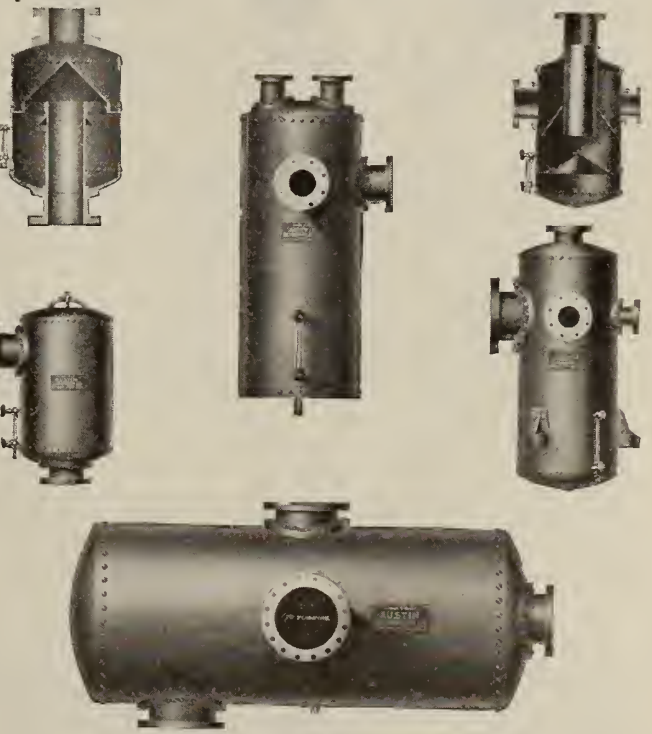
The Murray automatic is the most simple, efficient and dependable boiler feed regulator made. More than 300 of them have been installed in one plant. With regulator in use it is essential that pressure of water in feed line to boiler be uniform. The Murray automatic pump governor never fails to maintain that uniform pressure.



Sizes of Murray regulators are governed by size of feed line to boiler, and are made as follows: 3/4, 1, 1 1/2, 2, 2 1/2, and 3 ins. with screwed ends and 3 ins. with flanged ends. Connection can be made to either top and bottom or side opening.

Special Separators for Special Purposes.

Designed and built to solve problems of separation which can not be handled by standard designs of separators. Write, stating conditions requiring special separators.



SPECIAL SEPARATORS

Austin Live Steam Separators.

Guaranteed to render the highest possible efficiency in the elimination of moisture from steam.



FIG. A. LIVE STEAM VERTICAL IRON SEPARATOR



FIG. B. LIVE STEAM VERTICAL IRON RECEIVER SEPARATOR

DATA, AUSTIN LIVE STEAM VERTICAL SEPARATORS

Sizes.....	1½	2	2½	3	3½	4	4½	5	6	7	8	10	12	14
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FIG. A

Diam. of flanges, ins.	S.E.	S.E.	7	7½	8½	9	9½	10	11	12½	13½	16	19
Face to face, ins.	11	11	13	15¼	16¾	18	20	22¼	25¼	28½	31½	37	40¾
Weight, lbs.	50	50	95	125	135	160	215	245	315	440	575	910	1000
Drains, ins.	½	½	¾	¾	¾	¾	¾	1	1	1¼	1¼	1½	1½

FIG. B

Diam. of flanges, ins.	S.E.	S.E.	7½	8½	9	10	10½	11	12½	14	15	17½	20½	23
Face to face, ins.	16	16	18	19¾	22½	26¼	30½	34	37¼	42¼	48¼	58	64	70
Weight, lbs.	35	35	115	145	175	240	315	375	515	665	930	1615	2400	3155
Drains, ins.	½	½	¾	¾	¾	¾	¾	1	1	1¼	1¼	1½	1½	2



FIG. M. LIVE STEAM HORIZONTAL IRON SEPARATOR



FIG. E. LIVE STEAM HORIZONTAL IRON RECEIVER SEPARATOR



FIG. L. LIVE STEAM HORIZONTAL CAST HEAD AND LARGE STEEL SHELL RECEIVER SEPARATOR

DATA, AUSTIN LIVE STEAM HORIZONTAL SEPARATORS

Sizes.....	1½	2	2½	3	3½	4	4½	5	6	7	8	10	12	14	16	18	20
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FIG. M

Diam. of flanges, ins.	S.E.	S.E.	7	7½	8½	9	9½	10	11	12½	13½	16	19	21
Face to face, ins.	9	9	13¼	15¼	16	18¼	19¼	20¾	24¼	27¼	30¼	31	36	39
Weight, lbs.	45	45	115	125	165	215	265	285	435	600	835	1135	1545	1625
Drains, ins.	½	½	¾	¾	¾	¾	¾	1	1	1¼	1¼	1½	1½	2

FIG. E

Diam. of flanges, ins.	6½	7½	8½	9	10	10½	11	12½	14	15	17½	20½	23
Face to face, ins.	9	11	12¼	13¾	14¾	16¼	19	21	22¾	24	30	34	39¾
Weight, lbs.	35	125	155	170	230	310	470	565	715	880	1670	1945	3055
Drains, ins.	½	¾	¾	¾	¾	¾	1	1	1¼	1¼	1½	1½	2

FIG. L

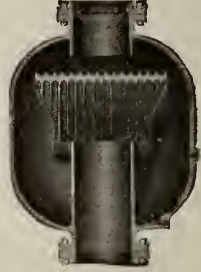
Diam. of flanges, ins.	8½	10	11	12½	14	15	17½	20½	23	25½	28	30½
Face to face, ins.	12¼	14¾	19	21	22¾	24	30	34	39¾	41½	43	45
Weight, lbs.	350	450	680	900	1150	1350	2190	2650	3750	4600	5765	6700
Drains, ins.	¾	¾	1	1	1¼	1¼	1½	2	2	2	2½	2½

Austin Special Oil Separators.

These separators are guaranteed to so thoroughly eliminate oil, grease and impurities from exhaust steam that the steam, when condensed, is entirely suitable for boiler use, ice making, steam laundries, heating systems, or any other purpose for which exhaust steam is employed.



Exterior



Interior

FIG. R. AUSTIN VERTICAL SPECIAL OIL SEPARATOR

DATA, AUSTIN VERTICAL SPECIAL OIL SEPARATOR

Fig. R

Sizes.....	4	5	6	7	8	10
Diam. of flanges, ins.	9	10	11	12½	13½	16
Face to face, ins.	20¾	24¼	28½	33½	37¼	41¾
Drains, ins.	1	1¼	1½	1½	1½	1½



Exterior



Section

FIG. S. AUSTIN HORIZONTAL SPECIAL OIL SEPARATOR

DATA, AUSTIN HORIZONTAL SPECIAL OIL SEPARATOR

Fig. S

Size pipe, ins.	Diam. of flanges, ins.	Bolt circle, ins.	Bolt number and size, ins.	Face to face of flanges, ins.	Wide, ins.	High, ins.	Center of pipe to top, ins.	Size drip, ins.	Weight, lbs.
1½	Serd.	-	-	9¾	12	15½	6¼	¾	60
2	Serd.	-	-	10	12½	15½	6¼	¾	60
2½	7	5½	4-5/8	10¼	14½	17½	7½	1	150
3	7½	6	4-5/8	10½	15	18	7½	1	165
3½	8½	7	4-5/8	11	17	20	8½	1	190
4	9	7½	8-5/8	12	19	23	9½	1	235
4½	9½	7¾	8-3/4	13	21	25	10½	1¼	290
5	10	8½	8-3/4	15	23	27	11½	1¼	370
6	11	9½	8-3/4	17	25	30	12½	1½	475
7	12½	10¾	8-3/4	17½	27	33	13½	1½	545
8	13½	11¾	8-3/4	18	29	36	14½	1½	650
10	16	14¼	12-7/8	19	32	40	16½	1½	855
12	19	17	12-7/8	20	34	42	17½	1½	905
14	21	18¾	12-1	20	36	43	18½	1½	1050
16	23½	21¼	16-1	22	40	44	20½	1½	1150
18	25	22¾	16-1½	24	42	46	21½	1½	1375
20	27½	25	20-1½	26	44	49	22½	1½	1475
22	29½	27¼	20-1¼	30	48	55	24½	2	2075
24	32	29½	20-1¼	33	54	62	27½	2	2500
26	34¼	31¾	24-1¼	36	58	68	29½	2	3050
28	36½	34	28-1¼	38	64	74	32½	2½	4400
30	38¾	36	28-1½	40	69	80	34½	2½	5650
32	41¾	38½	28-1½	42	74	86	37½	2½	6150
34	43¾	40½	32-1½	44	80	93	40½	3	6500
38	48¼	45¼	32-1½	44	90	105	45½	3	7550
42	53	49½	36-1½	48	100	116	50½	3	8400
46	57¼	53¾	40-1½	48	106	120	53½	3	9350
48	59½	56	44-1½	48	112	129	56½	3	10000

Sizes 12 to 48 ins. are built with close flanges and furnished with stud bolts
Eye bolts placed on all sizes above 12 ins., inclusive.

AMERICAN STEAM GAUGE & VALVE MANUFACTURING CO.

ORIGINAL STEAM GAUGE COMPANY

GENERAL OFFICES AND FACTORY
208-220 Camden Street
BOSTON, MASS.

BRANCH OFFICES

PITTSBURGH, PA., Jenkins Arcade Building
NEW YORK, N. Y., 118 Liberty Street

CHICAGO, ILL., 25-27 South Jefferson Street
ATLANTA, GA., Candler Building

Products.

GAUGES—Steam, Air, Water, Compound Pressure and Vacuum, Ammonia, Hydraulic, Gas, Oil, Automobile, Test, etc., both Index and Recording.

GAUGE BOARDS, to order; GAUGE TESTERS.

VALVES—Pop Safety, Cylinder, Water and Hydraulic Relief, Snifting, etc.

STEAM and GAS ENGINE INDICATORS; STEAM TRAPS; FEED WATER FILTERS; MARINE and LOCOMOTIVE CLOCKS; REVOLUTION COUNTERS.

Also, Steam Whistles, Hydraulagraphs and Trainagraphs.

Experience.

Having been engaged in this line of business over threescore years, operating the largest plant of its kind in the world, this company offers its products for efficient and durable use throughout the industrial field.

American Single Spring Bourdon Pressure and Vacuum Gauge (Patented).

Gauges of this standard type manufactured and installed exclusively by this company until expiration of patent. Graduated to any pressure desired, not exceeding 500 lbs. for either steam or water. Graduations as high as 1000 lbs. furnished to order. Movement is of best non-corrosive metal, and springs are made of solid drawn tube of special mixture. A siphon should be used with each gauge on steam pressure.

Regularly furnished with silver finished brass dial; figures and graduations cut and filled with black



SINGLE BOURDON GAUGE



DOUBLE BOURDON GAUGE

enamel, or, if desired, black dial with silver figures will be furnished. Standard connection is $\frac{1}{4}$ -in. male.

Cock furnished with all gauges up to 500 lbs., sizes 3 in. and larger.

DOUBLE BOURDON PRESSURE GAUGE—For marine and portable work. It possesses rigid qualities, lessening vibration, and sensitiveness. Graduated for either steam or water to any pressure not exceeding 500 lbs.

PRICES, SINGLE BOURDON GAUGES, INCLUDING COCK

Size dial, in.	Iron case, brass ring	Iron case, N. P. ring	Brass case	N. P. case	Brass deep case, O. G. or oct. ring	N. P. deep case, O. G. or oct. ring
12	\$50.00	\$51.50	\$75.00	\$79.00	\$80.00	\$84.00
10	32.00	33.00	40.00	43.00	44.00	47.00
8 1/2	22.00	22.75	30.00	32.50	33.50	36.00
6 3/4	16.00	16.60	20.00	22.00	23.00	25.00
6	13.00	13.50	16.00	17.50	18.50	20.00
5 1/2	10.00	10.25	12.00	13.25	13.75	15.00
5	8.00	8.20	11.00	12.00	12.50	13.50
4 1/2	8.00	8.20	10.00	11.00	11.50	12.50
3 1/2	7.00	7.18	9.00	9.75	10.25	11.00
3	6.00	6.15	8.00	8.60	9.25	9.75
2 1/2	6.00	6.15	8.00	8.60	9.25	9.75
2	6.00	6.15	8.00	8.60	9.25	9.75

PRICES, DOUBLE BOURDON GAUGES, INCLUDING COCK

Size dial, in.	Iron case, japanned	Iron case, N. P. ring	Brass case	N. P. case	Brass deep case, O. G. or oct. ring	N. P. deep case, O. G. or oct. ring
12	\$55.00	\$56.50	\$80.00	\$84.00	\$85.00	\$89.00
10	37.00	38.00	45.00	48.00	49.00	52.00
8 1/2	25.00	25.75	34.00	36.50	37.50	40.00
6 3/4	18.00	18.60	22.00	24.00	25.00	27.00
6	15.00	15.50	18.00	19.50	20.75	22.25
5 1/2	12.00	12.25	14.00	15.25	16.25	17.50

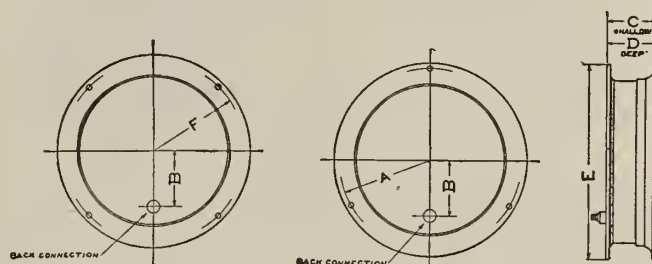


DIAGRAM OF AMERICAN GAUGE

DIMENSIONS OF CASE IN INCHES

Size, in.	3 1/2	4 1/2	5	5 1/2	6	6 3/4	8 1/2	10	12
A	2 1/8	2 1/8	2 3/8	3 1/8	3 1/2	3 1/2	4 1/2	5 1/2	6 1/2
B	1 1/8	1 1/8	1 1/8	1 1/8	2 1/8	2 1/8	2 1/8	3 1/8	3 3/8
C	2	2 1/8	2 1/4	2 1/4	2 1/2	2 1/2	2 3/4	3	3 1/4
D	4 5/8	5 1/8	6	6 5/8	7 3/8	8 3/8	10 1/2	12 1/2	14 1/2
E									
F									

Illuminated Dial Gauges.

All American gauges can be made with illuminated dials, for use in darkened or obscure places, if desired.

American Compound Pressure and Vacuum Gauge (Patented).

Graduated by two mercury columns, indicating both pressure and vacuum.

AMERICAN COMBINATION GAUGE—For use in pumping stations to indicate height in feet, and corresponding pounds per square inch of water, in reservoir or standpipe.

WHEN ORDERING—State maximum pressure on which gauge will be used.

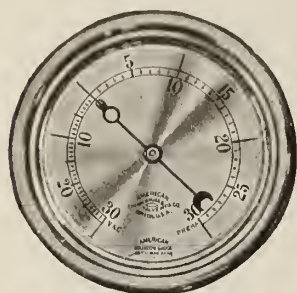


FIG. 255



FIG. 256

AMERICAN COMPOUND PRESSURE AND VACUUM GAUGE
PRICES, INCLUDING COCK

Size dial, in.	Iron case, japanned	Iron case, N. P. ring	Brass case	N. P. case
12	\$60.00	\$61.50	\$80.00	\$84.00
10	40.00	41.00	50.00	53.00
8 1/2	30.00	30.75	40.00	42.50
6 3/4	20.00	20.60	25.00	27.00
6	16.00	16.50	20.00	21.50
5 1/2	14.00	14.25	16.00	17.25
4 1/2	12.00	12.20	14.00	15.00
3 1/2	10.00	10.18	12.00	12.75

Gauges will be furnished with back connection, when so ordered, without extra charge.

American Ammonia Gauge.

Specially adapted for ice and refrigerating machines.

New construction, tube being bored and turned from solid bar high grade tool steel. No leaky joints to give trouble.

Sizes, 5 to 8 1/2 in.; connection from bottom or back of case.

Send for further details.

American Hydraulic Gauge (Patented).

Used in best railroad shops, sugar refineries and cottonseed oil mills. Made for pressures from 500 to 20,000 lbs. per sq. in. Springs of heavy solid bar steel turned and bored to size. Furnished with back connections when desired.



FIG. 260
AMMONIA GAUGE

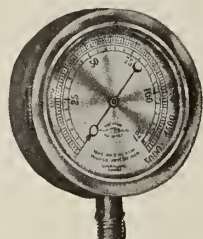


FIG. 259
HYDRAULIC GAUGE

American Standard Test Gauge.

An established standard gauge for exhaustive tests of gauges of all types, wherever made. Graduated on an open column of mercury and tested under most severe conditions. Extremely sensitive under all pressures and guaranteed to be absolutely correct.



FIG. 258
STANDARD TEST GAUGE

American House Heater Gauge (Patented).

Bourdon single spring type. Constructed so as to prevent corrosion of the moving parts. Adapted for use in cellars, basements, etc. A siphon should be used with these gauges. Dial plainly marked with large figures.

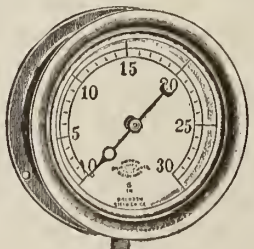


FIG. 272
HOUSE HEATER GAUGE

American Altitude Gauge.

Indispensable in connection with hot water heaters, for denoting height of water in tank or reservoir.

NOTE—Short red hand is set at point on dial designating necessary height at which water should be kept in tank or reservoir. Long black hand automatically registers actual height of water at all times. Dial marked in feet instead of pounds.

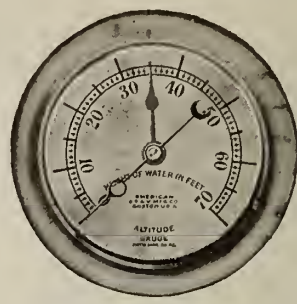


FIG. 270
ALTITUDE GAUGE

American Recording Gauge.

A superior instrument for recording all pressures or vacuum. Features of construction include high grade 7-jewel clock enclosed in inner dustproof case, and improved fountain pen requiring filling only every 30 days. In writing, always state working pressure.

This company also makes ammonia recording gauges (pressure and vacuum); duplex recording gauges, for registering two distinct pressures on one chart; also, gauges fitted with special movements for 1, 12 and 48 hours and 7-day records, etc.

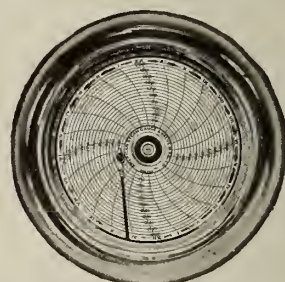


FIG. 287
AMERICAN RECORDING GAUGE

American Marine and Locomotive Clocks.

These 8-day clocks are made with ring hinged to case; fitted with lock and key, and any standard movement desired.

Designed for stationary plants, marine engines, locomotives, etc. Case is similar in style to that used on our standard gauges.

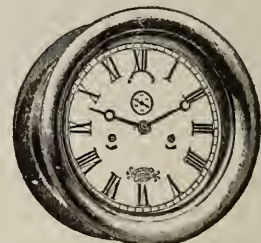


FIG. 282
MARINE AND LOCOMOTIVE CLOCK

American Revolution Counter (Patented).

Operated by either a reciprocating or continuous rotary motion, counting ahead whichever way the shaft revolves. It works equally well on pumps where length of stroke varies, counter-crank being adjusted for shortest stroke. Construction details sent upon application.

These counters are also made fitted in special oblong cases; also in square cases, for use with engines, pumps, grain scales, etc.



FIG. 284
REVOLUTION COUNTER

American Dead Weight Gauge Tester (Patented).

This pump possesses all the advantages of the mercury column; enclosed in much smaller space; and eliminates use of test gauges, their repair and their return to factory for accuracy trials.

All tests are made with dead weights in 5-lb. units, furnished for any desired pressure up to 1,000 lbs.

Designed for testing all types of pressure gauges in railroad shops, mills, factories and other establishments where many gauges are in use. When shipped, pump is filled with a light mineral oil, ready for use. Directions for operating accompany each tester (Fig. 312).

Also made in the hydraulic types, for testing high pressure or hydraulic gauges. Equipped for pressures up to 5,000 and to 25,000 lbs. per sq. in.

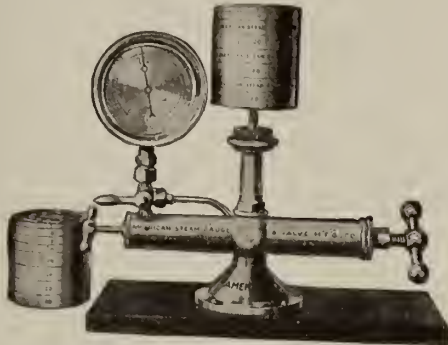


FIG. 312. DEAD WEIGHT GAUGE TESTER

American Gauge Boards.

For sets of instruments. Made in various shapes, of black walnut, cherry, mahogany, or plain oak boards; also of slate or marble.

For use in engine rooms of electric plants, steamships, mills, office buildings, mines, water works and factories.

When Ordering Gauges.

(1) State figure number; (2) pressure and size of connection; (3) whether goods are to be iron, brass or nickelplated.

American Pop Safety Valve.

For stationary and marine boilers. Fitted with adjustable blow-down ring. Valves are spring-loaded and relieve automatically at any desired pressure. Adjustment is simple; opening and closing are automatic; and the relief, size for size of valve, is greater than any other valve in existence. Least number of parts to maintain.

Reliability, durability and mechanical superiority have been established during many years. (Figs. 367, 369 and other illustrations).

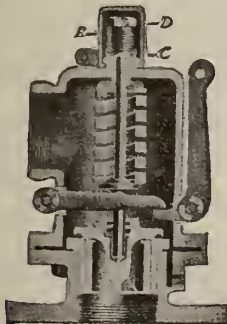


FIG. 367
Inside View

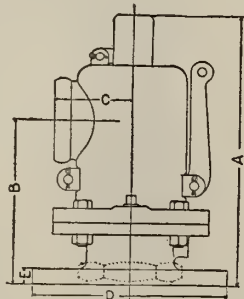


FIG. 369
Sectional Diagram
POP SAFETY VALVE

DIMENSIONS OF SAFETY VALVES IN INCHES

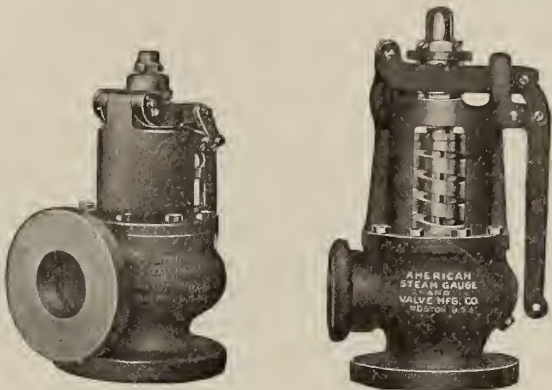
Size of inlet and outlet, in..	2	2½	3	3½	4	4½	5	6
Extreme height.....	A 13 1/8	14 1/4	14 1/2	16 1/4	18 1/2	19 1/8	19 1/2	21 1/8
Height from face of inlet to center of outlet.....	B 7 1/8	8 1/8	8 1/2	10 1/4	11 1/2	11 1/8	11 1/2	13 1/8
Center of valve to face of outlet.....	C 3 1/4	3 1/2	4	4 5/8	5	5 1/4	5 1/2	6 1/8
Diam. inlet flange.....	D 6 1/2	7 1/2	8 1/4	9	10	10 1/2	11	12 1/2
Thickness inlet flange....	E 1 1/2	1	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8
Diam. neck at bottom....	F 3 3/8	4 1/8	4 1/2	5 1/8	6	6 1/8	7 1/4	8 1/8

American Pop Safety Valve, Models E and G.

Made of cast iron, semisteel or cast steel.

Constructed with both open and incased spring and with straight or compound drop levers, as ordered. Incased spring prevents contact of spring with steam. Spindle passes through bottom of spring case, which acts as a guide, and, by reason of small diameter of spindle, friction is eliminated.

LIFTING LEVERS—Leverage of long vertical arm is compounded by short connecting link, which becomes a toggle (as long arm approaches horizontal position) and acts with further leverage upon spindle through top horizontal lever.



Model E, Enclosed Spring Model G, Outside Spring
POP SAFETY VALVE, MODELS E AND G

Designed for working pressures up to 300 lbs., with test pressure of 450 lbs. Adapted for all styles of horizontal and vertical tubular boilers as well as all sectional and water tube boilers

American Marine Pop Safety Valves.

For merchant marine. Internal construction is similar to that of American pop safety valves, Models E and G.

These valves comply with rules and regulations of United States Board of Supervising Inspectors of Steam Vessels; also, English Board of Trade and French Lloyds' Inspection Bureaus.

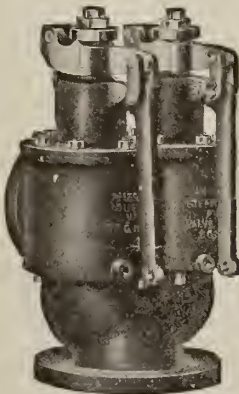


FIG. 379. Duplex
DUPLEX IMPROVED MARINE POP SAFETY VALVES

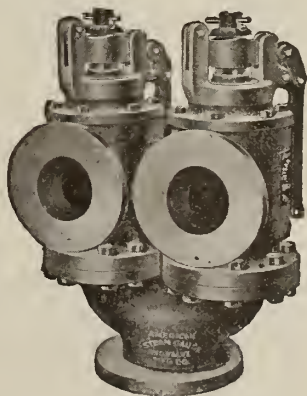


FIG. 385. Twin

Types—Made in several styles as follows:

- (1) With straight lever.
- (2) With drop lever.
- (3) Duplex (two halves in one casing having one common opening).
- (4) Twin (two stationary valves mounted on a common "Y" base).
- (5) With outside spring (Fig. 374).

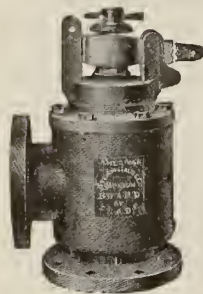


FIG. 375
Straight Lever Single Valve

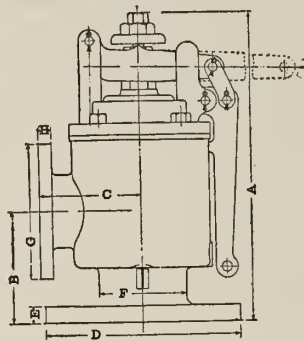


FIG. 377
Diagram Drop Lever

MARINE POP SAFETY VALVES

DIMENSIONS IN INCHES—FIGS. 375 AND 377

Size of inlet and outlet, in.....	2½	3	3½	4	4½	5	6
Extreme height.....	A	15	16	18½	19½	20	22¼
Height from face of inlet to center of outlet.....	B	5⅝	5¾	6⅝	7½	7¾	7½
Center of valve to face of outlet.....	C	4½	5¼	5⅝	6½	7½	7¾
Diam. inlet flange.....	D	7½	8¼	9	10	10½	11
Thickness inlet flange.....	E	1	1⅛	1⅝	1¾	1⅝	1⅞
Diam. neck at bottom.....	F	4⅜	4⅝	5⅞	6	6⅝	7¼
Diam. outlet flange.....	G	7	7½	8½	9	9½	10
Thickness outlet flange.....	H	1⅞	2	2¼	2½	2⅝	3

American Brass Pop Safety Valves.

Fig. 425 has top outlet and will be found in very general use on all portable types of boilers.



FIG. 425
Portable



FIG. 432
Side Outlet

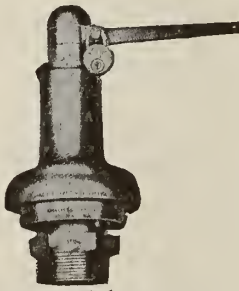


FIG. 436
Dist. Police Lock Type

TYPES OF POP BRASS SAFETY VALVES

Fig. 432 is more extensively used for marine work.

Fig. 436 is for heating type boilers only.

American Cylinder Relief Valve.

Designed for use on steam cylinders, feed pumps, fire pumps, jackets, valve chests, condensers, auxiliary exhausts, etc. Sizes, ½ to 4 ins.

Made inlet, if desired. Flanged ends to order.



FIG. 389
CYLINDER
RELIEF VALVE

American Water Relief Valve.

Made of iron, brass mounted. For pumps, either steam, rotary or plunger.

Valves are accepted by Inspection Department of Associated Factory Mutual Fire Insurance Companies for use on standard underwriter fire pumps. Used by manufacturers of underwriter pumps.

Fig. 405 shows an all-brass valve, of similar design, made in small sizes for small pumps.

Their capacity for relief, size for size, is guaranteed to be far greater than any other valve (Figs. 399, 404 and 405).

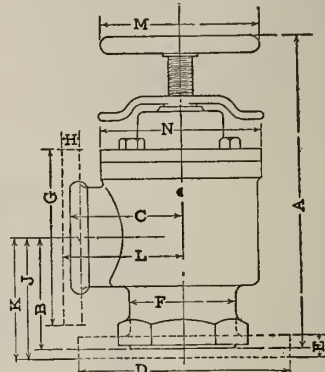


FIG. 404



FIG. 399. IRON UNDERWRITER
WATER RELIEF VALVE



FIG. 405. BRASS
WATER RELIEF VALVE



FIG. 408



FIG. 409



FIG. 410



FIG. 411

AMERICAN WATER RELIEF VALVES

Standard type, all-bronze. For use on tanks, pipe lines, etc. For pressures not exceeding 250 lbs.

American Thompson Improved Indicator.

Indicator shows graphically the exact conditions of pressure within cylinder, indicating adjustments in valve gear which may be required to insure economical operations and prolong life of engine.

SPECIAL ADVANTAGES—The indicator shows (1) pressure acting on piston; (2) drop in pressure between boiler and cylinder; (3) exact horsepower developed; (4) exact consumption of water; (5) waste of coal; (6) leaking piston and valve; (7) improperly set valve; (8) power demanded by full load; (9) power wasted at low load; (10) cost of running idle; (11) loss resulting from improper piping from boiler to engine and exhaust; and (12) like results in gas and ammonia work.

DRUMS—Made in sizes 1½ and 2 in.

REDUCING WHEEL ATTACHMENT—Wheel, made of aluminum, brass and steel, is to reduce accurately the motion of an engine crosshead to that required for a paper drum of an indicator.

ELECTRICAL ATTACHMENT—It consists of instruments furnished in pairs in a box, fitted with push button and two dry batteries.

Used in making tests of plants having two or more engines.

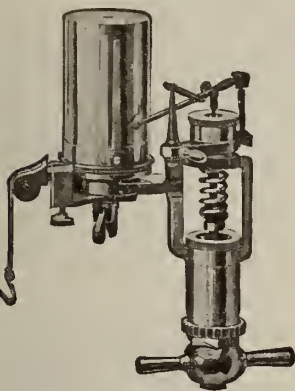


FIG. 477
Exposed Spring Indicator, Plain

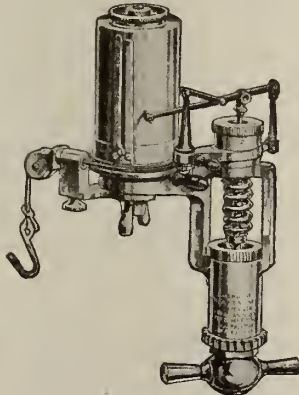


FIG. 478
Exposed Spring Indicator, with Detent Motion

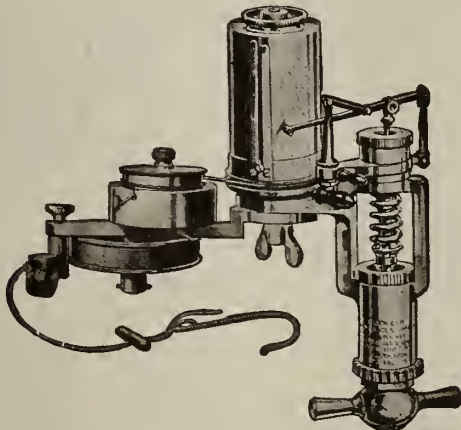


FIG. 479
Exposed Spring Indicator with Detent Motion and Ideal Reducing Wheel
AMERICAN THOMPSON IMPROVED INDICATORS

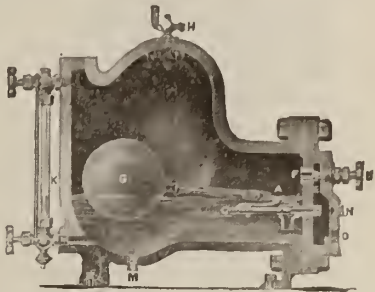
American Ideal Steam Trap.

It has been on the market over 10 years. Operates on pressures up to 295 lbs. Has a patented valve leverage

that permits use of heaviest floats (to withstand heaviest working pressures) ever put into steam traps. Float is seamless copper.

Valve is water sealed and can not leak steam.

Lifting capacity, 2 ft. of water for each pound pressure at trap. Valve discharges against any back pressure less than pressure in trap.



MODEL "C" TRAP
Showing seamless float (made any size), valve, etc.



IDEAL FLOAT VALVE
Adapted for any service. Float same as used in steam trap. Water level regulated by changing angle of float at "K"

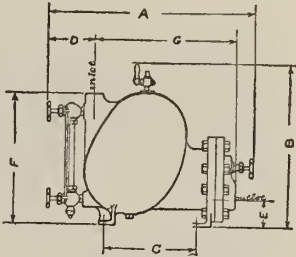


DIAGRAM MODEL "C" TRAP

DATA, MODEL "C" TRAP*

Size	0	1	2	3	4	5
DIMENSIONS IN INCHES						
Pipe connections	1½	1½	¾	1	1¼	1½
A	18½	22¾	23¼	26¼	28½	31½
B	14½	17¼	18¾	21½	23	25½
C	8	11	11¼	13	15	17½
D	4½	5	5	5½	5¾	6
E	2½	3⅝	3½	3¾	3¾	3¾
F	12½	15¼	16½	19	19¾	22¾
G	12	15	16½	19¼	21¾	23¼
Width required	8	10	10¾	12½	12¾	14
RATED CAPACITIES PER HOUR AT 100 POUNDS						
Pounds water	4402	6853	8320	9986	13486	17616
Lineal feet 1-inch pipe	7827	12184	14793	17692	23978	31322
Square feet radiation	2609	4062	4931	5898	7993	10441
Net weight h. p. trap, lbs	85	110	150	210	250	320
List price, effective Oct. 1, 1919	\$50.00	60.00	80.00	96.00	120.00	160.00

* Table based on condensation ratio of 9 oz. per lin. ft. per hour. Allowance should be made for conditions causing a higher ratio, always selecting trap of sufficient size to care for maximum amount that may come to it at any time.

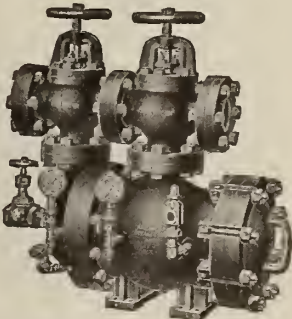
American H₂O Grease Extracting Feed Water Filter.

Designed for the efficient removal from feed water of grease which, after slight boiling, adheres in the form of "slugs" to boiler shell and flues.

This filter has a filtering surface many times greater than area of the feed water pipes, and occupies small space.

OPERATION—Under double filtration, filtering cages are covered with two layers of "Turkish toweling," which cloths are to be changed as often as conditions require. Temporary cleaning, however, may be effected by applying a reverse current of steam and drawing off the oil and grease while filter is in service.

Further particulars sent on request.



GREASE EXTRACTING FEED WATER FILTER

THE BRISTOL COMPANY

Recording Instruments

WATERBURY, CONN.

BRANCH OFFICES

NEW YORK, 114 Liberty Street
PITTSBURGH, Frick Building

BOSTON, Old South Building
SAN FRANCISCO, Rialto Building

CHICAGO, Monadnock Block

Products.

BRISTOL'S RECORDING PRESSURE, VACUUM, DRAFT and COMBINATION GAUGES; LIQUID LEVEL GAUGES; RECORDING THERMOMETERS; RECORDING PSYCHROMETERS; INDICATING and RECORDING ELECTRIC PYROMETERS; THERMOSTATS; TEMPERATURE CONTROLLERS; RECORDING VOLTMETERS, AMMETERS and WATTMETERS; RECORDING MILLIVOLTMETERS; RECORDING SHUNT AMMETERS; FREQUENCY METERS; ELECTRICAL and MECHANICAL TIME RECORDERS; RECORDING TACHOMETERS; COUNTERS.

Bristol-Durand Radii Averaging Instruments.

For Belt Lacing, Safety Set Screws, etc., see page 862.

Bristol's Recording Pressure and Vacuum Gauges.

For securing continuous night and day records of pressure or vacuum, for steam, air, gas and liquids. Charts furnished to read in pounds, ounces, inches, feet, metric or any desired units; for ranges from full vacuum to 12,000 lbs. per sq. in.

The construction of these instruments is extremely simple. On instruments for high ranges, the pen arms are attached directly to the pressure tubes without employing gears, levers or other multiplying devices. The original form Model 11 case affords space for a long length of pen-arm with small angle of deflection to cover entire scale. Many instruments of this model have been in continuous service for 15 years without even being repaired.

Round form models can be furnished at somewhat lower prices than the original form.

Bristol's Recording Liquid Level Gauges.

For use where it is necessary or desirable to locate recording instruments at a higher or a lower level than the liquid to be measured.

Especially valuable for automatically and continuously recording the depth or level of water or other liquids in tanks, water towers, reservoirs, etc.

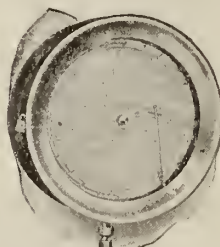
Differing from float gauges, these instruments are independent of freezing temperatures.



RECORDING LIQUID LEVEL GAUGE



RECORDING GAUGE
Original form—Model 11



RECORDING GAUGE
Round form—Model 60

TRADE-MARK
BRISTOL'S

REG. U. S. PAT. OFFICE

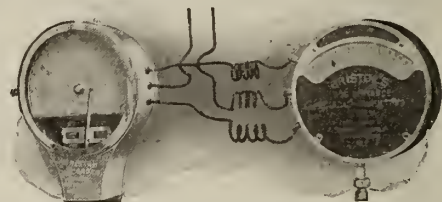
Bristol's Long Distance Transmitting and Recording System.

For transmitting electrically, over distances of many miles, records of pressure,

liquid level, temperature, mechanical motions, etc.

The needs of such an equipment are numerous in connection with water works,

central heating stations, hydro-electric plants, gas distribution systems, irrigation projects, etc.

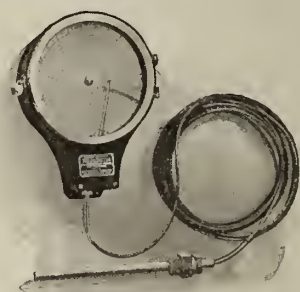


Bristol's Recording Thermometers.

For all commercial ranges of temperatures from 60° below zero to 800° Fahr.

Equipment furnished with plain sensitive bulb for use in dry kilns, etc. The bulb is located where the temperature is to be measured, and connected with flexible leads to the recorder, which may be placed in the most convenient location. Patented automatic compensators furnished when needed to insure accurate results.

Also furnished with bulbs having union and screw connections for recording temperatures of water or other liquids in closed spaces under pressure, such as boiler feed water, superheated steam, milk pasteurizers, etc.



RECORDING THERMOMETER
Model 311



RECORDING THERMOMETER
Moistureproof—Model 140

Bristol's Recording Wet and Dry Bulb Thermometers or Psychrometers.

For determining the degree of humidity or moisture in the atmosphere.

Two independent thermometers are mounted in one case and register on the same chart.

Equipped with a motor and fan, which keeps a good circulation of air over the bulbs. Also equipped with patented device for producing a continuous flow of water through wick to keep it moist.



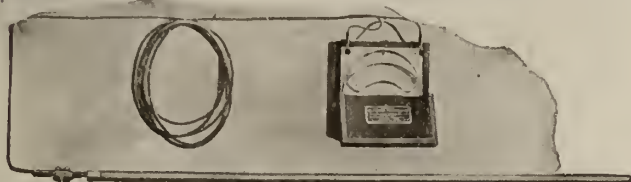
RECORDING
PSYCHROMETER

Bristol's Indicating and Recording Electric Pyrometers.

For ranges up to 3000° Fahr. The internal type cold end compensator exclusively applied to Bristol's pyrometers is one of the most radical improvements in thermo-electric pyrometry. High resistance Model 319 is especially suited for use in connection with furnaces for hardening high speed steel, also brick and pottery kilns and furnaces. Pyrometer may be installed a long distance



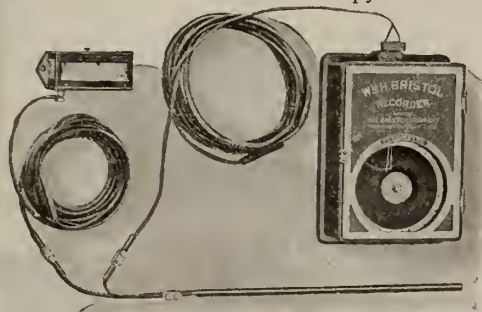
INDICATING PYROMETER
High resistance Model 319



PORTABLE INDICATING PYROMETER

from the furnace if desired. Portable instruments can be furnished, suitable for general checking both in shop and laboratory.

Combination units of Bristol's pyrometers are ex-



COMBINATION UNIT OF ELECTRIC PYROMETERS

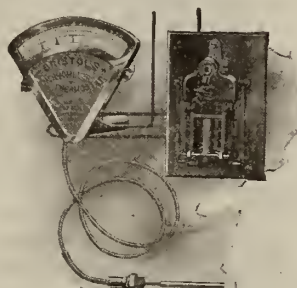
tensively used, indicating instrument being located at the furnace to guide the operator, and recording instrument located in superintendent's office.

Bristol's Temperature Controllers.

For automatically controlling temperatures of ovens and furnaces heated by oil, gas or electricity. Models 176, 276 and 376 are used for temperatures up to 800° Fahr.; Model 473 for higher temperatures.

Bristol's Recording Electric Meters.

Bristol's recording voltmeters for all commercial ranges of D. C. and A. C. It is important to maintain uniform voltage for operating electric lights and for many other purposes. Records obtained with Bristol voltmeters show whether desired results are secured.



THERMOSTAT
Model 276



TEMPERATURE
CONTROLLER
Model 473 for high
temperatures



RECORDING VOLTMETER
Switchboard—Model 510

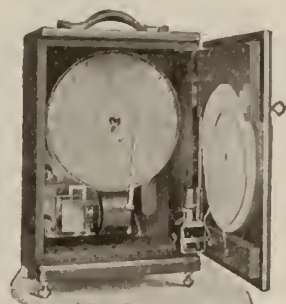


FIG. 573. RECORDING AMMETER
Portable—Model 612

Bristol's recording ammeters, furnished in switchboard or portable type, provide continuous records of current on generator and feeder panels, for motor and transformer tests and to provide records of customers' current consumption.

Bristol's strip type recording wattmeter, portable model, designed for use on both polyphase and single phase alternating current. Convenient and practical for carrying about to points where it is desired to obtain records of consumption of electrical energy.

Bristol's recording millivoltmeters, equipped with high grade pivot jewel bearing movements, are extensively used for recording very minute potentials which are involved in electrolysis investigations.

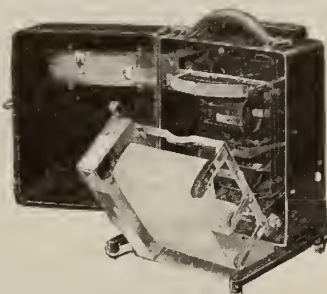
Bristol's Operation Recorders.

For recording occurrence and duration of mechanical movements and machine operations.

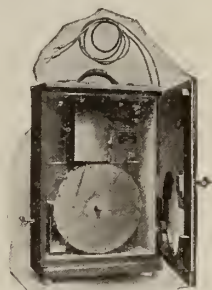
This strip type electric time recorder is designed to record 20 different operations on one chart. There are thousands of uses for this operation recorder in manufacturing plants. Easy to install.

Bristol's Recording Tachometers.

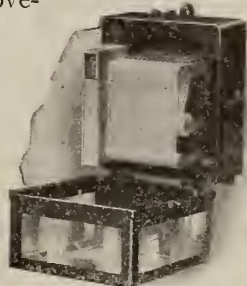
For recording speed of shafting, machines, engines, etc. Furnished in pneumatic type or electric for either A. C. or D. C. Simple in construction. Particularly suitable for use with paper machines and for use in connection with blowing engines at blast furnace plants.



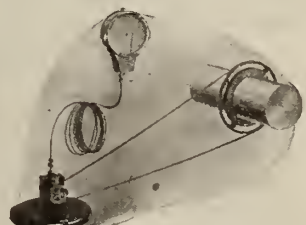
RECORDING WATTMETER
Strip type—Model 725



RECORDING MILLI-
VOLTmeter
Portable type



ELECTRIC TIME
RECORDER
Strip type—Model 925



RECORDING TACHOMETER

THE FOXBORO CO., INC.

Manufacturers of Recording and Indicating Instruments

FOXBORO, MASS.

BRANCH OFFICES

NEW YORK, 50 Church Street
CHICAGO, Monadnock Building
PITTSBURGH, Park Building

CLEVELAND, Union Building
PHILADELPHIA, Stock Exchange
Building

ST. LOUIS, Railway Exchange Building
BIRMINGHAM, Brown-Marx Building
SAN FRANCISCO, 461 Market Street

MONTREAL, CAN., PEACOCK BROS. TULSA, OKLA., Oklahoma Gas Building

Products.

FOXBORO INDICATING and RECORDING GAUGES for pressure and vacuum; INDICATING and RECORDING THERMOMETERS; AUTOMATIC TEMPERATURE CONTROLLERS; INDICATING and RECORDING ELECTRIC PYROMETERS; DIFFERENTIAL PRESSURE RECORDERS; FLOW METERS for gas and liquids; INDICATING and RECORDING LIQUID LEVEL GAUGES; RECORDING PSYCHROMETERS; RADIAL PLANIMETERS; REVOLUTION COUNTERS; CO₂ RECORDERS for flue-gas analysis; GAUGE BOARDS.

Mechanical and Electric Time Recorders, Clocks, Indicating and Recording Tachometers, Siphon and Mercury Gauges, Air-speed Indicators, Airplane Thermometers.

Foxboro Gauges.

RECORDING—For steam, gas, water, air, oil, ammonia, brine, anything under vacuum or pressure; any range from full vacuum up to 20,000 lbs.; any unit of measurement: inches water, ounces, pounds, feet, metric units, etc. New inverted type does away with blotted records and dirty pen arms. All gauges are equipped with patented chart holder; micrometer adjustment pen arm; automatic release pen lifter. All cases round form and dusttight.

Two-pen recording gauges furnished to record two separate pressures on one chart. Bulletin BA-98-1.

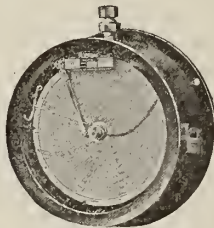
INDICATING — All movements are absolutely *non-corrosive* and independent of the case. Perfect alignment of working parts insures accuracy.

Ammonia gauges and hydraulic gauges for pressures over 1000 lbs. have nickel steel screwed tubes. Positively will not set or leak. Bulletin BA-95-1.

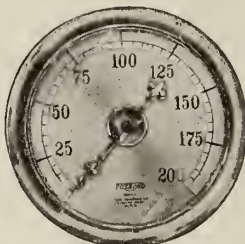
Foxboro Thermometers.

RECORDING — Depend upon expansion of liquids, gas and the vapor tension of volatile liquids for their action. Impossible to deteriorate with age.

No mercury used—effect of atmospheric conditions is thus eliminated. Connecting tube can be 300 ft. long and accurate results guaranteed. The actuating movement is our improved helical tube movement. *No multiplying devices are used.*



RECORDING GAUGE
Sizes 8, 10 and 12 in. Any finish desired



INDICATING GAUGE
Sizes 2 to 24 in. Range, from full vacuum to 20,000 lbs. per sq. in.



RECORDING THERMOMETER
Sizes 8, 10 and 12 in. From — 60° to + 1000° Fahr., or corresponding ranges in Centigrade or Reaumur

FOXBORO
TRADE MARK

Charts either even scale or increasing scale as desired. Bulbs made to suit any kind of application. Special lead and acid resisting bulbs are made for the chemical industry.

Two-pen and three-pen recording thermometers, to record on one chart 2 or 3 separate temperatures, can be supplied. Bulletin No. BA-104-1.

INDICATING—Designed to eliminate excessive breakage. An instrument easy to read and of the long distance type as well as stem type. No mercury—the same principle applies as in the recording thermometer. Bulletin BA-104-1.

Foxboro Recording Psychrometers.

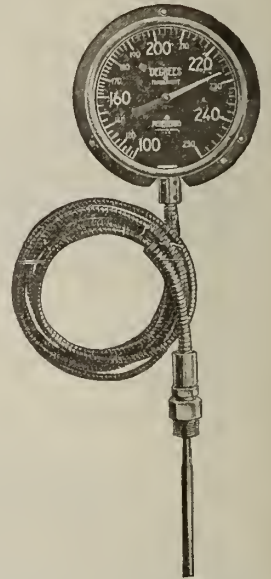
Same principle as in the recording thermometers but with 2 pens, one to record the dry bulb and the other the wet bulb temperatures.

Furnished in 2 distinct types: self-contained (as illustrated), and long distance.

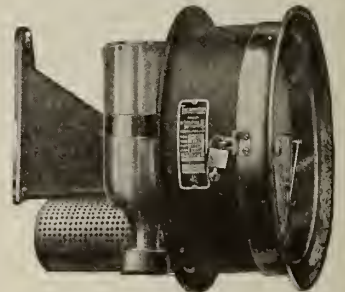
Special table furnished with each instrument makes determination of humidity very easy. Bulletin BA-103-1.

Foxboro Automatic Temperature Controllers.

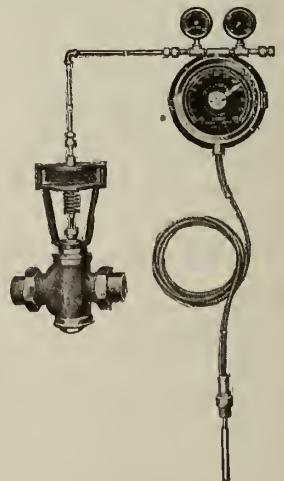
Improved type motor valves operated by vacuum or pressure; automatically close if air system fails; overheating prevented. Controllers operate 1, 2 or 3 valves on one system. Can be equipped with clock for time control. Built in combination with recording thermometer. Bulletin No. BA-112.



INDICATING THERMOMETER
From — 25° to + 1000° Fahr., or corresponding degrees Centigrade or Reaumur



RECORDING PSYCHROMETER



AUTOMATIC TEMPERATURE CONTROLLER

From — 60° to + 800° Fahr. Operate valves up to 12 in.; graduated scales. Set index hand at desired point and regulator automatically controls temperature at that degree

Foxboro Electric Pyrometers.

Indicating and recording types. Stationary or portable. For any heat treatment of any metal. All fire bars and thermo-couples are *interchangeable*. Send for Bulletin BA-108.



INDICATING PYROMETER

RECORDING PYROMETER
OR "TAPALOG"

Records automatically 1 to 6 separate temperatures on 1 chart. Up to 3000° Fahr. for use with base metal or platinum rhodium thermo-couples

Foxboro Liquid Level Gauges.

Both indicating and recording types.

Primarily designed for recording varying levels of rivers, reservoirs, canals, forebays, tail races, etc.; but have been widely adopted for sewer work, weir measurements, specific gravity recorders, and paper mills use them to record the height of stuff in Jordan stuff chests, etc.

Are not affected by ice formation; can be used on liquids other than water; guaranteed for accuracy and will be sent on trial. Complete list in Bulletin No. BA-82.



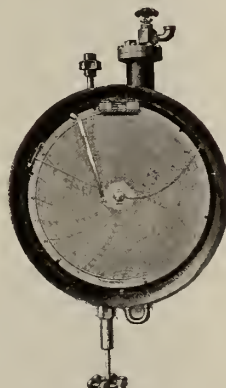
LIQUID LEVEL GAUGE

Foxboro Differential Pressure Recorders and Orifice Meters for Gas.

The difference between two existing pressures can be accurately recorded by these instruments. Float type. Can not blow mercury.

Used extensively in connection with orifice plates, Pitot tubes and Venturi throats for measuring the flow of gases and liquids under pressure.

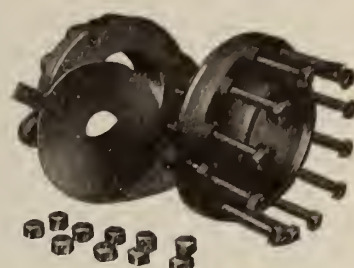
Complete orifice meters for measuring the flow of gases and liquids are supplied. A complete meter consists of a differential recorder, static pressure recording gauge, special flange union and orifice plate as shown. The

DIFFERENTIAL
RECORDING GAUGE

Guaranteed to give satisfactory results under pressures from 0 to 4-in. head of water and up to any desired differential pressure, and under static pressure up to 1000 lbs. per sq. in.

instruments are mounted on angle iron frame, with all necessary pipe fittings.

These meters are adaptable to many kinds of service. Complete data in Bulletin No. BA-113.



ORIFICE PLATE AND FLANGES

Foxboro Improved Radial Planimeters.

For averaging any kind of records on circular charts.

A very convenient instrument. Gives mean ordinate in linear inches.

Made for us by Amsler & Son, Switzerland. Complete information and instructions for use will be found in Bulletin BA-101.



RADIAL PLANIMETER

Foxboro Revolution Counters.

For either right or left, rotary or reciprocating motions. Equipped with easily operated device for resetting to zero.

Can be built with capacity of 99,999,999. Round type furnished in sizes, 6, 8½, 10 and 12 in. Send for Bulletin BA-95.

REVOLUTION COUNTER
Round type**Foxboro CO₂ Recorder.**

Used for flue-gas analysis. Compact and rugged in construction. Simple, sure and accurate in operation. No rubber tubing to deteriorate. This is strictly a commercial machine and not a delicate laboratory instrument.

A neat dotted line on the chart shows amount of CO₂ in flue gas at a glance, affording ready means for observing the efficiency of firing. Send for Bulletin BA-114.

CO₂ RECORDER**Foxboro Gauge Boards.**

This company is prepared to design and build to order neat attractive gauge boards for any combination of Foxboro instruments.

Complete proposals will be submitted on receipt of specifications.

How to Specify.

Specify Foxboro recording and indicating instruments. Our Engineering Department is at your service.

PRECISION INSTRUMENT COMPANY

Manufacturers of Recording and Indicating Instruments for Power and Gas Plants

FACTORY AND MAIN OFFICE

21 Halsey Street

NEWARK, N. J.

BRANCH OFFICE, DETROIT, MICH.

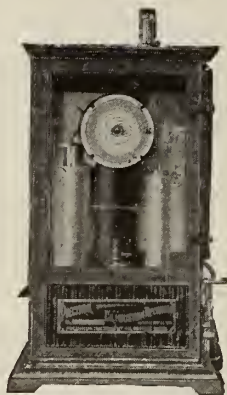
Products.

AUTOMATIC CO₂ RECORDERS; INDICATING and RECORDING GAUGES for vacuum and pressure, with scales in inches, pounds and millimeters of water, mercury and kerosene; COMBINED RECORDING and INDICATING GAUGES; HAND ORSATS or FLUE GAS ANALYZERS; SPECIFIC GRAVITY RECORDERS; RECORDING GAS CALORIMETERS; GAS COLLECTORS; COAL CALORIMETERS; MICRO-METER GAUGES; LABORATORY GLASSWARE.

Also, SO₂ Recorders, Wet Gas Test Meters, Pitot Tubes.

CO₂ Recorder.

Automatically analyzes the flue gases and records on a 24-hour or 60-day chart. True orsat in principle. Reagent used is potassium hydroxide. Simple in construction; accurate to .5 of 1% CO₂. Standard range, 0 to 20% CO₂. Also supplied in 0 to 10% for producer gas; 0 to 50% for blast furnaces and lime and cement kilns; 65 to 100% for soda ash manufacturers.



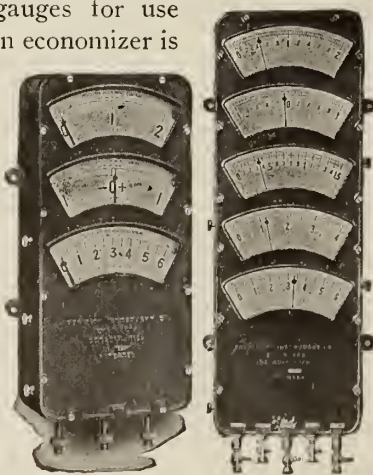
CO₂ RECORDER

Precision Gauges.

Precision 5-in-1 gauges to indicate the drafts in boiler where Cox or Harrington stokers are installed, enabling the fireman to read pressure and drafts at every part of the boiler. Dead beat construction under Precision patents.

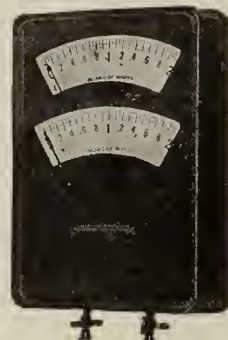
Precision 4-in-1 gauges for use in installations where an economizer is installed. Same general construction as 5-in-1 gauge.

Precision 3-in-1 gauges for use with stokers with forced draft; and are installed to enable the operating man to see at a glance the three vital points of draft in a boiler. Can also be supplied in recording 24-hour type.



3-in-1 5-in-1
PRECISION DRAFT GAUGES

Precision 2-in-1 gauges for use in natural draft boilers, showing the draft in the combustion chamber and the last pass or any other points of draft desired.



PRECISION 2-IN-1 DRAFT GAUGE

The above named gauges supplied in ranges from 1 in. vacuum or pressure to 10 in. pressure to meet the requirements of the installation.

Precision single indicating gauges for indicating vacuums or pressures. Rugged in construction, and of well-known Precision dead beat type.

Supplied in inches, pounds and millimeters of water, mercury or kerosene.

Precision 60-day tape gauges, supplied in ranges from 2 in. vacuum to any desired pressure, are of dead beat construction, and used to record drafts at the boiler or steam pressures.

Precision 24-hour recording gauges guaranteed accurate. Dead beat construction. Ranges 1 in. to 500 lbs. vacuum and pressure.

In feet head for liquid levels.

For coke oven use, can be supplied in millimeters of kerosene.



PRECISION SINGLE GAUGE



PRECISION
60-DAY TAPE
GAUGE



PRECISION 24-
HOUR RECORD-
ING GAUGE

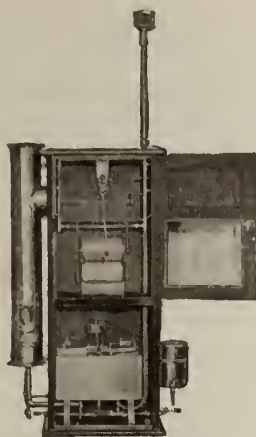
Precision Recording Calorimeters.

Precision recording calorimeters for recording on a 60-day chart the British thermal units of artificial, natural or producer gas. Automatically compensates for variations in temperature, specific gravity and pressure. Accurate and reliable.

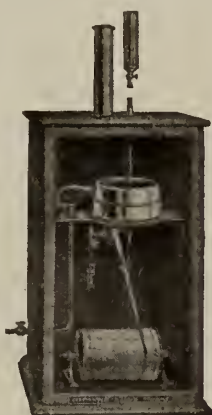
Simple in construction, and gives permanent record.

Precision Specific Gravity Recorders.

Precision specific gravity recorders automatically record the specific gravity of gases; and are applicable for natural gas, producer gas, artificial gas, and in the oil and gasoline fields. They are accurate, simple and reliable.



PRECISION RECORDING CALORIMETER



PRECISION SPECIFIC GRAVITY RECORDER

Precision Standard Orsats.

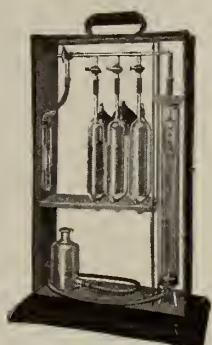
Orsats in 1, 2, 3, 4 tubes. Burettes graduated for 50 cc or 100 cc. All metal and glass construction. Analyze for CO_2 , CO , O , H .

Orsats for other readings can be supplied to your specifications.

Combined Recording and Indicating Gauges.

Give the indication at a glance, and also the permanent record of the condition on a 60-day tape chart. Made for either vacuum or pressure, direct reading or differential, and can be supplied with a re-winding device for the used chart if desired. Case is of all-metal construction, black enamel. Bronze front can be furnished at extra cost.

When ordering give range desired, as these gauges are made with diaphragm construction for the low ranges and Bourbon tube type for the higher ranges.



PRECISION 100 CC STANDARD ORSAT



PRECISION COMBINED RECORDING AND INDICATING GAUGE

Gas Collectors.

Enable the engineer to make a complete analysis of the gas and accurately check up the efficiency of the boiler.

The improved type consists of a substantial galvanized iron tank with piping arranged for constantly drawing a sample of gas from the flue.

This instrument was especially designed for small power plants.

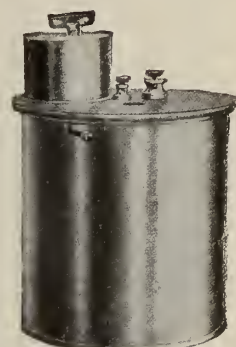


PRECISION GAS COLLECTOR

Coal Calorimeters.

A simple and reliable patented instrument for determining the heating value of coal.

This company has been identified with the manufacture and sale of coal calorimeters for several years, and the subject is now receiving the special attention it deserves, for within the last few years coal buyers have begun to realize the financial advantage of buying coal on a heating value basis from tests of the coal offered for sale.

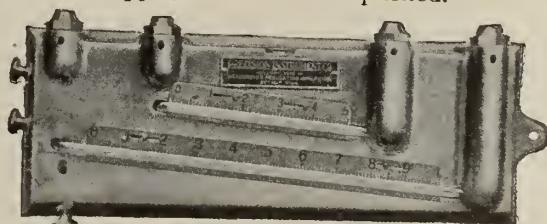


PRECISION COAL CALORIMETER

Double Micrometer Level Gauges.

These instruments combine rapid and accurate calibration with low maintenance and the minimum chance of breakage. Absolutely no strain is placed upon the glass in these gauges. The connection between glass and metal is through a simple seal.

If it is desired for portable purposes, make a fixed joint by inserting the proper mixture in the seal cups, screw in the nipple, and it is accomplished.



PRECISION DOUBLE MICROMETER LEVEL GAUGE

Chemical Glassware.

The PRECISION INSTRUMENT COMPANY will make to specifications chemical glassware or supply standard articles.

THE BROWN INSTRUMENT COMPANY

Pyrometers, Thermometers and Recording Instruments

PHILADELPHIA, PA.

BRANCH OFFICES

NEW YORK, 50 Church Street
DENVER, 1742 Champa Street
SAN FRANCISCO, 576 Mission Street

PITTSBURGH, Oliver Building
CHICAGO, Conway Building
DETROIT, Ford Building

ST. LOUIS, Railway Exchange Building
LOS ANGELES, 363 New High Street
MONTREAL, CANADA, 137 McGill Street

Products.

PYROMETERS; THERMOMETERS; GAUGES; TACHOMETERS and other SCIENTIFIC INSTRUMENTS.

Pyrometers.

HIGH RESISTANCE INDICATING TYPE—For measuring temperatures from 300° to 3000° Fahr. or equivalent Cent.

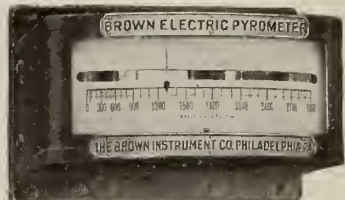
Operates on thermoelectric principle. Entirely unaffected by temperature changes along wire connecting thermocouple to instrument.

Also designed to automatically control or regulate temperatures of electric, gas or oil furnaces.

HIGH RESISTANCE RECORDING TYPE—Keeps a continuous record, day and night, of temperatures. Eliminates guesswork. Gives executive a check on plant operation.

CONTINUOUS RECORDING TYPE—Makes a continuous record of temperatures over a 2 months' period. It requires only the winding of 8-day clock mechanism once a week. Made in types to record the temperature of 1, 2, 4, 6, 8 or 10 thermocouples in different colors on one chart.

PORTABLE TYPE—Made in both high and low resistance types. Height, 7 in., width, 7 in., depth, 4½ in., weight only 6½ lbs.



HIGH RESISTANCE INDICATING PYROMETER



RECORDING PYROMETER



CONTINUOUS RECORDING PYROMETER



PORTABLE PYROMETER

Recording Thermometers.

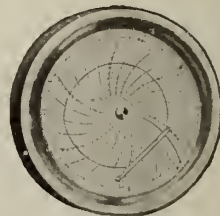
For measuring temperatures up to 800° Fahr. Operates on the principle of expansion of gas or liquid with change of temperature. Tubing can be 100 ft. long. Readings are unaffected by atmospheric changes in temperature along tubing or at instrument. Makes a clear, accurate chart.



RECORDING THERMOMETER

Recording Pressure Gauge.

For recording all ranges of vacuum and pressure from a few ounces of water to 3000 lbs. Operate through expansion or contraction of a helical hollow spring for high pressure and a series of diaphragms for lower pressures and vacuums. Positive and accurate.



RECORDING PRESSURE GAUGE



TIME AND OPERATION RECORDER

Time and Operation Recorder.

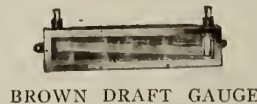
Extensively used for recording the time of operation of machinery, switches, valves, pumps and for recording the reversals of glass melting tanks, open hearth furnaces and annealing furnaces. Also for recording the time of starting and stopping of paper machines and other devices.

Other Brown Instruments.

Ammeters; draft gauges, electrical tachometers, mercurial tachometers; mercury gauges; milli-ammeters; milli-voltmeters; recording gauges; temperature controllers; mercurial thermometers; vacuum gauges; voltmeters; differential gauges.



BROWN ELECTRIC TACHOMETER



BROWN DRAFT GAUGE



BROWN MERCURIAL THERMOMETER INDUSTRIAL TYPE

PRECISION THERMOMETER & INSTRUMENT CO.

1434 Brandywine Street
PHILADELPHIA, PA.

Products.

THERMOMETERS for Laboratory, Factory and Power Plants; HYDROMETERS; HYGROMETERS; BAROMETERS; AUTOMATIC REGULATORS; METEOROLOGICAL INSTRUMENTS; VACUUM GAGES; PRECISION INSTRUMENT WORK—special and experimental.

Automatic Regulators.

Electrical for heavy duty.

Barometers (Government Standard).

Mercurial standard U. S. W. B. type.

Hydrometers.

Plain and combination standard grades only, with individually calibrated hand written scales.

Hygrometers (Government Standard).

Wet and dry bulb hygrometers for the accurate determination of relative humidity.

Vacuum Gages.

Full column mercurial gages with trap.

Calender Micrometers.

Indicating and recording, for use on calendering machines to indicate the thickness of paper, linoleums, etc.

Ballistic Instruments (Government Standard).

"Precision" LeBoulange chronograph of improved design, as adopted in 1917 by U. S. Government and the largest powder manufacturers. Complete units furnished.

Low Temperature Thermometers.

Special chemical thermometers reading to—100 C. filled with toluol, and to—200 C. filled with pentane.

Thermometers (Navy Standard).

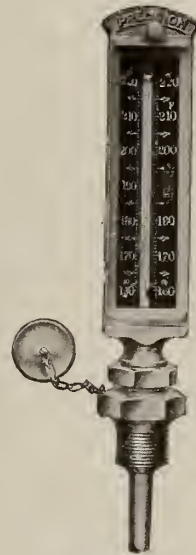
Navy Department, Bureau of Steam Engineering standard type thermometers.

Thermometers (Government Standard).

Armored	Pocket
Asphalt testing	Precision
Bakers	Railway
Bake oven	Registering
Brass case	Shiphold
Brine pipe	Size's registering
Calorimeter	Sterilizing
Cellar	Sugar
Chemical	Tin case
Cold storage	Standard
Cold test	Titer test
Confectioners	Vulcanizing
Copper case	Weather bureau
Distillers	
Dough testing	
Electric alarm	
Engineers	
Glass angle	
Glass straight	
Iron angle	
Iron straight	
Japanning oven	
Kettle	
Laboratory	
Marine	
Mash tub	
Mash pipe	
Maximum	
Maximum and minimum	
Oil	
Oven	
Pasteurizer	
Pipe straight	
Pipe angle	



VACUUM
GAGE



ENGINEERS
THERMOMETER



KETTLE
THERMOMETER

Co-operative Service.

Circulars and a general catalogue describing, listing and illustrating these instruments are published

by this company for free distribution, on request. The above, however, is but a partial list of the products manufactured, since many instruments are constructed to meet the particular requirements of customers. The company is equipped for small machine work, precision instrument work—special and experimental. On receipt of specifications or drawings covering instruments of special design, information with reference to prices and deliveries will be promptly furnished.

THE SCHAEFFER & BUDENBERG MFG. CO.

Instruments for Measuring Pressure, Temperature, Power and Speed

MAIN OFFICE AND WORKS

BROOKLYN, N. Y.

BRANCH OFFICES

LOS ANGELES, CAL.

CHICAGO, ILL.

PITTSBURGH, PA.

PHILADELPHIA, PA.

Products.

GAUGES: Pressure, Vacuum and "Redline" Differential and "U" Draft.

RECORDING GAUGES: "Columbia" and "Schaeffer."

GAUGE TESTERS.

INDICATING THERMOMETERS: "Crescent" and "Reform."

RECORDING THERMOMETERS: "Columbia" and "Schaeffer."

TACHOMETERS: Hand and Stationary.

COUNTERS: Indicating and Recording.

OPERATION RECORDERS.

CALORIMETERS: "Carpenter's" Separating and Throttling Steam.

Gauge Boards and Complete Equipment.

Gauges.

A complete line of pressure, vacuum and draft gauges for all purposes. Constructed on most approved principles with the best of material and workmanship.

Catalogue S-C 1.



GAUGE

Recording Gauges.

For accurately recording all pressure, vacuum or draft "Columbia" and "Schaeffer" recording gauges will meet the most exacting requirements.

The "Columbia" is furnished with 8-in. or 12-in. charts making one revolution in 24 hours, 7 days, or other time periods.

The diameter of the "Schaeffer" chart is approximately $7\frac{1}{2}$ ins.

Equipped with "Day and Night" border charts, removable and adjustable recording pen arm, non-corrosive and non-spilling glass pens, etc.

Catalogue S-C 100.



"COLUMBIA"
RECORDING
GAUGE

Draft Gauges.

In many designs and types is our line of gauges for measuring draft. Two of the most commonly used are here shown. Catalogue shows them all.

Catalogue S-C 75.



"Redline" Differential Type
DRAFT GAUGES



"U" Type

Gauge Testers.

Gauges must be accurate at all times and should, therefore, be periodically tested. Among the many types of S & B gauge testers for testing gauges of all types and capacity, there is sure to be an apparatus that is compatible with every need.

Catalogue S-C 50.

Calorimeters.

For determining the percentage of moisture in steam (which is an important factor in power plant testing) our throttling and separating calorimeters, designed by Prof. R. C. Carpenter, of mechanical engineering fame, are used and recommended by most eminent mechanical engineers.

Catalogue S-C 700.

Thermometers.

Among our line of high grade "Crescent" thermometers will be found those used in every industry. Also other types of thermometers for diverse industrial requirements.

Also the "Reform" mercury-actuated dial face thermometer which can be had with rigid back or bottom connection or with flexible connection and for any temperature range up to 1000° Fahr.

Catalogue S-C 200.



"Reform" Dial
"Crescent"
THERMOMETERS

Recording Thermometers.

Give authentic records of temperature up to 1000° Fahr.

The "Columbia" has won universal approbation for its accuracy and durability. The "Schaeffer" is a less expensive offspring of the "Columbia." The latter can be furnished with 8-in. or 12-in. charts; the Schaeffer with chart approximately $7\frac{1}{2}$ ins. in diameter.

Principal features of our recorders are mercury actuated, rugged construction, compensated, removable and adjustable recording pen arm, special insulation protecting the steel connecting tubing, "Day and Night" border charts, non-corrosive non-spilling glass recorder pens, etc.

Catalogue S-C 300.

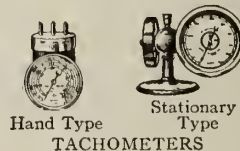


"COLUMBIA"
RECORDING
THERMOMETER

Tachometers.

For measuring speeds of shaftings, machines, motors, turbines, etc., directly in revolutions per minute, our line of American made tachometers is complete. Hand tachometers in several styles. Stationary tachometers for permanent connection of both indicating and recording types for all applications.

Catalogue S-C 23.



Hand Type
Stationary Type
TACHOMETERS

Counters.

Indicating and recording counters for diverse requirements, as well as operation recorders for recording the frequency, time of occurrence and duration of all mechanical operations, are illustrated in catalogue.

We are equipped to build special counters for special requirements.

Catalogue S-C 600.



SQUARE CASE
COUNTER



ENGINE REGISTER
COUNTER

STANDARD THERMOMETER COMPANY

65 Shirley Street
BOSTON, MASS.

Products.

STANDARD METALLIC THERMOMETERS.
STANDARD THERMOSTATS.

Thermometers.

This company manufactures types of standard thermometers to meet the various demands of a wide range of uses. The highest degree of accuracy and sensitiveness has been achieved through 25 years of experience building products which are thoroughly tested and leave the factory with a full guarantee to give satisfaction.

Standard Recording Thermometers are designed and made for every condition demanding a permanent temperature record, and especially adaptable for industrial installations, such as dry kilns, japan and bake ovens, refrigerating and cold storage plants and greenhouses.

No. 200 is for use in public buildings, factory rooms, hospitals, offices, clubs or homes. No. 200 recording thermometers are furnished in attractive oxydized copper or black enamel cases and with daily or weekly charts providing for temperature ranges of from 0° to 500° Fahr.

While extremely sensitive to changes, these instruments are practically indestructible, a feature of importance when they are to give service in kilns, brick ovens, etc., where the hazard of damage would ordinarily be great.



No. 200. STANDARD RECORDING THERMOMETER

Mechanical Thermometers.

No. 42—For installation in sugar boilers, vacuum pans, japan and bake ovens, kilns, water and oil tanks, retorts, steam and hot water lines, etc. This type furnished also in Reamur or Centigrade scale.

No. 43—Same type as No. 42, but has vertical extension.

No. 34—Has 6-in. dial and protecting brass shell over the extension, perforated over the lamina, which increases the sensitiveness of the instrument. No. 34 is especially designed for service where dry heats are maintained, and has a range of from 0° to 400° Fahr.

EXTENSIONS—A threaded extension, either horizontal or vertical is furnished with instruments to be used in kilns, retorts, etc., with which temperatures from below 50° to above 500° Fahr. can be accurately recorded. The length of an extension is measured from the end of the screw thread to the end of the lamina cover, and is the portion of the thermometer extending into receptacle.



VERTICAL EXTENSION



No. 34. SHOWING EXTENSION



No. 42. WITH EXTENSION

ADVERTISING THERMOMETERS—For households, offices and public buildings.

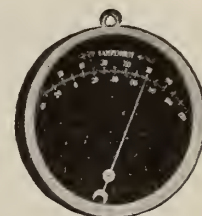
No. 85 "Standard"—Has full revolution movement and 9-in. dial. Is very easy to read and provides a conspicuous place for the advertiser's message on dial. An advertising medium of the highest grade. Furnished in copper, oxidized copper, black, or nickel finish.

No. 197 "Amesbury"—Is similar to No. 85, except that a 90° arc dial is used, thereby providing greater space for advertising on dial. Advertisement printed in as many colors as required.

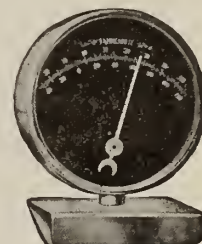
No. 138S, Desk Type Thermometer—A 3-in. thermometer set in highly polished pressed steel base. Is very desirable for use on desk, table, or mantel. As a premium or advertising medium it is unexcelled. Advertisement carried on either the dial or front of the base.



No. 85 THERMOMETER



"AMESBURY" SPECIAL NO. 197



DESK TYPE "AMESBURY"

Thermostats.

STYLE B—For the control of motors and regulation of steam and heat of furnaces, vulcanizers, boilers, etc., this instrument can be furnished with extensions up to 24 in. though the 4 in. is the regular length.

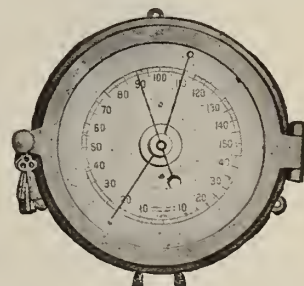
TEMPERATURE RANGES

B-1 0° to 200° Fahr.
B-2 50° to 250° Fahr.

B-3 100° to 300° Fahr.
B-4 200° to 400° Fahr.

GREENHOUSE THERMOSTATS—No. GH3—High temperature and low temperature contact hands set at desired points by stud through glass.

No. GH4—Similar to No. GH3, but set stud is under glass. Lock prevents tampering and case is hermetically sealed.



GREENHOUSE THERMOSTAT

Shipping.

Each instrument is packed in a separate mailing case and its safe arrival is guaranteed.

C. J. TAGLIABUE MFG. CO.

Manufacturers of Indicating, Recording and Controlling Instruments

TELEPHONE:
SUNSET 2466-7-8-9

18-88 Thirty-third Street
BROOKLYN, N. Y.

CABLE ADDRESS:
"TAGLIABUE, N. Y."

BRANCH OFFICES
BOSTON PITTSBURGH CHICAGO TULSA, OKLA., PORTLAND, ORE. SAN FRANCISCO

Products.

INDICATING, RECORDING and CONTROLLING INSTRUMENTS:

Automatic Temperature, Pressure, Time, Vacuum, Liquid Level, Condensate, Time-temperature and Time-pressure Controllers; Mercurial Barometers; Humidity Indicating Instruments; Hydrometers; Hygrophants; Oil Testing Instruments; Pyrometers; Recorders; Recording Gages and Thermometers; Thermometers: Indicating, Recording and Registering; Vacuum Gages, etc.

Automatic Controllers.

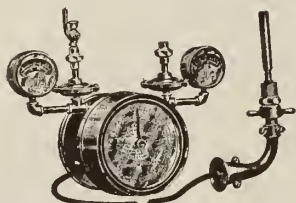
Roesch-designed, of both air-operated and self-operating types, for purposes enumerated below.

APPLICATION—All TAG Controllers are supplied with variations of features, according to nature of the industry and specific local conditions.

Therefore, they can be advantageously employed in practically every industry where the factor of uniform control of temperature, pressures, etc., is essential for economy, efficiency and the guaranteed quality of the products.

Temperature Controllers.

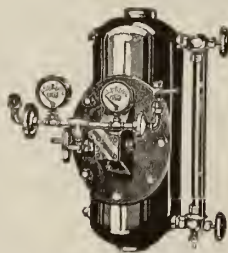
For use at from -40° to 900° Fahr., or equivalent; of both air-operated and self-operating types. (Refer to opposite page concerning the self-operated type.)



"PERFECT" TYPE AIR-OPERATED TEMPERATURE CONTROLLER



DIAPHRAGM MOTOR VALVE
Replaces hand valve and is operated by controller



P. & W. LEVEL AND CONDENSATE CONTROLLER

Pressure Controllers.

For maintaining uniform pressures within the limits of as little as 1/25-in. water column, and as high as 400 lbs. per sq. in.; of both air-operated and self-operating types. (Refer to opposite page concerning the self-operated type.)



TRADE-MARK

Liquid Level Controllers.

For either open or closed tanks at any elevation, and for holding any kind of liquid.

Condensate Controllers.

For effectively discharging any volume of condensate under practically any conditions.

Time Controllers.

For automatically shutting off the heating or cooling supply entirely, at the end of any time period for which the controller is set.

Vacuum Controllers.

For vacuums as slight as 1/25-in. water column and up to 30-in. mercury column.

Thermometers.

TAG industrial mercurial thermometers for all industrial requirements where accuracy is a factor of importance, with scale limits from 60° Fahr. below zero to 1000° above or equivalent; in a variety of forms and sizes.

Provided with various features to best suit the particular requirement of usage.

Also other industrial thermometers of less refinement, in a great variety of styles.

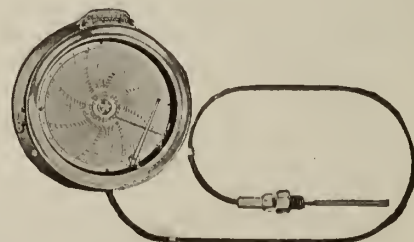
Miscellaneous thermometers of all types and forms for every purpose.



TAG INDUS-TRIAL THER-MOMETER
Straight form

Recording Thermometers.

For temperature from 60° Fahr. below zero to 800° above, or equivalent; of self-contained and long distance forms, in various sizes and patterns. Arranged with numerous special connections and other features for, in each case, recording the temperature with the highest degree of accuracy.



RECORDING THERMOMETER

Oil Testing Instruments.

For determining the specific gravity, flash and fire point, boiling point, melting point, freezing point, viscosity, etc., of oil, fat, wax, grease, etc. Hydrometers of various ranges and forms; jars, tubes, bottles and glasses for test purposes; oil thieves and samples; water indicators; special thermometers; gage and want-age rods; centrifuges; stills; separatory funnels, etc.

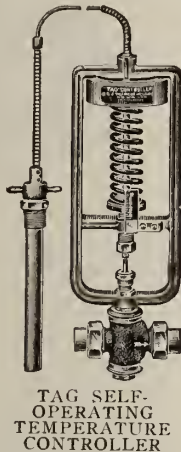
Self-operating Controllers for Temperature and for Pressure.

These TAG controllers can be applied to practically any apparatus where control of temperature or pressure is desired within the ranges of 90° to 290° Fahr. and 2 to 70 lbs., in either a vertical or horizontal position.

ECONOMY—They need no compressed air for their operation, being entirely self-contained and self-operating. There are no levers, air valves or lines, etc., to look after.

Bear in mind that these controllers are just the same in perfection of operation, accuracy and reliability as this company's well-known air-operated "Simplex," "Perfect," and "Faultless" controllers.

The improvement consists of the simplicity of operation, and the practical elimination of any upkeep expense.

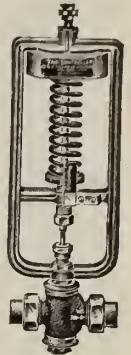


SIMPLICITY—They are so simple in principle and operation that an ordinary workman can obtain quick and highly satisfactory results. The charts reproduced below graphically illustrate the efficiency of TAG automatic control vs. hand regulation of the steam inlet valve.

RUGGED RELIABILITY—All of the parts are heavy, strong, durable, practically unbreakable—nothing that can give out—nothing delicate, no weak link in the sturdy chain. Absolutely unaffected by vibration.

FOOLPROOF—The most ignorant operator can not harm them, except wilfully, as there are no delicate adjustments or parts.

EASILY INSTALLED—The complete and explicit instructions that are sent with each controller will readily enable any careful pipefitter to easily install them.



TAG SELF-OPERATING PRESSURE CONTROLLER

Bulletin.

For further details, ask for Bulletin SC-388.

Guarantee and Co-operative Service.

All TAG products are guaranteed. Literature, blue prints and further information sent on request.

Submit your problems to this company's nearest sales engineer. No obligation incurred for such co-operation.

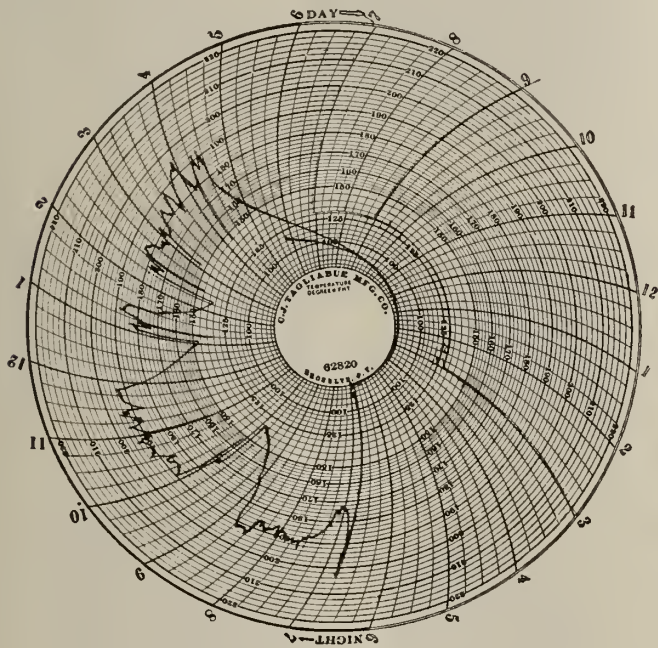


FIG. 1

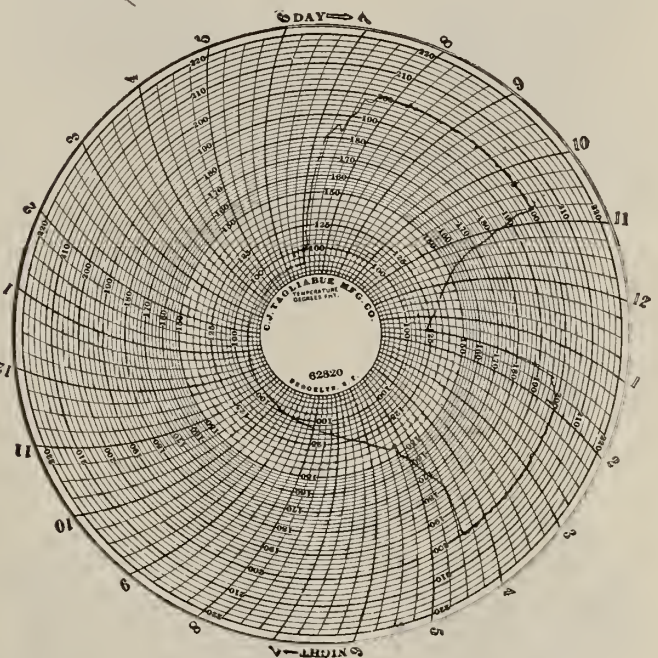


FIG. 2

ILLUSTRATING THE EFFICIENCY OF TAG AUTOMATIC CONTROL VS. HAND REGULATION OF STEAM INLET VALVE

Records of the temperature of the size maintained in a slasher under identical operating conditions, the temperature desired being 200° Fahr. Fig. 1 shows the irregularity and fluctuations produced by the most careful hand control, and Fig. 2 the uniformity produced by a TAG Automatic Temperature Controller

TAYLOR INSTRUMENT COMPANIES

Manufacturers of Industrial Thermometers, Regulators and Pyrometers

ROCHESTER, N. Y.

BRANCHES

NEW YORK BOSTON CHICAGO WASHINGTON ST. LOUIS PHILADELPHIA TORONTO

Products.

AUTOMATIC TEMPERATURE REGULATORS.

THERMOMETERS: Recording; Index Tycos Thermometers for any industrial application; Engraved Stem.

GAUGES: Recording, Mercury Column, Vacuum, and Absolute Pressure; Draft; Air Blast; Gas Pressure.

TEMPERATURE CONTROLS; ANEROID and RECORDING BAROMETERS; HYGROMETERS; AIRMETERS and ANEMOMETERS; HYDROMETERS; PYROMETERS.

Also, Brine and Cold Storage, and Melting Tank Thermometers.

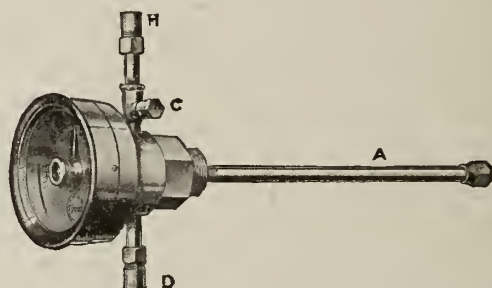


FIG. 1. TYCOS AUTOMATIC TEMPERATURE REGULATOR

For closed or open hot water tanks, for hot water house heaters, combined hot water tanks and heaters, plating baths, potash tanks, dye vats, vulcanizers, retorts, etc.

Furnished for operation with water or air pressure

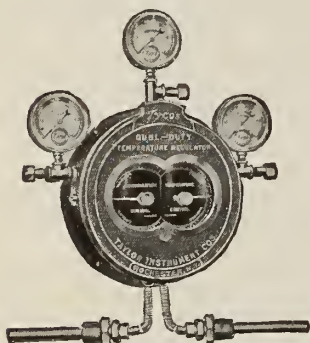


FIG. 2. DUBL-DUTY TYPE TEMPERATURE REGULATOR

Furnished with flexible capillary tubing.

Case of regulator can be mounted at considerable distance from apparatus under control.

Controls temperature with bulb K-1 and discharges water of condensation from heater or coils with bulb K. Operates with compressed air



FIG. 3. TYCOS TEMPERATURE CONTROL, ELECTRIC CONTACT TYPE

For automatically controlling temperature of electrically heated apparatus, especially within limits of 40° below zero to 1000° above zero Fahr.

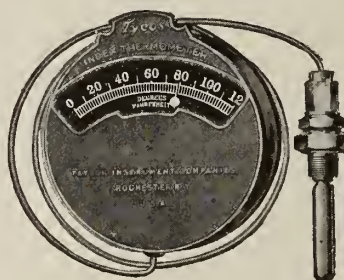


FIG. 4. Indicating

TYCOS THERMOMETERS, CAPILLARY FORM

Can be supplied with any range of temperature within the limits of 40° below zero to 1000° above zero Fahr.

Fig. 5 has pen arm equipped with patent seal, which prevents adjustment by unauthorized persons. Chart is of practical dimensions with uniform scaling as wide as on so-called 12-in. charts



FIG. 5. Recording

TYCOS THERMOMETERS, CAPILLARY FORM



FIG. 6. TYCOS PRESSURE AND VACUUM RECORDING GAUGE

Built with same case, clock movement, size chart, sealing device, etc., as used with Tyco's recording thermometers, thus where mounted together, the two instruments harmonize



FIG. 7. TYCOS TRAVELING RECORDING THERMOMETER

Adapted to taking temperatures in pasteurizers. Every fluctuation of temperature that occurs in the product is recorded on revolving chart in the case, giving a continuous temperature record for every stage of the pasteurization process



FIG. 8. TYCOS RE-RECORDING THERMOMETER, SELF-CONTAINED FORM

Specially adapted for recording indoor air temperatures.

Bulb or sensitive member inside of case. Sides of case well perforated to allow free circulation of air, making instrument sensitive

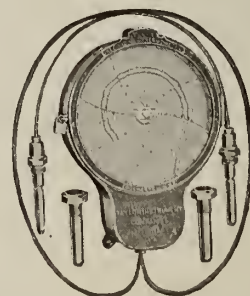


FIG. 9. TYCOS BI-RECORD RECORDING THERMOMETER

For obtaining temperature drop on brine, ammonia and hot water circulating systems.

2 pens, 2 flexible tubes and 2 bulbs. The 2 systems operate independently and a continuous record of the temperature to which bulbs are subjected is provided



FIG. 10. Right Side Angle Form

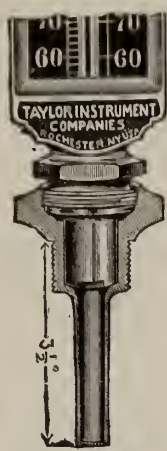


FIG. 11. Separable Socket Connection



FIG. 12. Union Connection, Pipe Threaded Hub Form

TYCOS ANGLE AND STRAIGHT STEM THERMOMETERS

Furnished in straight or variable angle stem and with vertical, inclined or reclining face forms. Made in 3 scale-case sizes for 7-, 9- and 12-in. scale lengths. Intermediate and high range scales for superheated steam are in 12-in. case only. Flue gas thermometers made with 12-in. case and scale range of 210° to 950° Fahr. with 30-in. stem. Made with separable socket connection and union threaded hub connection as illustrated

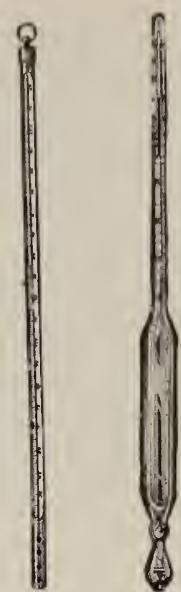


FIG. 13. ARMORED TYCOS HY-ENGRAVED STEM THERMOMETER



FIG. 14. TYCOS HYDROMETER

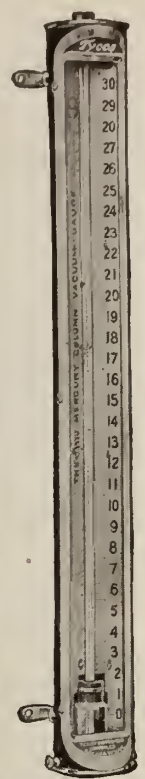


FIG. 15. Absolute Pressure TYCOS MERCURY COLUMN GAUGES

FIG. 16. Vacuum Pressure TYCOS MERCURY COLUMN GAUGES

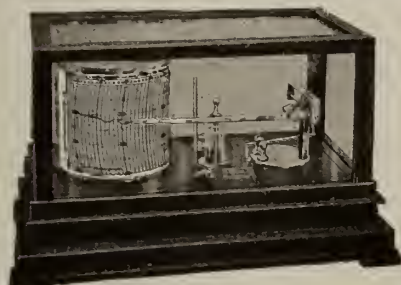


FIG. 17. TYCOS RECORDING BAROMETER



FIG. 18. TYCOS AIR-METER



FIG. 19. TYCOS ALTITUDE ANEROID



FIG. 20. TYCOS HIGH RESISTANCE WALL TYPE INDICATING PYROMETER



FIG. 21. TYCOS THREAD TYPE RECORDING PYROMETER



FIG. 22. TYCOS FÉRY RADIATION PYROMETER

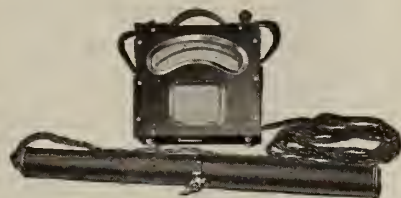


FIG. 23. FOSTER PORTABLE FIXED FOCUS RADIATION PYROMETER

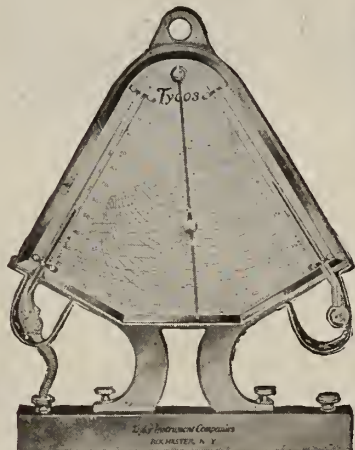


FIG. 24. Hanging Type Hygrodeik

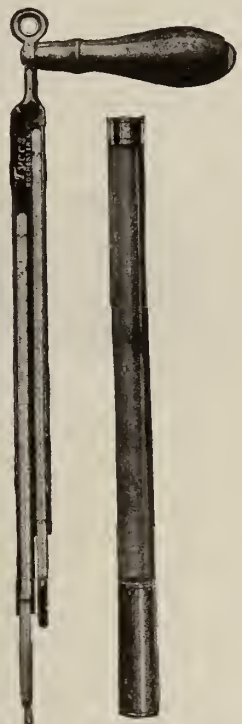


FIG. 25. Sling Psychrometer or Hygrometer

For long distance measurement of high temperatures. Temperature ranges are 800° to 2400° Fahr. and 1600° to 3000° Fahr. Centigrade and special scales also furnished

Tests made quickly and readings accurately obtained, as in whirling bulbs, they are subjected to a perfect circulation

TYCOS WET AND DRY BULB HYGROMETERS

THWING INSTRUMENT COMPANY

3352 Lancaster Avenue
PHILADELPHIA, PA.

BRANCHES

LOS ANGELES, CAL., 716 South Hill Street

NEW YORK, N. Y., 59 Pearl Street

SAN FRANCISCO, CAL., 506 Butler Building

PITTSBURGH, PA., 932 Oliver Building

PORTLAND, ORE., 45 4th Street

Products.

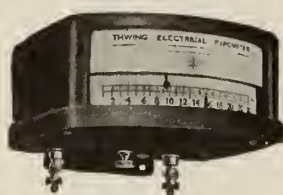
THWING THERMO-ELECTRIC, RADIATION, and RESISTANCE PYROMETERS, INDICATING and SINGLE and MULTIPLE RECORDING SYSTEMS for measuring all temperatures between -250° to 3000° Cent. (-420° to 5500° Fahr.).

Thwing Multiple Recording System.

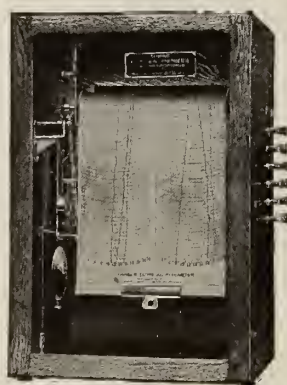
A Thwing multiple-record indicating and recording pyrometer system is a real necessity wherever heat conditions are to be measured or controlled.

The recorder in the office keeps the conditions at every heat source constantly under the manager's observation, warns of irregularities, checks inexperienced men, detects the shirkers and gives *permanent* records. These records afford the best possible means of determining and duplicating the ideal time and heat relation for perfect product, minimum fuel consumption and for maximum plant capacity, through completion of the process in the shortest possible time. The Thwing multiple system of recording produces 1 to 12 records on a single chart and thereby avoids the extra expense of additional instruments, charts, etc.

The indicators at the heat sources enable attendants to keep their fires right at all times to avoid losses from overheating or underheating.



WALL PATTERN INDICATOR



6-RECORD RECORDER

Thwing pyrometers are made in the following types:

TYPE "A" (THERMO-ELECTRIC)—For temperatures from 100° Cent. (200° Fahr.) to 1600° Cent. (2900° Fahr.).

Operation is based upon measurement of the electric current generated by insertion of the "hot end" of a thermo-couple into the temperature to be measured.

The thermo-couple is made of base metal or platinum, with outer protection of fused quartz, porcelain, clay, iron, etc., as conditions require, and when installed as directed will give continuously accurate results with very low expense for renewals.

TYPE "B" (RADIATION)—For temperatures from 500° Cent. (925° Fahr.) to 3000° Cent. (5500° Fahr.).

This is the quickest acting pyrometer made and is accurate to the highest temperatures. No part enters the fire nor does the operator have to get uncomfortably close to the heat. The construction is simple, practical and very durable; and as no focusing, leveling or reference to tables are required, readings can be taken in rapid succession.

Made for both portable and stationary use and particularly desirable for reading temperatures in furnaces, ovens, kilns, fire pits and within moving molten metal and other material.

TYPE "C" (RESISTANCE)—For temperatures from -250° Cent. (-420° Fahr.) to 200° Cent. (400° Fahr.) and in special cases up to 425° Cent. (800° Fahr.).

This instrument is based upon measurement of the resistance to an electric current passing through a bulb of fine wire located at the point of temperature measurement. The resistance type is most used for measuring low temperature where the cold ends of a thermo-couple can not easily be kept at constant temperature.

Engineering Service.

Wide experience and records of performance in about every imaginable temperature measurement peculiarly fit this company to offer correct advice. Gladly and *without charge* special reports will be rendered and desirable arrangements for difficult conditions suggested.

Literature.

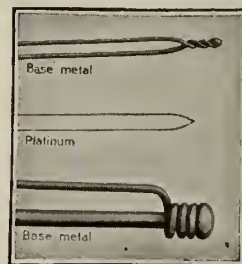
Literature with detailed description of any type of Thwing instrument and giving valuable hints on pyrometer selection and use will be sent free on request.



GOLD MEDAL AWARD
PANAMA-PACIFIC EXPOSITION, 1915



PORTABLE RADIATION PYROMETER



THERMO-COUPLES

UEHLING INSTRUMENT COMPANY

Power Plant Economy Apparatus

2016 Empire Building
NEW YORK, N. Y.

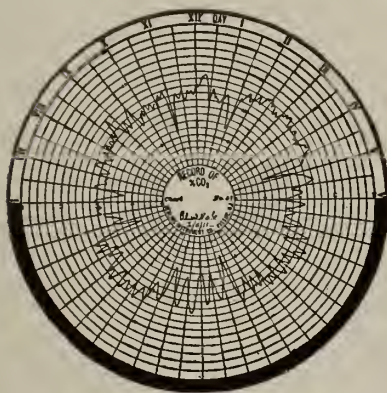
Products.

Manufacturers of RECORDING INSTRUMENTS, which include Uehling CO₂ Recording Equipment; Combined CO₂ and Temperature Recorders; Combined Barometer and Vacuum Recorders; Absolute Pressure Indicators; Pressure and Vacuum Recorders.

Also, Hand CO₂ Machines, Pyrometers, Waste Meters, Differential Pressure Recorders, Draft Recorders and Indicators, Revolution Recorders, etc.

Uehling CO₂ Recording Equipment.

Uehling CO₂ recording equipment provides the simplest means for keeping continuous check on the fuel wasted up the chimney. It is made up in the single and multiple form for one boiler or a battery. With each unit is included a recorder which can be located in the office of the chief engineer or superintendent, and an auxiliary CO₂ indicator which can be located at the boiler front for the fireman's guidance, by means of which he can be held responsible for



CO₂ RECORD (Reduced)



CO₂ RECORDER



TRADE-MARK



BOILER FRONT INDICATOR



ABSOLUTE PRESSURE INDICATOR

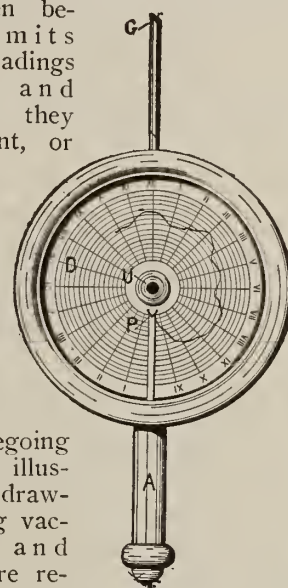
Uehling Recording Instruments.

The distinctive features of Uehling recording instruments are simplicity, accuracy and reliability. They are based on the hydrostatic principle, by the application of which all springs, levers and joint movements are avoided.

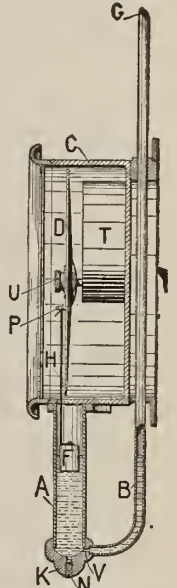
In addition to these important advantages, the hydrostatic principle permits of making

the scale open between the limits where the readings are important and narrow where they are unimportant, or eliminating that part of the scale altogether which is of no use, thus utilizing the whole width of the chart for important readings.

The foregoing principles are illustrated by the drawings of Uehling vacuum recorder and Uehling pressure recorder reproduced herewith.

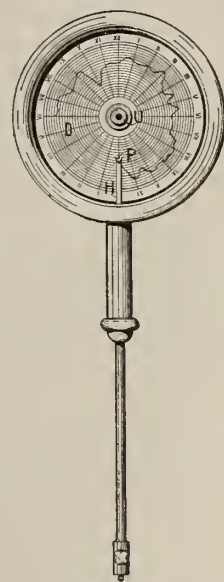


UEHLING VACUUM RECORDER

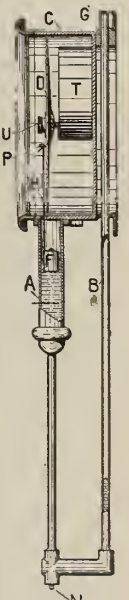


Combined Barometer and Vacuum Recorder.

For power plants, particular attention is drawn to the Uehling combined barometer and vacuum recorder which puts a record of both the barometric pressure and vacuum on the same chart. The distance between the two records, therefore, always represents the absolute back pressure. This recorder is most accurate and is meeting with much favor as applied to condensing plants.



UEHLING PRESSURE RECORDER



the record produced and thus for the fuel wasted up the chimney. The continuous and uninterrupted record is made on an 8-in. circular chart or on a rectilinear chart if desirable.

Absolute Pressure Indicator.

The fact that the accuracy of all vacuum measuring devices is affected by any change in barometric pressure led to the development of the Uehling absolute pressure indicator, which measures the absolute pressure in any chamber and is entirely independent of any change in atmospheric pressure. Mercury is used as the indicating medium.

Special Instruments.

This company also has a department for designing and developing special instruments for special purposes.

BAILEY METER COMPANY

2019 East 46th Street
CLEVELAND, OHIO

Products.

FLUID METERS: Recording and Integrating the Flow, Pressure and Temperature of High and Low Pressure Steam, Exhaust Steam, Feed and Service Water, Brine, Compressed Air, Natural, Coke Oven and Illuminating Gas.

BOILER METERS: Recording and Integrating Steam Flow, also Recording Air Flow, Flue Gas Temperature, Stoker Speed, Steam Temperature, etc., and Indicating Firebox Draft.

V-NOTCH WEIR METERS.

Also Recording Instruments.

All manufactured under the trade-name "Bailey."

Bailey Fluid Meters.

Bailey meters use a thin plate monel metal orifice placed between a pair of existing flanges in the pipe line and can be inserted the same as a gasket without any changes whatever in existing piping, except to drill and tap the pipe on each side of the flange for connections to the meter.

The Bailey orifice serves the same purpose as a Venturi tube, but can be installed much easier and is more accurate for measuring steam, water, air or gases. The pressure loss is too small to be noticed. The orifice does not change due to wear or scale.

A variable area bell sealed in mercury gives a high degree of accuracy at low rates of flow, and produces a record on a 12-in. uniformly graduated 24-hour chart reading directly in thousand pounds per hour, or other desired units. This bell also has ample power to accurately move an integrator without the use of any cams or other troublesome mechanism and gives totals directly in pounds, gallons, cubic feet, etc.

The capacity of the meter is readily changed by exchanging orifices. The meter can be used for portable work or permanently piped to two or more orifices in different steam or water lines and switched from one to another by merely changing valves.

Bailey Boiler Meter.

This meter records steam flow, air flow and flue gas temperature. It may also be supplemented with firebox draft indicator, wind box pressure recorder, steam flow integrator or other useful supplemental recorded or indicated results essential to the operation of the furnace or stoker.

The Bailey boiler meter not only checks the work of the fireman but helps him to know whether he is obtaining maximum efficiency and desired capacity at all times, and shows him what changes should be made to correct any faulty condition promptly.

STEAM FLOW—The same type of mechanism previously described is used to record the rate of steam output from the boiler. This usually reads in per cent of boiler rating, but may read in horsepower or thousand pounds of steam.

An integrator reading direct in thousand-pound units may be supplied and the actual evaporation of

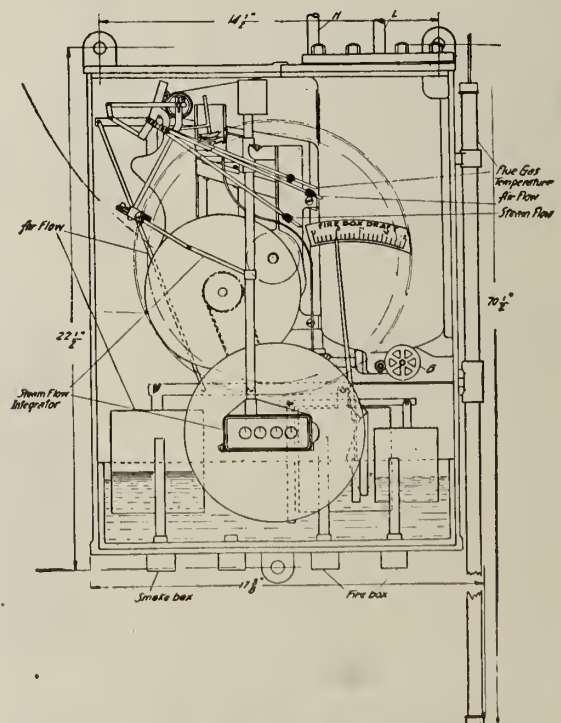
each boiler, or of each fireman obtained if accurate means for weighing coal are in use.

AIR FLOW—Air is a fuel just as much as coal and a certain evaporation per pound of air should be secured. The air flow part of this meter is adjusted, after practical tests, to read the same as the steam flow so long as the proper amount of air is being used for best efficiency. Too much air causes the air flow reading to exceed the steam flow. Deficiency of air, which also causes loss in efficiency, is shown by a lower reading than the steam flow.

When the steam flow and air flow read the same it indicates that the fuel bed is in perfect condition, and the flue gas analysis shows highest CO_2 desirable with minimum loss due to CO . When the fire is maintained in this condition any reasonable capacity may be obtained from the boiler by increasing or decreasing the rate of air supply.

FLUE GAS TEMPERATURE—Dirty tubes and poor baffles are often the cause of more loss of heat in the average power plant than is the improper supply of air. With the flue gas temperature recorded on the same chart with the rate of steam and air flow, the effect of the rate of steaming and the air excess can be eliminated and the heat absorbing efficiency of the boiler directly determined.

The Bailey flue gas temperature recorder is different in that it gives a true average temperature of all gases leaving the boiler, even where 24 ft. wide; it may be heated to 1200° Fahr. without damage and is free from sources of error common to most recorders.



BAILEY BOILER METER, TYPE D26, CLASS 56

Bailey Weir Meter.

Records flow of water or other liquids through V-notch or rectangular weirs on uniformly graduated chart without the use of cams or other complicated mechanism.

This meter is equipped with integrator reading directly in pounds and gallons. For feed water, hot well discharge, etc., at or near atmospheric pressure. It can be provided with temperature recorder.



BAILEY WEIR METER, TYPE F2

Some Types of Bailey Meters.

TYPE C2, CLASS 2 FLUID METER—Records rate of flow of steam, water, air or gas on the outer $2\frac{1}{4}$ -in. section of a 12-in. chart; integrates total flow; and records pressure on the inner 2-in. section of same chart.

TYPE C2, CLASS 24—Same as Type C2, Class 2, but includes temperature recorder in addition to rate of flow and pressure.

TYPE C6, CLASS 1 FLUID METER—Records rate of flow of steam, water, air or gas with $4\frac{1}{4}$ -in. pen motion on a 12-in. chart and integrates total flow.

TYPE C9, CLASS 1 FLUID METER—Records rate of flow of low pressure gas (by-product, coke oven, illuminating, etc.) or air with $4\frac{1}{4}$ -in. pen motion on a 12-in. chart.

TYPE C10, CLASS 3 FLUID METER—Records rate of flow of low pressure gas or air with $4\frac{1}{4}$ -in. pen motion



BAILEY FLUID METER, TYPE C2, CLASS 2



BAILEY FLUID METER, TYPE C10, CLASS 3

on a 12-in. chart and integrates total flow reading directly in cubic feet. It also records pressure on the same chart.

TYPE D21, CLASS 56 BOILER METER—Records steam flow and air flow on outer $2\frac{1}{4}$ -in. section of 12-in. chart; records flue gas temperature on inner 2-in. section of same chart and indicates firebox draft.

TYPE D22, CLASS 356—Same as D21, Class 56, except it has integrator giving total steam output in thousand pounds, and records wind box draft on inner section of chart.

TYPE D25, CLASS 36 BOILER METER—Records steam flow, air flow and wind box draft with $4\frac{1}{4}$ -in. pen motion on a 12-in. chart; also indicates firebox draft.

TYPE D26, CLASS 56 BOILER METER—Records steam flow, air flow and flue gas temperature all on 12-in. chart with $4\frac{1}{4}$ -in. pen motion; also integrates total steam flow in thousand pounds and indicates firebox draft. (Shown on preceding page.)

OTHER TYPES—Many other types of meters are made and several other classes (representing supplemental recorders or indicators) may be furnished.

Write for information.

A Few of the Many Users of Bailey Meters.

American Can Co., New York, N. Y.
 American Hard Rubber Co., Akron, Ohio
 American Sheet & Tin Plate Co., Pittsburgh, Pa.
 American Steel & Wire Co., Cleveland, Ohio
 American Sugar Refining Co., New York, N. Y.
 Anaconda Copper Mfg. Co., New York, N. Y.
 Atlantic Refining Co., Philadelphia, Pa.
 Berwind-White Coal Mining Company, Philadelphia, Pa.
 Bethlehem Steel Co., Bethlehem, Pa.
 Boston Woven Hose & Rubber Co., Boston, Mass.
 Cambria Steel Co., Johnstown, Pa.
 Central Illinois Light Company, Peoria, Ill.
 Columbus Railway, Power & Light Co., Columbus, Ohio
 Consolidated Gas, Electric Light & Power Co., Baltimore, Md.
 Crucible Steel Co. of America, Pittsburgh, Pa.
 Dayton Power & Light Co., Dayton, Ohio
 Denver Gas & Electric Co., Denver, Colo.
 Detroit Edison Co., Detroit, Mich.
 E. I. du Pont de Nemours & Co., Wilmington, Del.
 Duquesne Light Co., Pittsburgh, Pa.
 Eastman Kodak Company, Rochester, N. Y.
 Edison Electric Illuminating Co. of Boston, Boston, Mass.
 Firestone Tire & Rubber Co., Akron, Ohio
 Ford Motor Company, Detroit, Mich.
 B. F. Goodrich Co., Akron, Ohio
 Harvard University, Cambridge, Mass.
 Hyatt Roller Bearing Co., Newark, N. J.
 Interborough Rapid Transit Co., New York, N. Y.
 Jones & Laughlin Steel Co., Pittsburgh, Pa.
 Lackawanna Steel Company, Buffalo, N. Y.
 Narragansett Electric Lighting Co., Providence, R. I.
 National Aniline & Chemical Co., Buffalo, N. Y.
 National Tube Co., Pittsburgh, Pa.
 New Jersey Zinc Co., New York, N. Y.
 New York, New Haven & Hartford R. R. Co., New Haven, Conn.
 New York Central Railroad, New York, N. Y.
 New York Steam Co., New York, N. Y.
 Pacific Gas & Electric Co., San Francisco, Cal.
 Pennsylvania Rubber Co., Jeannette, Pa.
 Stone & Webster Corporation, Engineers, Boston, Mass.
 Toledo Railway & Light Co., Toledo, Ohio
 U. S. Metals Refining Co., Chrome, N. J.
 United Electric Light Co., Springfield, Mass.
 United Electric Light & Power Co., New York, N. Y.
 Westinghouse, Church, Kerr & Co., Engineers, New York, N. Y.
 Whitaker-Glessner Company, Portsmouth, Ohio
 Worcester Electric Light Company, Worcester, Mass.
 J. G. White Engineering Corporation, Engineers, New York, N. Y.
 Youngstown Sheet & Tube Co., Youngstown, Ohio

BUFFALO METER CO.

Manufacturers of Oil Meters, Water Meters and Water Meter Accessories

2915 Main Street
BUFFALO, N. Y.

Products.

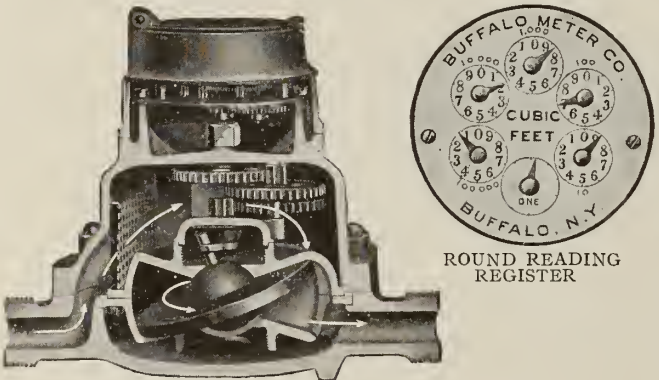
OIL METERS, WATER METERS, HOT WATER METERS.
Portable Testing Water Meters; Gasoline Meters;
Jet Meters for regulating flow to flush tanks; Curb
Boxes for extension dial meters; Lock Boxes for enclosing
5/8-in. meters; Sealable Upright Pipe Meter Connections,
Meter Reading Books, Office Meter Record Books.

Niagara and American Water Meters.

The American meter and the Niagara meter are of the disk type and differ only in their outer cases.

The Niagara meter has the outer casing made of a fine grade of cast iron, carefully galvanized. When a meter is frozen, one-half of the outer case usually breaks, thus relieving the inner and more expensive parts from injurious strain.

The American meter has the main outer casing made of bronze with either a galvanized iron base or



5/8-INCH WATER METER, SECTIONAL VIEW

ROUND READING REGISTER

a bronze base. The galvanized iron base reduces the cost of the meter and also increases its rigidity.

The works are carefully made on the interchangeable plan from bronze composition, hard brass, hard rubber, and nickel bronze; they are protected by an internal strainer. The measuring chamber is of large capacity, and is fitted with a strong reinforced hard rubber measuring disk. All submerged bearings are protected against sand and sediment.

The meters may have either round reading or straight reading registers indicating cubic feet, gallons or liters at buyer's option.

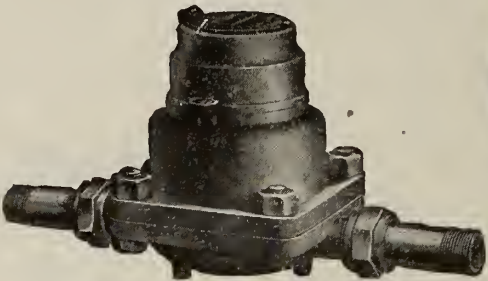
GROSS PRICE LIST NIAGARA AND AMERICAN WATER METERS

Size of meter, in.	Greatest proper cap., U. S. gals. per min.	Niagara Meter only with all-galv. iron outside case	American Meter only with bronze main case and galv. iron base	American Meter only with all-bronze outside case	Brass couplings per pair extra	Approx. Weight, meter and couplings boxed, lbs.
5/8 x 1/2	20	\$16.00	\$18.00	\$20.00	\$1.00†	14
5/8 x 3/4	20	16.00	18.00	20.00	1.50†	14
1	34	24.00	27.00	30.00	1.50†	20
1 1/2	53	35.20	39.60	44.00	2.20†	30
2	75	48.00	54.00	60.00	3.00	40
2 1/2	100	64.00	72.00	80.00*	4.00	60
3	160	96.00	108.00	120.00*	6.00	100
	240	140.00	157.50	175.00	8.75	150
	315	192.00	216.00	240.00	Flanges no charge.	200

† In these sizes, quarter bent couplings may be furnished at the following prices per pair: 1/2-in., \$1.50; 3/4-in., \$2.00; 1-in., \$3.00.
* 1 1/2-in. and 2-in. all-bronze case meters may be furnished with internal standard pipe threads when specially ordered.

Niagara Oil Meters.

Niagara oil meters are used to measure fuel oil, lubricating oil, gasoline and oils of all kinds. They will operate by pump or gravity pressure of 1 lb. or more per sq. in. and with oil of any temperature.



OIL AND HOT WATER METER



STRAIGHT READING REGISTER

The register is all-metal straight reading type indicating U. S. gallons, imperial gallons or liters. Each meter is tested and adjusted to measure within 1% of absolute accuracy at its rated capacity.

GROSS PRICE LIST NIAGARA OIL METERS

Size of meter	*Capacity for continuous rates of flow per hour, U. S. gals.	†Size and kind of pipe connections	List prices
A	6 to 300	1/2-in unions	\$20.00
B	10 to 500	1/2-or 3/4-in. unions	20.00
C	30 to 1000	3/4-or 1-in. unions	30.00
DV	60 to 2000	1- or 1 1/4-in. unions	44.00
EV	90 to 3000	1 1/4-or 1 1/2-in. unions	60.00
FV	120 to 4000	1 1/2-in unions	80.00
F	175 to 6000	1 1/2-or 2-in. unions	120.00
G	250 to 9000	2- or 2 1/2-in. unions	160.00
G	250 to 9000	3-in flanges	200.00

For all sizes of Niagara oil meters with large vertical dial add to these list prices \$20.00.

* These minimum quantities are the smallest rates of flow which the meters should be expected to measure accurately. The maximum quantities are the highest rates of flow for continuous operation without undue wear. Meters used only occasionally may be safely operated on flows twice the maximum quantities.

†The size of meter required is not determined by the size of pipe on which it is to be set, but by the flow to be measured. To facilitate setting on different sizes of pipes each meter may be furnished with either of the two sizes of openings and connections listed.

Niagara Hot Water Meters.

The Niagara hot water meter is similar in design to the Niagara oil meter, but has works of special construction to run in water of any temperature up to 250° Fahr.

GROSS PRICE LIST NIAGARA HOT WATER METERS

Size of meter	Capacity according to h.p. of boilers	†Size and kind of pipe connections	List prices
B	8 to 20 h.p.	1/2-or 3/4-in. unions	\$20.00
C	10 to 40 h.p.	3/4-or 1-in. unions	30.00
D	25 to 90 h.p.	1- or 1 1/4-in. unions	44.00
EV	40 to 150 h.p.	1 1/4-or 1 1/2-in. unions	60.00
E	50 to 200 h.p.	1 1/2-or 2-in. unions	80.00
F	80 to 325 h.p.	1 1/2-or 2 1/2-in. unions	120.00
G	150 to 600 h.p.	2- or 2 1/2-in. unions	160.00
G	150 to 600 h.p.	3-in. flanges	200.00
Battery 2-3 in.	300 to 1200 h.p.	4- or 6-in. internal threads	450.00

For all sizes of Niagara hot water meters with large vertical dial add to these list prices \$20.00.

†The size of meter required is not determined by the size of pipe on which it is to be set, but by the flow to be measured. To facilitate setting on different sizes of pipes each meter may be furnished with either of the two sizes of openings and connections listed.

BUILDERS IRON FOUNDRY

THE VENTURI DEPARTMENT

PROVIDENCE, R. I.

BRANCH OFFICES AND REPRESENTATIVES

NEW YORK, N. Y.

CHICAGO, ILL.

PITTSBURGH, PA.

ATLANTA, GA., E. A. SCOTT

SAN FRANCISCO, CAL., N. B. LIVERMORE & Co.

PORTLAND, ORE., NORTHWESTERN EQUIPMENT Co.

TORONTO, ONT., CAN., ALLEN GENERAL SUPPLIES, LTD.

OTTAWA, ONT., CAN., GENERAL SUPPLY Co.

Products.

Manufactured by the Venturi Department: VENTURI METERS for liquids, gases, steam, etc.; VENTURI RATE of FLOW CONTROLLERS.

Venturi Chemical Feed Regulators; Loss of Head Gauges; Water Level Recorders, etc.

Other Instruments: Barometric Type Mercury Manometer for testing work; Type Q S Register for air and gas; Effluent Controllers and Gauges for filtration plants, etc.

Venturi Meter Tube.

A Venturi Meter Tube is placed in a pipe line in the same manner as ordinary pipe. From the inlet to the throat the interior diameter gradually decreases and then gradually increases again to the full diameter at the outlet. The unrestricted passageway thus formed permits high differential pressure between inlet and throat with minimum friction loss. Annular pressure chambers are provided at inlet and throat. The throat is lined with bronze. Connection to the indicating, recording or registering instrument is simply made by two small pipes from the inlet and throat chambers.



VENTURI METER TUBE

STANDARD VENTURI METER TUBES AND CORRESPONDING MEASURING RANGES FOR WATER

Diameter of pipe, in.	Catalogue number	Length of meter tube, ft.	in.	Pounds per hour		Gals. per minute	
				Min.	Max.	Min.	Max.
2	25 $\frac{3}{4}$	1	11 $\frac{1}{4}$	1360	17600	3	35
	25 $\frac{1}{4}$	1	10 $\frac{1}{4}$	1960	25400	4	55
	21	1	7	3470	45100	7	90
3	31	2	11	3470	45100	7	90
	31 $\frac{1}{4}$	2	7 $\frac{3}{4}$	5420	70400	11	140
	31 $\frac{1}{2}$	2	4 $\frac{1}{2}$	7820	102000	16	205
4	41 $\frac{1}{4}$	4	3 $\frac{3}{4}$	5420	70400	11	140
	41 $\frac{5}{8}$	3	10 $\frac{7}{8}$	9170	119000	18	240
	42	3	6	13900	181000	28	360
5	51 $\frac{3}{8}$	5	1 $\frac{3}{8}$	9170	119000	18	240
	52	4	8 $\frac{1}{2}$	13900	181000	28	360
	52 $\frac{1}{2}$	4	2	21700	282000	44	565
6	62	5	11	13900	181000	28	360
	62 $\frac{1}{2}$	5	4 $\frac{1}{2}$	21700	282000	44	565
	63	4	10	31300	406000	63	810
12	124	11	0	55600	722000	110	1440
	125	9	11	86900	1129000	175	2260
	126	8	10	125000	1626000	250	3250
24	248	21	2			445	5780
	2410	19	0			695	9020
	2412	16	10			1000	13000
36	3612	31	4			1000	13000
	3615	28	1			1560	20300
	3618	24	10			2250	29300
48	4816	41	6			1780	23100
	4820	37	2			2780	36100
	4824	32	10			4000	52000

Type M Register-Indicator-Recorder.

This machine has the advantage of unusual ruggedness and extreme accuracy.

The Type M furnishes three distinct kinds of information: it indicates momentary rate of flow through the meter tube; permanently records this rate upon a large circular chart; gives the total quantity on a circular counter dial. Each register is graduated for the particular meter tube with which it is to be used.

For cold and hot water and other liquids, high pressure gases, steam, etc. Universally employed for main water supply lines, boiler feed, hot water heating systems, and many other important kinds of service.



TYPE M REGISTER-INDICATOR-RECORDER

Type M Indicator-Recorder.

The lower dial is 10 in. in diameter and indicates the rate of flow (pounds per hour, gallons per minute, etc.) through the Venturi Meter Tube. The upper dial records this rate continuously on a large circular chart. The interior mechanism is simply and positively actuated through large cast iron floats, resting on mercury columns, and rack and spur gearing.

The total quantity may be obtained by tracing the charts with a special planimeter manufactured by BUILDERS IRON FOUNDRY.

The Type M Indicator-Recorder may be used for the same kinds of service as the Type M Register and is also frequently employed for temporary installations at various points where it is desired to study the consumption or output through certain main pipe lines, or the efficiency of operation of important plant units.



TYPE M INDICATOR-RECORDER

Bulletins.

Bulletins describing the Venturi for hot and cold water, sewage, brine chemical solutions, oil, gas, air or steam sent on request.

SIMPLEX VALVE AND METER COMPANY

112 North Broad Street

PHILADELPHIA, PA.

Products.

SIMPLEX DEVICES for the Measurement and Control of Water, as follows:

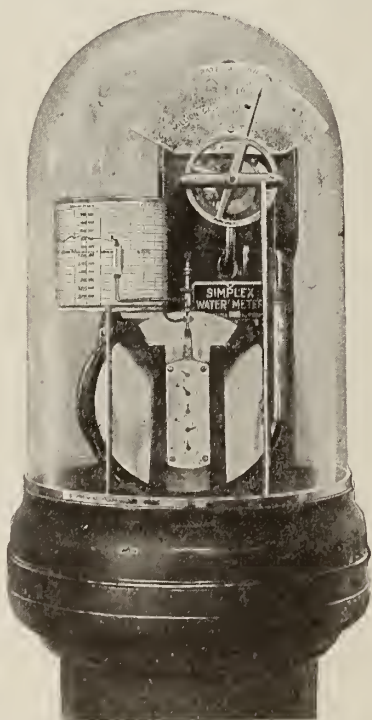
Meter Registers for use with Venturi Tubes, Pitot Tubes, and Orifices; Meters for Measurement of Boiler Feed Water; Rate of Flow Controllers, Direct Acting and Indirect Types, for Mechanical, Slow Sand and Pressure Filters; Loss of Head and Rate of Flow Gages, Indicating, Recording and Combined Types, which do not require copper floats and their float pipes.

Also, Elevation Gages, Indicating and Recording Types; "Head and Fall" or Water Level Recording Gages, for Water Wheel Plants; Portable Pitot Chart Recorders for Water Waste and Pump Slippage Determination; Manometers for use with Venturi and Pitot Tubes; Automatic Air Valves; Combined Air and Vacuum Poppet Valves for Large Mains; Mercury Altitude Regulating Attachment for Hydraulic Gate Valves; Altitude Valves, Mercury or Float Operated, which prevent waterhammer; Chemical Feeding Devices, for both Low Head and Pressure Service.

Simplex Meter Register.

DESCRIPTION—Simplex meters, actuated by Venturi and Pitot tubes are adapted to filter plants, water works, pumping stations, powerhouses, gravity mains, sewage disposal plants and industrial plants. They lend themselves to the measurement of flow through gravity mains, and may be located in gate houses, pits or chambers, requiring only the removal of the chart and winding of the clock once a week. They are ornamental in appearance, and are equally suitable for placing in a pumping station or powerhouse, where they may be required to measure the flow from usual types of reciprocating and centrifugal pumps. The same register may be used with any size Venturi tube, from a 1-in. boiler feed installation up to a steel or concrete conduit of large size.

In places where glass domes can not be used without too much danger of breakage metal covers are recommended. These are also applicable for replacing glass domes on the present meter registers.



SIMPLEX METER REGISTER,
UPPER PART

ters when required, and they are furnished at a small additional cost.

CONSTRUCTION AND OPERATION—The Simplex meter is the most logical answer to date to the problem of flow measurement. Its construction involves a minimum number of parts which are almost frictionless in operation.

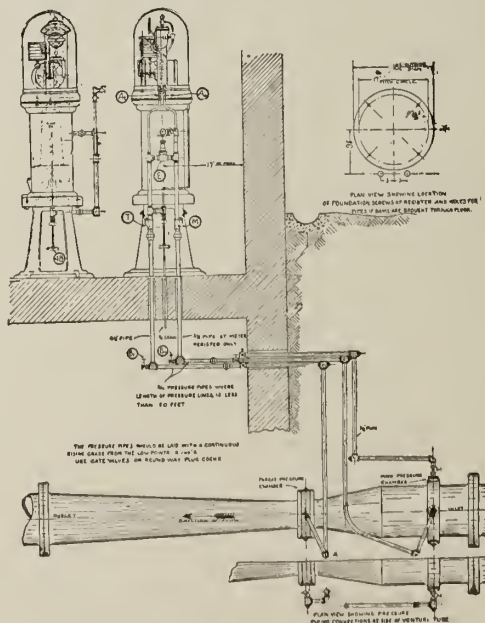
A bell shaped float rests in a cylinder containing mercury. A pipe connected with the full section of the Venturi tube transmits pressure to the cylinder and around and above the float. Pressure is carried from the throat to another pipe, located beneath the bell and thence through the mercury. The float rests on the mercury and its movement is guided by hard rubber bearings located on a guide rod in the axis of the float.

The interior of the float is accurately shaped to such a curve that its resultant total downward vertical movement (when subjected to the difference in pressure due to flow through Venturi tube) is always proportional to the quantity of fluid passing through the tube.

The travel of the float is also recorded without the necessity of cams, gears or other intricate devices.

The simplicity of this construction is such that the movement of the float is transmitted to the indicating, recording and registering mechanism with minimum friction loss. One dial indicates the rate of flow; another shows the total quantity discharged and a rectangular chart produces a permanent record of both rate and quantity.

The high degree of accuracy of Simplex meters at low velocities permits the use of Venturi tubes with large throats. This is of vital importance for many reasons, particularly as the loss of head due to friction through the Venturi tube varies directly as the fourth power of the diameter ratio.



CONNECTIONS BETWEEN VENTURI TUBE AND SIMPLEX METER

Simplex Portable Pitot Chart Recorder.

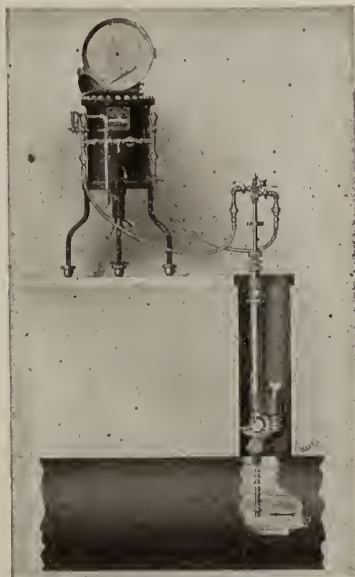
This company has a department which specializes in the investigation of flow in existing water mains and uses for its work the Simplex Pitot tube, Manometer and Portable Chart Recorder.

Investigation can be made of the flow into an entire city or in a small distribution system.

The Portable Recorder and Rod shown by the illustration is in use by a considerable number of water departments, water corporations and industrial plants, who use it as a *universal meter*. It requires only that a corporation cock tap be made in an existing main and the rod, the manometer and recorder moved to the site.

A traverse of the pipe is first made to determine the relation between the mean velocity through the main and at the center. With this data in hand the total flow is readily computed from the chart record taken from the recorder.

The construction of the device embodies the same float principle as is used in the Simplex meter and the apparatus is capable of measuring flows between $\frac{1}{2}$ ft. and 10 ft. per second.



SIMPLEX PORTABLE PITOT
CHART RECORDER

Universal Portable Meter.

The instrument described as Portable Pitot Chart Recorder is readily adapted to use with Venturi tubes that are in place in a feed line.

Because of the ability to use this device with Venturi tubes, orifices between flanges, or with a Pitot tube that may be inserted in a main when in service, it fills a need long felt.

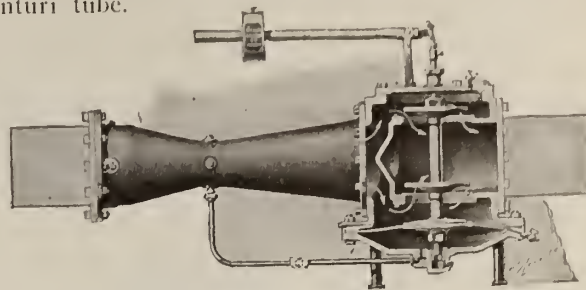
Simplex Rate Controller, Type "B."

The controller consists of a double disk balanced valve and a Venturi tube.

The water enters the Venturi tube and discharges into the valve body between the disks and their seat rings, and thence into the effluent main. The valve stem is carried upward through a stuffing box in the top cover and ends in a flexible connection attached to the short end of a lever mounted on knife edges. The long end of the lever supports an adjustable counterweight. The lower end of the valve stem is shouldered to receive supporting plates for a rubber diaphragm, and its bottom projection rides in a guide in the bottom cover.

By this construction the valve body has two compartments; that above the diaphragm through which the water flows in its way out under the valve disks, with comparatively low velocity, and the portion underneath

the diaphragm, through which no water flows, but which is joined by a pipe connection to the throat of the Venturi tube.



SIMPLEX RATE CONTROLLER

Showing method of operation of valves, diaphragm and counterweight

OPERATION—The upper and lower surfaces of the diaphragm receive water pressures of different values, the lower or Venturi tube throat pressure being delivered to the underside. This arrangement places a considerable load on the diaphragm, and thus tends to close or throttle the valve. In the operation of the controller, this closing tendency is resisted by the opposite pull on the valve stem, due to the counterweight on the long arm of the lever.

For a given rate of discharge through the throat of the Venturi tube and the body of the controller, there must be a certain difference in pressure on the two sides of diaphragm, and consequently a definite diaphragm load. As a result the valve will be self-throttled, until for any given position of the counterweight the pull on the valve stem due to it is exactly balanced by the differential pressure being delivered to the diaphragm.

Simplex Loss of Head and Rate of Flow Gage.

In the Simplex devices for indicating and recording loss of head in filters and the rate of flow through them, use is made of hollow inverted hard rubber floats resting in mercury.

Guide pintles which are fastened in the float lightly touch the hard rubber incased pressure pipe or a hard rubber liner in the cylinder. Raw water presses downward on the float and effluent water upward on the interior with the result that the float moves into the mercury in proportion to the loss of head. In the rate gage, use is made of the Venturi tube that is put on the Simplex rate controller and the pressure from the main section of the tube is transmitted to the outside of the float and from the throat to the interior of the float. This float is suitably shaped so that its movement is proportional to the flow.



SIMPLEX LOSS OF HEAD AND RATE
OF FLOW GAGE

UNION WATER METER COMPANY

Manufacturers of Water Meters and Specialties

WORCESTER, MASS.

Products.

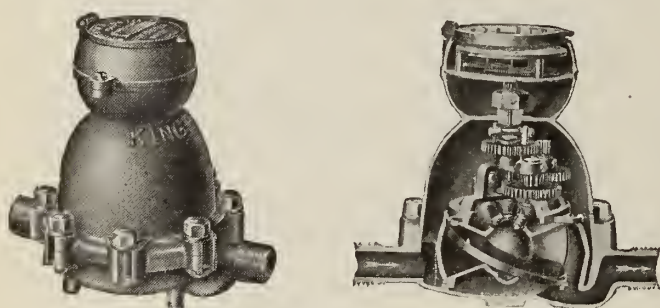
WATER METERS, COMPOUND PRESSURE VALVES, PRESSURE REGULATORS.

Experience.

For over 50 years the UNION WATER METER COMPANY has manufactured products of determined value, embodying sound, simple, sensible features with a superiority that the test of time has demonstrated. It is the constant endeavor of this company to maintain and increase the reputation that its goods have so long enjoyed.

King Disc Meters.

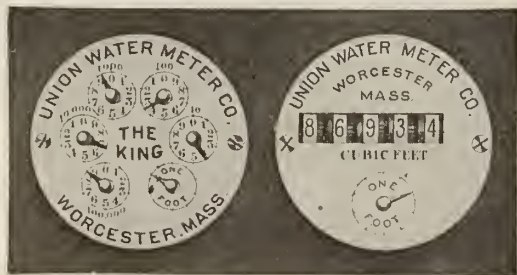
In designing the King disc meter of the positive measuring, self-draining type for house service, strength, simplicity, durability and accuracy under varying conditions, have been the aim. Conscientious attention has been paid to the details of correct proportioning, the convenient arrangement of parts and thoroughness of manufacture.



KING DISC METER, MODEL B

The best materials obtainable are used throughout. All internal moving parts are accessible for inspection without removing the meter from the service pipe.

The vertical meter is actuated by the same mechanical principles but provides for vertical connections.



DIAL READING REGISTER DIRECT READING REGISTER

Body—Bronze.

WORKING PARTS—Bronze, monel metal and hard rubber.

Disc—Hard rubber, three part type, reinforced by steel; rubber controller roll on disc spindle prevents

galvanic action and insures perfect contact with intermediate crank.

MEASURING CHAMBER—Hard bronze. Consists of three parts, ring, upper and lower heads, and has unusually large capacity, resulting in a low rate of piston travel and consequent reduction of wear, thereby increasing the life and sensitiveness of the meter.

INLET SCREEN—Directly covering inlet, of perforated copper, tinned, and is easily removable.

THE INTERMEDIATE—Has three hard rubber spur gears and cut monel metal pinions.

REGISTER—Circular or straight reading.

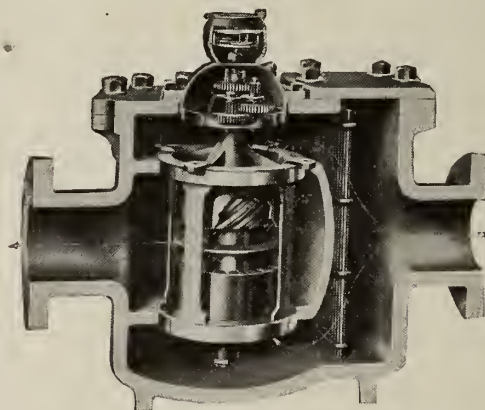
REGISTER CASE—Bronze. Glass is secured by brass ring.

DATA, MODEL B

Size, in.	Safe maximum delivery per min.		Dimensions			Net weight, lbs.
	Cu. ft.	U. S. gals.	Length, in.	Width, in.	Height, in.	
$\frac{5}{8}$	2 66	20	8	$5\frac{1}{2}$	$6\frac{3}{4}$	$7\frac{1}{2}$
$\frac{3}{4}$	4 66	35	9	$6\frac{1}{4}$	$7\frac{3}{4}$	$9\frac{3}{4}$
1	8	60	$10\frac{3}{4}$	7	$8\frac{3}{8}$	14

Nilo Velocity Meters.

Nilo velocity meters are built for severe service requiring large volumes of water, with minimum loss of head, such as railroad standpipes, elevators, and supply mains.



SECTIONAL VIEW OF NILO VELOCITY METER

Body—Iron.

WORKING PARTS—Bronze, monel metal and hard rubber.

PISTON—Hard rubber; has two sections united by a bronze shaft, the upper half having right-hand, the lower half left-hand helical vanes which are incased

DATA, NILO VELOCITY METERS

Size, in.	Safe maximum delivery per min.		Dimensions			Net weight, lbs.
	Cu. ft.	U. S. gals.	Length, in.	Width, in.	Height, in.	
2	33.4	250	$15\frac{1}{4}$	$9\frac{1}{2}$	$13\frac{3}{4}$	76
3	93	700	22	$14\frac{1}{2}$	9	265
4	133.5	1000	24	$14\frac{1}{2}$	$20\frac{1}{2}$	295
6	294	2200	26	17	$24\frac{3}{4}$	450
8	534	4000	33	$22\frac{1}{2}$	28	950

in an outer shell, removing all possibility of breakage of veins. The water enters the piston from above and below preventing thrust.

DEFLECTOR PLATE—Between the two sections of piston; insures discharge of equal volumes of water from upper and lower halves.

INTERMEDIATE GEARING—Three reinforced hard rubber spur gears.

BEARINGS—All bearings are of ample proportions and are bushed with hard rubber.

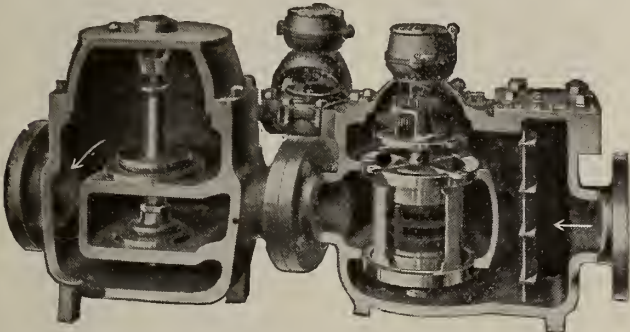
Nilo Compound Meters.

This device combines the efficiency and accuracy of the Nilo velocity meter for large volumes of water and of the King disc meter for small streams, by means of a double differential controlling or compounding valve of the vertical type.

The upper and lower valves of hard rubber, reinforced with bronze, are connected by a central vertical bronze shaft having guides bushed with hard rubber, and are ground at one time to a perfect bearing with hard bronze seats which insures ease of action, efficient control and accurate registration on all flows.

The proportion of the upper or larger valve is so finely adjusted to that of the lower valve that the necessity of additional weight and consequent wear is reduced to a minimum.

The combined area of the two valves is more than twice that of the pipe for which the meter is built.



SECTIONAL VIEW OF NILO COMPOUND METERS

The controlling or compounding valve is closed on small streams, all water passing through by-pass and King disc meter. When the volume increases to the range of accuracy of the Nilo meter the controlling valve opens and the water passes through both meters. The combined reading of the two meters is the total amount of water drawn. In no case is any water measured twice.

DATA, NILO COMPOUND METERS

Size, in.	Safe maximum delivery per min.		Dimensions			Net weight, lbs.
	Cu. ft.	U. S. gals.	Length, in.	Width, in.	Height, in.	
2 x 5/8	33	250	28 1/2	14 1/4	15 1/4	170
3 x 3/4	93	700	37 1/8	17 3/4	20 3/4	475
4 x 1	128	950	39 1/2	18	21	515
6 x 1 1/2	293	2200	48 3/4	26	27	980
8 x 2	525	3900	61 3/4	30	31 3/4	1730

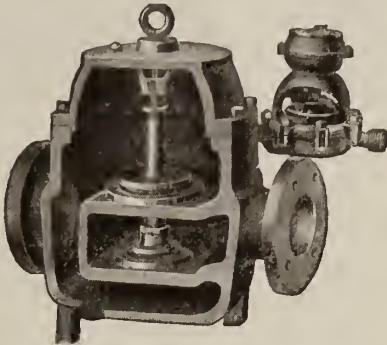
Union Compounding Valves.

Union compounding valves are identical with those used on Nilo compound meters and may be attached to any type meter 2 by 8 in. by tapping by-pass to King disc meter in the inlet of the large meter and the outlet of the valve. This insures accurate registration

on services where flow is at times lower than the range of accuracy of the large meter already in service.

Union compounding valves are furnished with flanges to any specifications necessitated by flanges of the meter in service.

Officials and engineers of some of the largest water works in the country have made exhaustive tests of these valves in actual service and have found an increase in



SECTIONAL VIEW OF UNION COMPOUNDING VALVE

revenue, quickly offsetting the installation costs, and removing the necessity of discarding serviceable meters perfectly satisfactory on larger flows.

BODY—Iron.
WORKING PARTS—Bronze and hard rubber.

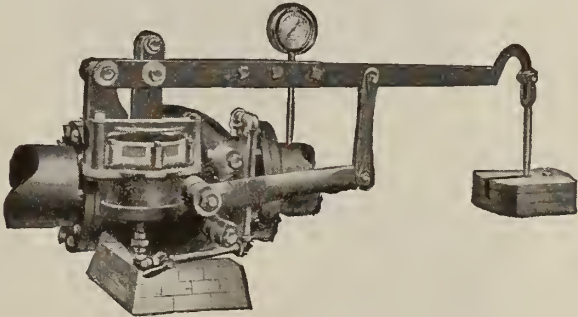
DATA, UNION COMPOUNDING VALVES

Size, in.	Safe maximum delivery per min. Cu. ft. | U. S. gals.	Dimensions			Net weight, lbs.
		Length, in.	Width, in.	Height, in.	
2 x 5/8	Capacity of compound valve will equal that of meter to which it is attached	13 3/8	9 7/8	13 3/4	81
3 x 3/4		15 1/8	11 1/4	19	184
4 x 1		15 3/8	11 1/4	19 1/4	192
6 x 1 1/2		22 3/4	15	25 1/4	475
8 x 2		28 3/4	19 3/4	29 3/4	700

Union Water Pressure Regulators.

The operating valve has iron body with bronze lining and bronze stem, giving all advantages of a bronze valve at a reduction of the cost.

The stem is carefully ground to a perfect bearing with bronze lining insuring extreme sensitiveness and long life.



UNION WATER PRESSURE REGULATOR

Union water pressure regulators are absolutely automatic in their action, depending in no way on springs which in time become crystallized and set.

The size of regulator to be used is determined by its proposed location, initial pressure, reduction desired and pressure to be maintained.

Sizes, 4, 6, 8, 10, 12 and 16 in.

YARNALL-WARING COMPANY

Manufacturers of Steam Specialties

7604 Queen Street
CHESTNUT HILL, PHILADELPHIA, PA.

BRANCH OFFICES AND REPRESENTATIVES

NEW YORK, N. Y.
CHICAGO, ILL.
PHILADELPHIA, PA.
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BOSTON, MASS.
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PORTLAND, ORE.

CLEVELAND, OHIO
HOUSTON, TEX.
SYRACUSE, N. Y.
EL PASO, TEX.

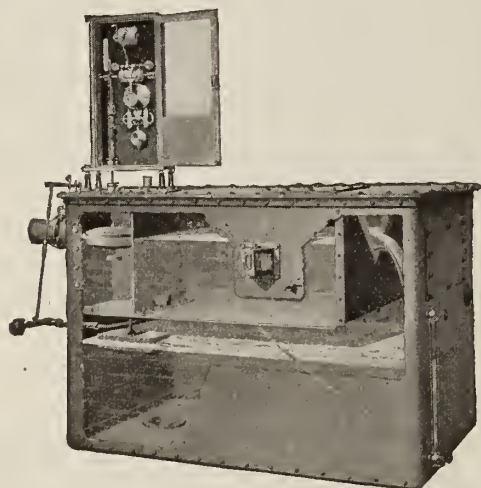
Products.

YARWAY-LEA V-NOTCH RECORDING LIQUID METER.
YARWAY SEATLESS BLOW-OFF VALVE.
YARWAY ADJUSTABLE SPRAY HEAD.
YARWAY BOILER SKIMMER.
YARWAY HYDRAULIC VALVE.
YARWAY PIPE JOINT CLAMP.
YARWAY AIR COMPRESSOR UNLOADERS.

Yarway-Lea V-Notch Meter.

Measures liquids accurately while they are flowing and records their volume or weight. 98½% accurate, even under wide fluctuations of temperature.

A Yarway meter keeps the plant in a state of continuous test. Faulty firing methods are shown up at



YARWAY-LEA V-NOTCH METER



WATER FLOWING THROUGH V-NOTCH

once. Serious trouble is forecasted so quickly that accidents may often be prevented and repairs made before a shutdown is necessary.

Measures continuously without interrupting or retarding any process.

More than 1500 Yarway-Lea meters in use in all parts of the world for measuring "water rate" in turbine plants, boiler feed water, make-up water, blow-down and heating system returns.

Hundreds of Yarway-Lea meters are being used in connection with feed water heaters.

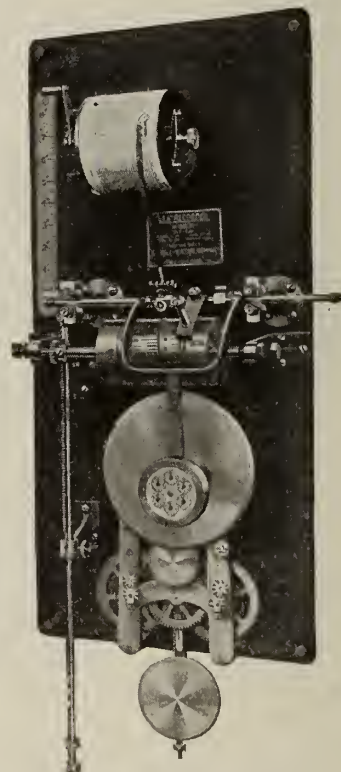
Meter and recorder may be set on a different level from the measuring tank, either a floor above or below or at another part of the same floor near a common instrument board.

Hundreds more Yarway-Lea meters are being used to record the flow of water for municipal and irrigation systems, and also to measure and record the flow of liquids in manufacturing processes where definite quantity of liquid has to be measured while it flows.

Measuring without interrupting or retarding the work not only increases production but lowers manufacturing costs.

Write for Bulletin L-40, which will describe advantages, mechanism parts, and tanks.

Different sizes of notches used to regulate flow through meter.



YARWAY-LEA RECORDER



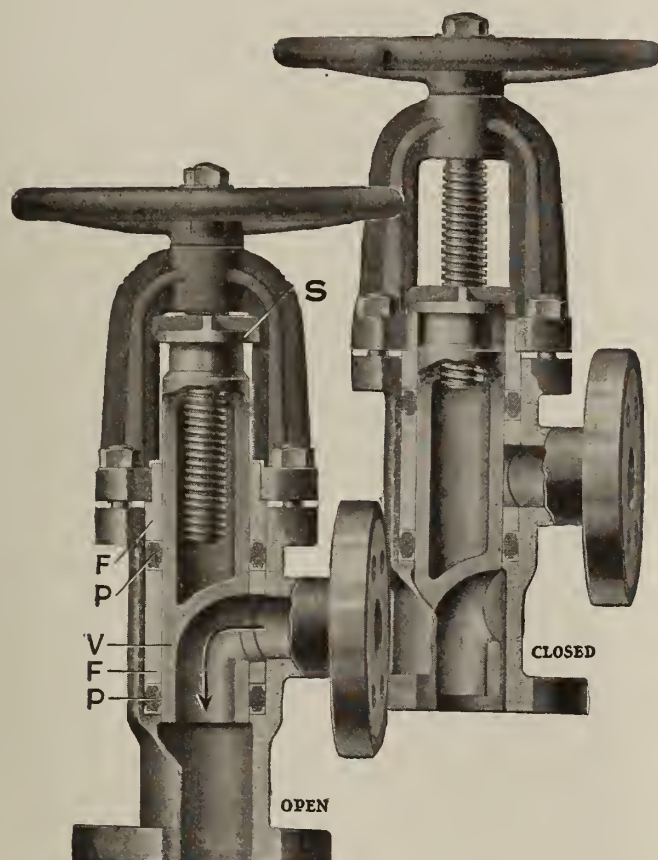
DIFFERENT SIZES OF NOTCHES USED TO REGULATE FLOW THROUGH METER

Yarway Seatless Blow-off Valve (formerly the Simplex).

Are leakless, because they are seatless. Nothing to cut or clog. Full, free opening through the valve. Note position of plunger when port is open and closed.

Packing is protected from action of the blow-off and is automatically compressed when the valve is closed. Many Yarway seatless blow-off valves have been in constant service 7 and 8 years without being repacked. Gradual opening—no danger of waterhammer.

Yarway seatless blow-off valves are made both angle and straightway, screw or flange, extra heavy throughout and are finished with all-iron, bronze mounted, or all-bronze body—for land or marine service. The standard blow-off valve in thousands of large plants in the United States and Canada.



YARWAY SEATLESS BLOW-OFF VALVES

In closing valve, shoulder "S" on plunger "V" engages loose follower gland "F," compressing packing "P" above and below the port, making an absolutely tight valve.



STRAIGHTWAY TYPE YARWAY SEATLESS BLOW-OFF VALVE

Yarway Adjustable Spray Head (C. C. Thomas Patents).

A simple, unique, efficient spray head for use on cooling ponds, or wherever a liquid needs to be cooled rapidly.

Adjustable to any rate of flow or pressure, to varying atmospheric and temperature conditions.

Can be flushed out by operating levers from shore.

Many ponds have been equipped with Yarway spray heads in the United States and other countries.



YARWAY ADJUSTABLE SPRAY HEAD

Yarway Boiler Skimmer.

A successful device for the removal of scale-forming matter from the water in the boilers.

It is based on the thermal principle of circulation in heated water.

Leading plants are securing greatly increased steaming power from boilers equipped with the Yarway automatic skimmer.

Fifteen tons of solid matter removed from 7 boilers in one large plant in one year.

Bulletin S-1201A gives full information and may be had for the asking.



YARWAY BOILER SKIMMER

Yarway Hydraulic Valve (Caskey Patents).

A short lever, quick acting, easily operated valve, designed for high pressure work from 500 to 5000 lbs. per sq. in. The greater the pressure the tighter the valve. Can be repacked. Thousands in use in many industries.

Yarway Pipe Joint Clamp (formerly the Simplex).

For permanently stopping leaks in pipe lines. Quickly and easily attached, even in out of the way places. A power, coal and money saver. The standard in thousands of plants.

Yarway Air Compressor Unloader (Richards Patents).

A power saver for the motor driven air compressor. Simple, automatic, cool running and long wearing. Hundreds in successful service for years.

Bulletins and Information.

All Yarway specialties are described at length in different folders and bulletins which will be sent for the asking.

PNEUMERCATOR COMPANY, INC.

15 Park Row
NEW YORK, N. Y.

REPRESENTATIVES

PHILADELPHIA, PA., HARRY S. PARKS, 450 N. 10th Street
CLEVELAND, OHIO, THE HUGHES-LIMBACK CO., 512 Hippodrome Building
CHICAGO, ILL., BREWER & ANDERSON, INC., 333 South Dearborn Street

SEATTLE, WASH., W. S. DE PIERRIS Co., Hoge Building
SAN FRANCISCO, CAL., J. C. FERGUSON, Monadnock Building
VANCOUVER, B. C., BROWN, FRASER & Co., LTD., 1150 Homer Street

EUROPE: KELVIN, BOTTOMLEY & BAIRD, GLASGOW SCOTLAND

Product.

PNEUMERCATOR GAUGES for indicating the depth, weight, volume or specific gravity of any liquid or semi-liquid, fluid enough to seek its own level.

Principle of Operation.

The operation of all models of Pneumercator gauges is based on the maintenance of a true hydrostatic balance between the head of liquid to be measured and a column of mercury or other indicating medium, the pressure being transmitted by air confined in a small connecting tube between the liquid and the gauge.

Construction.

(1) A balance chamber located in the liquid to be measured. (2) A mercury or other gauge or gauges, located wherever readings may most conveniently be taken. (3) A hand pump or other source of compressed air. (4) A control valve attached to the gauge, and connected by small piping to the balance chamber and to the source of compressed air.

Advantages.

A Pneumercator gauge installed in any tank will provide a perpetual inventory of the liquid stored in the tank—an accurate check on liquid put in or withdrawn from the tank. The gauge will operate with equal accuracy on tanks open to the atmosphere or under pressure or vacuum. The accuracy is not affected by changes in temperature of the liquid in the tank, or the temperature

through the pipe line connecting the tank to the indicating portion of the apparatus.

There are no floats, diaphragms or delicate mechanism of any kind to stick or get out of order.

Applications.

Can be applied on fuel oil tanks, acid tanks, molasses tanks, gasoline tanks, chemical storage tanks, stills, evaporators, automatic sprinkler tanks, automobile tank trucks, reservoirs, standpipes, flumes, tail races, dams, water works, tide fluctuations, etc.

Trade-mark.

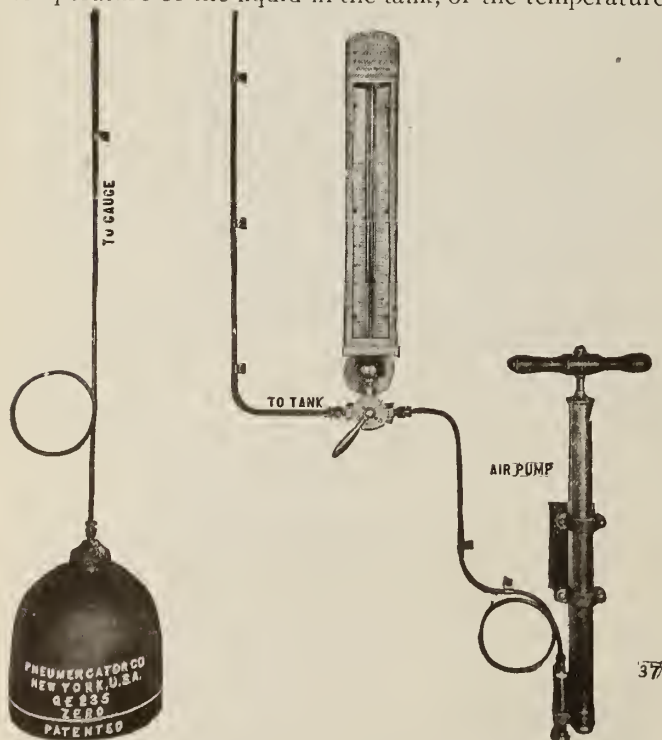
The coined word, "Pneumercator" is our registered trade-mark and is attached to all instruments sold by us, our representatives, or licensees under our patents throughout the world.

Information and Prices.

As each Pneumercator gauge has to be made up for the specific purpose for which it is to be used, in order to advise and quote intelligently, it is necessary to have the following information:

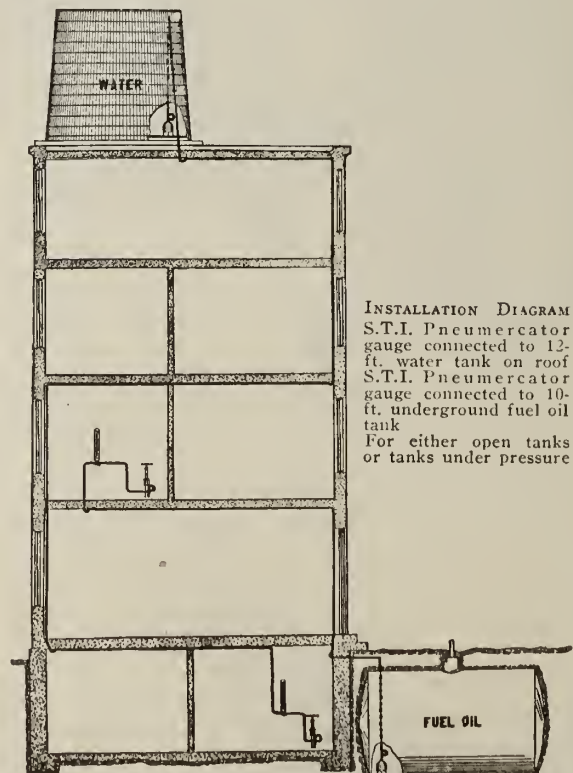
Dimensions of tank (or tanks). Distance from tank to indicating portion of the instrument. Nature and specific gravity of the liquid to be measured.

Prices and full information will be promptly furnished on request.



COMPONENT PARTS OF MODEL S.T.I. PNEUMERCATOR GAUGE, SHOWING BALANCE CHAMBER, AIR PUMP, ETC.

For sprinkler service, ballast and feed water tanks, reservoirs, standpipes, open or pressure tanks, etc.



INSTALLATION DIAGRAM
S.T.I. Pneumercator gauge connected to 12-ft. water tank on roof
S.T.I. Pneumercator gauge connected to 10-ft. underground fuel oil tank
For either open tanks or tanks under pressure

INSTALLATION OF MODEL S.T.I. PNEUMERCATOR GAUGE FOR WATER TANK ON ROOF AND FOR FUEL OIL TANK UNDERGROUND

Estimates and prices on application

CRANE PACKING COMPANY

Manufacturers of "John Crane" Flexible Metallic Packings

MAIN OFFICE AND WORKS

1813 Cuyler Avenue
CHICAGO, ILL.

BRANCHES

NEW YORK, N. Y., 1547 Park Row Building

HOUSTON, TEX., 416 Scanlan Building

CANADIAN OFFICE AND FACTORY: WINDSOR, CAN., FLEXIBLE METALLIC PACKING CO., LTD.

DISTRIBUTERS IN ALL THE PRINCIPAL CITIES

Products.

"JOHN CRANE" FLEXIBLE METALLIC PACKING for Steam Engines, Steam Pumps, Turbines, Valves, Expansion Joints and Traps; a Flexible Metallic Packing for Steam, Air, Ammonia, Water, Oils and Acids; SPECIAL PACKINGS for Superheated Steam and Hot Oil, suitable for high temperatures and heavy pressures.

FLEXIBLE METALLIC GASKETS, Lead and Copper, Plain or Corrugated, for use on Pipe Lines, Manholes, Handholes, Flange Fittings, Flange Unions, Ice Machines, Pumps, Filters, Steam Traps, Tanks, Lamps, Autoclaves and Extractors.

CONDENSER TUBE PACKINGS, All-metallic, for packing Surface Condensers, Heaters and Evaporators.

"John Crane" Flexible Metallic Packing.

Made of thin sheets of the smoothest babbitt foil, wound spirally, thoroughly impregnated with nature's pure graphite and oil. Made in sizes from $\frac{1}{16}$ in. up to $1\frac{1}{2}$ in. in coils 10 ft. long, coiled into a handy spiral. It is flexible, compressible and, by view of these babbitt sheets wrapped spirally, impervious to any pressure. It will not disintegrate or deteriorate, being entirely of metal construction.

USES—Composed of all metal materials, it easily withstands the highest temperatures and the heaviest pressures and, as babbitt in an engine journal, friction is reduced to the very minimum when applied to the stuffing boxes, whether service is steam, air, ammonia, water, oil, acid or any other vapor or liquid.

Engineers are using it very extensively on hand valves, header valves, expansion joints, traps, Corliss valve stems and piston rods. Manufacturers of engines, pumps, air compressors and motors are standardizing because of its long life and permanency and its tendency to polish the rods and shafts, rather than score them.

SPECIAL PACKING—The Engineering Department of the CRANE PACKING COMPANY has been very successful in developing special packings for high temper-



TRADE-MARK

atures and heavy pressures and special liquors. They will be glad to co-operate with any manufacturer or user of packing on any special packing problem.

"John Crane" Flexible Metallic Gaskets.

These asbestos copper-jacketed gaskets, as well as the lead and copper, corrugated and plain, are being used in power plants for industrial and manufacturing purposes. Standard gaskets of all kinds in stock.

Condenser Tube Packing.

Condenser tubes packed with "John Crane" flexible metallic rings are absolutely tight and remain tight many years. Electrolytic action ceases when "John Crane" metal bonds the tube to the tube sheet. They are easier to install than any fiber or candle wicking. The metal never hardens or dries up and a perfect vacuum is always maintained.



"JOHN CRANE" RING FORM

How to Order "John Crane."

Furnished in coils 10 ft. in length, in all sizes from $\frac{1}{16}$ in. to $1\frac{1}{2}$ in. Illustration shows "John Crane" in this form. In ordering coils, state number and size.

In ordering "John Crane" in ring form or sets, give diameter of rod, diameter of box and depth; also give temperature and pressure.

In ordering gaskets, send sample or templet and describe service to which gaskets will be exposed.



"JOHN CRANE" SPIRAL COIL

DURABLA MANUFACTURING COMPANY

Compressed Asbestos Sheet, Gaskets, Rod Packing and Gauge Glass

114 Liberty Street
NEW YORK, N. Y.

BRANCH OFFICES

CHICAGO, ILL., 337 West Madison Street
PHILADELPHIA, PA., 1428 Callowhill Street

PITTSBURGH, PA., 108 Smithfield Street
DALLAS, TEX., 416 Commerce Street

Products.

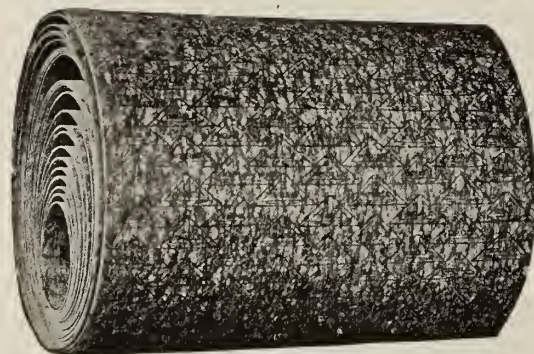
DURABLA COMPRESSED ASBESTOS SHEET; DURABLA GASKETS; DURABLA U. S. A. HIGH PRESSURE GAUGE GLASSES; DURABLA SEMIMETALLIC ROD PACKING; DURABLA VALVE DISCS.

Durabla Compressed Asbestos Sheet.

Durabla compressed asbestos sheet is a guaranteed product, a *standard for all gasket work*.

Durabla gaskets make tight joints on steam, water, air, oil, ammonia and acids at all temperatures and pressures. Joints packed with Durabla can be broken without injury to gaskets.

Durabla gives uninterrupted service. It eliminates



DURABLA ASBESTOS SHEET
Registered trade-mark all over the sheet

the necessity of carrying in stock various packings for different purposes.

Vibration or condensation does not affect Durabla. It will not burn out, blow out or pulp at the joints, and requires no following up.

Durabla sheets can be rolled and unrolled; never dries out or opens up. It does not deteriorate.

Durabla is manufactured in standard thicknesses of $\frac{1}{64}$, $\frac{1}{32}$, $\frac{1}{16}$, $\frac{3}{32}$ and $\frac{1}{8}$ in. and in sheet sizes of 36 by 144 in. and 48 by 144 in.

Durabla Rod Packing.

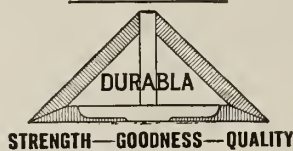
Durabla rod packing is a semimetallic packing, one of the patented features of which is the metal wearing surface which comes in contact with the rod. This feature prevents damage to the rod or to the packing when excessive pressure is caused by the gland being "pulled up" too tight.



DURABLA SEMIMETALLIC ROD PACKING

Durabla rod packing is made in 12-ft. lengths in sizes of $\frac{1}{16}$ in. from $\frac{3}{8}$ in. upwards and in spiral form only.

Durabla rod packing is flexible, which permits cutting rings of any size.



Excellent service is being given by Durabla rod packing on steam hammers, hot and cold distillates, chemicals, oil and water.

Durabla U. S. A. High Pressure Gauge Glasses.

Durabla U. S. A. high pressure glass tests as follows:

TEMPERATURE—Not affected after 18 two-minute submersions in oil at 380° Fahr., then in water at 40° Fahr.

EROSION—No trace of erosion, and perfectly clear after live steam at 100 lbs. pressure had passed through the glass for 96 hours.

TENSILE STRENGTH—Remained unbroken under hydraulic pressure of over 2000 lbs. per sq. in. for 2 minutes.

SERVICE—Under continuous operating conditions with pressure of 225 lbs., performance equaled in every respect the best service ever obtained by any foreign glass.



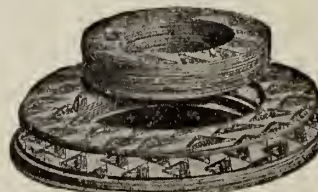
DURABLA U.S.A. METALLIC GAUGE GLASS
Durabla U.S.A. is etched on every glass

All sizes have fused ends.

Standard lengths always in stock. Any length furnished.

Durabla Gaskets.

Durabla standard and extra heavy gaskets $\frac{1}{16}$ in. thick are carried in stock in all sizes.



DURABLA GASKETS
Look for trade-mark on every gasket

Orders for gaskets in all shapes and thicknesses promptly filled.

Durabla Valve Discs.

Durabla discs are made for high pressures and superheated steam.



DURABLA VALVE DISC
Durabla stamped on every disc

Durabla discs will not chip or crack. They are not affected by any fluid, and have the strength and durability required by modern conditions.

GOETZE GASKET & PACKING CO.

10 Allen Avenue
NEW BRUNSWICK, N. J.

Products.

Manufacturers of "GOETZE" No. 2 ELASTIC and "GOETZE" No. 1 PLAIN CORRUGATED GASKETS; "GOETZE" VALVE DISCS, "GOETZERIT" SHEET PACKING and GASKETS.

"Goetze" Triumph Single and Double Jacket Gaskets, "Goetze" Devo Gaskets, "Goetze" Metallic Packing and Special Gaskets for Every Purpose.

"Goetze" No. 2 (Elastic).

Made from heavy copper, steel, monel and various other metals with closely twisted asbestos cord held in the corrugations as shown in illustration. It forms a cushion which takes care of contraction and expansion in pipe lines. The "comeback" in this gasket is so great that even where the piping is out of alignment and the flanges not equidistant the gasket will hold the joint firmly tight and give excellent service when used again.



"GOETZE" NO. 2 ELASTIC GASKET

"Goetze" No. 1.

A corrugated metal gasket without asbestos inlay and is recommended for flanges with smooth surfaces. Made of various metals to meet the particular conditions, and, as they are not of the flimsy type, the corrugations are deep giving elasticity to the gasket.



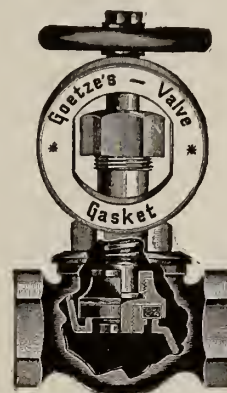
"GOETZE" NO. 1 GASKET

"Goetze" Valve Gaskets or Discs.

For valves of Jenkins, Crane and similar type and are made of copper or other metal and asbestos. They

furnish a cushion for the valve seats which will yield just enough to make a tight joint, but will not crumble or deteriorate or injure the valve seats in the slightest degree.

Their increasing use is proof enough of their excellence, for engineers who find their valve troubles eliminated by "Goetze" discs naturally praise them.



"GOETZE" VALVE GASKET

"Goetzerit" Sheets and Gaskets.

"Goetzerit" is a red asbestos sheet packing for flanged joints—for engineers who prefer to cut their own gaskets from the sheet rather than to use a metallic gasket or metal-asbestos combination. "Goetzerit" is easily the best sheet packing for such use, because it is made from pure prime asbestos fiber, compressed under an exceedingly high pressure and impregnated with a substance which makes it proof against the action of superheated or saturated steam. It does not squeeze out into the pipe openings. It does not blow out, even at the highest pressures now used. Specify "Goetzerit" for steam, air, ammonia, acids, oil, petroleum, etc.



TRADE-MARK

Sizes and Uses.

"Goetze" gaskets are made in any size desired from $\frac{1}{4}$ in. up to 15 ft. in diameter and larger, of various metals and combinations, for high and low pressures, superheated or saturated steam, gas and chemical lines.

For use on the following:

Acid lines	Locomotives
Aeroplane motors	Manholes
Air and ammonia compressors	Oil engines
Benzol and toluol stills	Pumps
Boiler domes	Steam chests
Boilers, stationary	Steam hammers
Boilers, marine	Steam shovels
Chemical lines	Steam traps
Coke oven by-product plants	Steam and gas engines
Condensed water lines	Stills and tanks
Cylinder heads	Submarines
Diesel engines	Superheaters
Distilleries	Tractors
Economizers	Unions
Flanged joints	Valve bonnets
Handholes	Water tube boilers
Heaters	

DETROIT LUBRICATOR COMPANY

DETROIT, MICH.

Products.

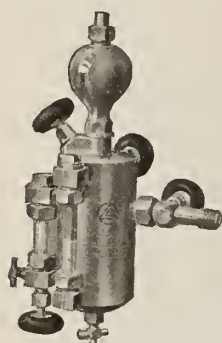
SIGHT FEED LUBRICATORS; FORCE FEED OILERS;
OIL and GREASE CUPS.

Oil Gages; Air and Priming Cups; Water Gages;
Fusible Plugs; Radiator Valves.

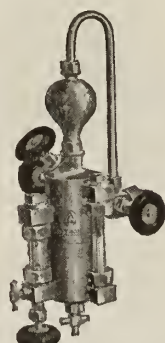
Sight Feed Lubricators.

Detroit lubricators are made in a sufficient variety of styles to properly lubricate the valves and cylinders of all types of steam engines, steam pumps, air compressors, etc. Scientifically designed, each for its purpose; afford efficient and constant lubrication; all parts made of proper metal and replaceable at a small cost.

Cored heating passage filled with steam at all times lubricator is in operation, maintaining oil at even temperature, keeping it in a thoroughly liquid condition and permitting no fluctuation in rate of feed. Lubricator is well fitted for feeding heavy oils.



DOUBLE CON-
NECTION SIGHT FEED
LUBRICATOR



SINGLE CONNEC-
TION SIGHT
FEED LUBRI-
CATOR



SIGHT FEED AIR
COMPRESSOR
LUBRICATOR

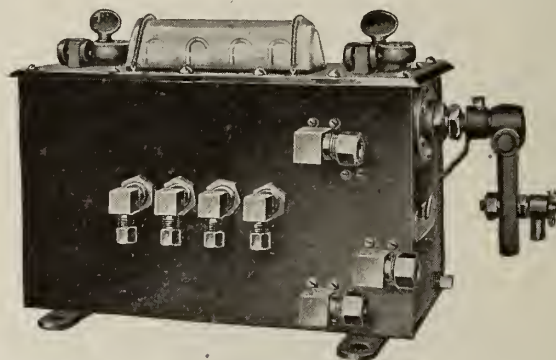
Force Feed Oilers.

For mechanical lubrication of gas, oil, gasoline, and steam engines, air compressors, machine tools, etc. Composed of one or more pumping units, one unit to each feed. Entire mechanism is contained in tank or reservoir and easily accessible for cleaning or inspection. Oiler driven by some moving part of the engine or machine which also automatically controls the speed at which it is driven. Made in large variety of ways and with different drives, etc., for different service requirements.

In addition to one or two lubricating compartments Detroit oilers can be made with a separate compartment



FOUR-FEED MODEL "J" DETROIT FORCE FEED OILER
Showing filler opening and screen

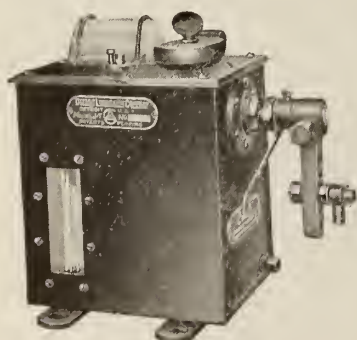


FOUR-FEED MODEL "JT" FORCE FEED OILER WITH GRAVITY
DISCHARGE FUEL PUMP
Rear view showing lubricating feeds, fuel feeds and overflow

for handling fuel—pumping it from an underground storage tank or other safe place into the fuel compartment from which point it is either forced or flows by gravity to the engine cylinder.

Glass Body Oil Cups.

For use on machinery and bearings of all kinds. Made in both cast and pressed brass, in all sizes with sight feed; sight and set feed; sight feed, set feed and stop feed features, as specified. Particularly adaptable to service where use of mechanical oilers is unnecessary. Construction insures oilers standing up under heavy service at all times. A very desirable feature is a patented slide fitted over oil filler opening which automatically closes when released, preventing dirt or other foreign substances from getting into oil.



ONE-FEED MODEL "JT" DETROIT
FORCE FEED OILER FOR
STEAM ENGINES



TWO-FEED MODEL "J" DETROIT
FORCE FEED OILER



DETROIT
PRESSED
BRASS GLASS
BODY OILER
WITH WICK
FEED



DETROIT
PRESSED BRASS
GLASS BODY
OILER WITH SET
FEED, SIGHT
FEED, AND STOP
FEED FEATURES

ESTABLISHED 1863

GREENE, TWEED & CO.

Manufacturers of Automatic Force Feed Lubricators

109 Duane Street
NEW YORK, N. Y.

TELEPHONE CONNECTION

Products.

ROCHESTER AUTOMATIC LUBRICATORS.

Application.

For the lubrication of the cylinders of all types of steam engines and pumps as well as air and ammonia compressors.

Construction.

Working parts are made of steel, and all bearings case hardened.

The mechanism of the Rochester automatic lubricator is compactly centered in a steel pump block, the principal working parts being enclosed and protected from dirt, grit, etc.

This block with all the mechanism can be almost instantly detached and removed, giving easy access to all the working parts for cleaning, repairing, etc., without disturbing the bowl or reservoir attached to the engine.

Driving Mechanism.

The clutch drive, while positively noiseless, is absolutely positive.

Notwithstanding the fact that the drive is a clutch drive, there is a regulating device whereby can be induced more or less lost motion of the actuating arm.

The clutch drive Rochester is especially adapted for use on high speed engines, having been used with great success on an engine running at 800 r.p.m.

Ratchet drive lubricators can be furnished if desired, the list prices being the same as for the clutch drive model.

Regulation.

Each feed regulated independently. Not affected by temperature, pressure or vacuum.

Improved Vacuum and Check Valves.

One of these check valves is furnished with each feed of every Rochester lubricator.

Special steel check valves and nipples, for use on ammonia cylinders, will be substituted if so specified on the order.



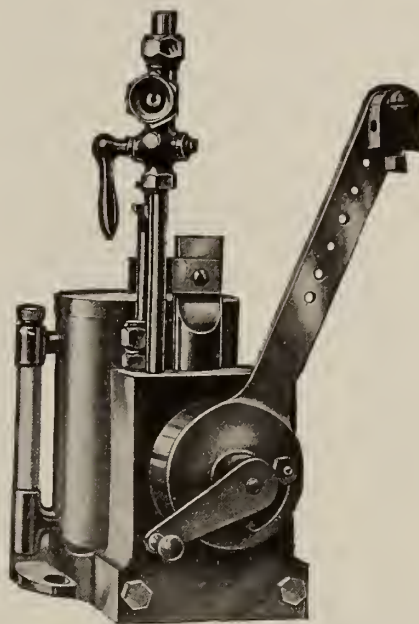
IMPROVED VACUUM AND CHECK VALVE

Sizes.

Made in all sizes from 1/2 pt. to 2 gals., and with any number of feeds from 1 to 8.

All sizes fully nickelplated.

Also made with 2 compartments, for use where different kinds of oil are used in the different cylinders of the same machine, as in the case of air compressors, ice machines, etc.



ROCHESTER AUTOMATIC LUBRICATOR
2-pint, single feed

FOR STATIONARY AND MARINE ENGINES AND PUMPS

1/2-pint single feed.....	\$20.00
1-pint single feed.....	25.00
2-pint single feed.....	30.00
3-pint single feed.....	35.00
1/2-gallon single feed.....	40.00
1-gallon single feed.....	45.00
2-pint double feed.....	45.00
3-pint double feed.....	50.00
1/2-gallon double feed.....	55.00
1-gallon double feed.....	60.00
2-gallon double feed.....	75.00
1/2-gallon triple feed.....	70.00
1-gallon triple feed.....	80.00
2-gallon triple feed.....	90.00
1/2-gallon quadruple feed.....	90.00
1-gallon quadruple feed.....	100.00
2-gallon quadruple feed.....	105.00
2-gallon quintuple feed.....	120.00
2-gallon sextuple feed.....	130.00
2-gallon septuple feed.....	140.00
2-gallon octuple feed.....	150.00

FOR AIR COMPRESSORS AND ICE MACHINES

3-pint double feed, 2-compartment.....	55.00
1-gallon double feed, 2-compartment.....	65.00
1-gallon triple feed, 2-compartment.....	85.00
1-gallon quadruple feed, 2-compartment.....	105.00

Prices include a multiplus sight feed, a vacuum and check valve and a steam nipple with each feed of every lubricator, also a connecting rod and connection, and an arm or bracket for connecting the lubricator to the engine, pump or compressor.

Some Prominent Users:

American Steel & Wire Co.
Atlas Portland Cement Co.
Carnegie Steel Co.
E. I. du Pont de Nemours & Co.
International Silver Co.
National Cash Register Co.
National Tube Co.
Pennsylvania R. R. Co.
Proctor & Gamble Co.
John A. Roebling's Sons Co.
Tennessee Coal, Iron & R. R. Co.
Tiffany & Co.

McCORD MANUFACTURING COMPANY, INC.

Force Feed Lubricators and Gaskets

DETROIT, MICH.

BRANCH OFFICES

NEW YORK, N. Y.

WASHINGTON, D. C.

CHICAGO, ILL.

Products.

FORCE FEED LUBRICATORS and "McKIM" COPPER-ASBESTOS GASKETS.

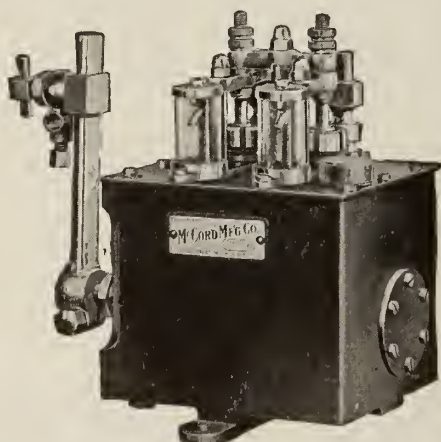
McCord Force Feed Lubricators.

The McCord force feed lubricator is made in from 1 to 14 feeds, and has a separate pump for each feed. Each pump has individual adjustment. It has constant sight feeds, which show exactly how much oil is being pumped to each bearing, and the flow can be adjusted from one drop to a full stream per stroke.

It is positive and automatic in action and operates in perfect synchronism with the engine or pump it is lubricating. It is not affected by viscosity of oil, variations in steam pressure or length of feed line.

ADVANTAGES—In addition to its standard features, such as positive sight feeds without pressure, separate pumps capable of individual adjustment for each feed, forced delivery of oil against pressure up to 1,000 lbs., etc., it has special advantages not found in any other device, as follows:

Internal mechanism—all working parts immersed in oil; auxiliary hand crank for accelerating feed; drop forged operating lever; reversible end bearing, so that lubricator can be driven from right or left hand end; heating chamber; plug for draining reservoir. (See catalogue for details.)



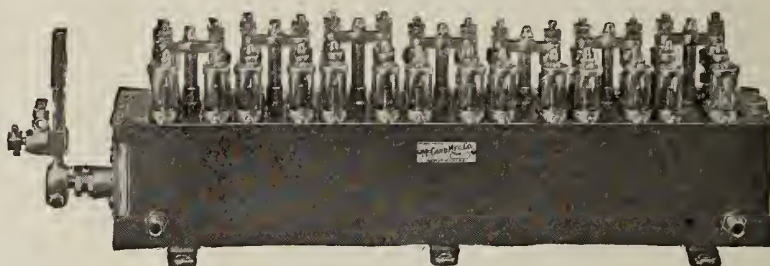
McCORD FORCE FEED LUBRICATOR
Class B, 2 feeds

CAPACITIES AND PRICES

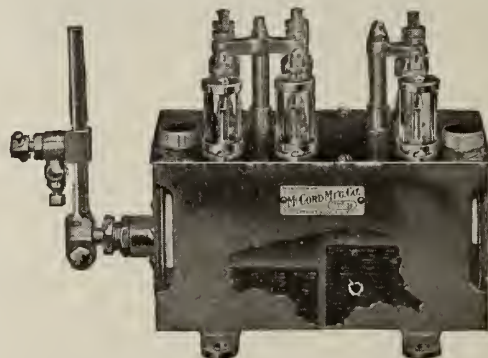
Capacity	Feeds	List	Capacity	Feeds	List
1 quart	1 feed	\$25.00	1 gallon	5 feeds	\$57.00
1 quart	2 feeds	30.00	1 gallon	6 feeds	63.00
2 quarts	1 feed	28.00	1½ gallons	7 feeds	75.00
2 quarts	2 feeds	35.00	1½ gallons	8 feeds	82.00
2 quarts	3 feeds	42.00	1½ gallons	9 feeds	90.00
2 quarts	4 feeds	49.00	1½ gallons	10 feeds	96.00
1 gallon	1 feed	33.00	2 gallons	11 feeds	108.00
1 gallon	2 feeds	39.00	2 gallons	12 feeds	115.00
1 gallon	3 feeds	45.00	2 gallons	13 feeds	125.00
1 gallon	4 feeds	51.00	2 gallons	14 feeds	135.00

Write for discount.

There is positively no pressure in sight feed; all working parts are of the best drop forged steel and operate in oil. Rotary or ratchet drive, finished in black enamel and nickel or black enamel and brass. Straightway spring check valves. Heating chamber and auxiliary hand crank furnished, as extras, when specified.



McCORD FORCE FEED LUBRICATOR
Class B, 14 feeds
Lubricates an entire plant from one point



McCORD DOUBLE COMPARTMENT LUBRICATOR
Feeds two kinds of oil

Especially adapted to Diesel engines, air compressors (steam or electric), ice machines, and high speed steam engines

CAPACITIES AND PRICES

2 quarts	2 feeds	1 feed in each	\$44.00
2 quarts	3 feeds	2 and 1 feed in each	50.00
2 quarts	4 feeds	2 feeds in each	57.00
1 gallon	2 feeds	1 feed in each	47.00
1 gallon	3 feeds	2 and 1 feed in each	54.00
1 gallon	4 feeds	2 feeds in each	60.00
1 gallon	5 feeds	3 and 1 feed in each	65.00
1 gallon	6 feeds	3 and 2 feeds in each	70.00
1 gallon	7 feeds	4 and 1 feed in each	70.00
1 gallon	8 feeds	4 and 2 feeds in each	75.00

Write for discount.

"McKim" Copper-asbestos Gaskets.

A pliable copper casing surrounding an asbestos packing, designed and constructed to withstand the ravages of heat, pressure and chemical action. Guaranteed not to spread or blow out and to withstand any pressure or superheat. May be re-applied repeatedly. "McKims" are saving from 50% to 80% of gasket maintenance in thousands of plants. Write today for free samples.



"MCKIM" GASKET

THE AMERICAN METAL HOSE CO.

WATERBURY, CONN.

BRANCH OFFICES

NEW YORK, N. Y., 173 Lafayette Street
CHICAGO, ILL., 29 East Madison Street

BOSTON, MASS., 84 Battery March Street
PITTSBURGH, PA., Union Bank Building

Products.

AMERICAN FLEXIBLE METAL HOSE and TUBING.

Description.

American Metal Hose is made in a number of different patterns. Heavy service hose is the interlocking construction shown in illustration below. Hose of this type is made from a continuous strip of bronze or galvanized steel which is first profiled into the desired shape and then wound spirally over itself; a packing of asbestos cord fed into place between the metal surfaces making the hose pressure-tight.

Scope of Use.

American Metal Hose is used in a wide variety of services. While extensively employed in the lighter classes of work, its wonderful efficiency and economy are most impressively demonstrated in the heavy duties such as conveying steam, oils, oil products, etc.

Oil Hose.

American Metal Hose for Oil, (BD15 Steel), is the cheapest and most satisfactory oil hose in the market. Oils and grease have no effect on it. It can be used under highest pressures, has the flexibility of rubber hose and under ordinary working conditions will last for years. American Metal Oil Hose is used in every conceivable connection in the general handling of oils. The U. S. Navy Department purchase from this company thousands of feet of it annually for this service.



UNLOADING TANK CAR WITH AMERICAN METAL HOSE
FITTED WITH SPECIAL ELBOW UNLOADING COUPLING

Steam Hose.

American Metal Hose for Steam, (BD15 Bronze), is the same as the steel oil hose except for the difference

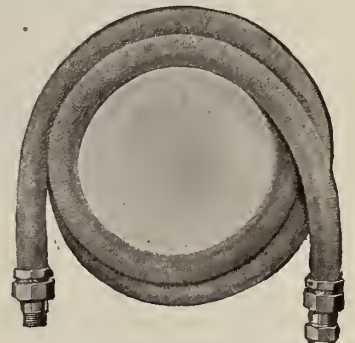
in the metal. It is free from all the weaknesses that limit the use of steam hose made wholly or in part of rubber, and can be counted on to render long and satisfactory service. It is used generally for the conveying of steam, both as a hose and also on machines in place of iron pipes and swing joints.



SHORT SECTION 2-IN. BD15 BRONZE STEAM HOSE WITH
HEATPROOF COUPLINGS ATTACHED

Gasoline Hose.

American Metal Special Gasoline Hose is a combination of flexible metal tubing and gasoline resisting rubber. It is light, strong, tight, durable and very flexible; has the approval of the National Board of Fire Underwriters. Adapted to use with pumps or wagons.



10-FT. LENGTH SPECIAL GASOLINE HOSE WITH COUPLINGS

Couplings.

Couplings are attached to the outside of metal hose, and the benefit of the full opening of the hose is always maintained. All couplings, unless otherwise specified, have standard iron pipe threads corresponding to the inside diameter of the hose to which they are attached.

Catalogue.

Catalogue and price list covering all the various types of metal hose and tubing made by this company, mailed on application.



HEAVY SERVICE INTERLOCKED FLEXIBLE METAL HOSE

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.

Broad and Race Streets
PHILADELPHIA, PA.

WORKS: WEST PHILADELPHIA, 72nd Street and Power's Lane
NEW YORK, N. Y. CHICAGO, ILL. BOSTON, MASS. CLEVELAND, OHIO PITTSBURGH, PA.

U. S. FLEXIBLE METALLIC TUBING CO.
LOS ANGELES, CAL. SAN FRANCISCO, CAL. HOUSTON, TEX. SEATTLE, WASH.

Products.

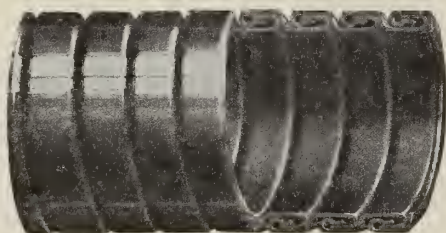
PENFLEX FLEXIBLE METAL HOSE for all purposes and pressures up to 1500 lbs. per sq. in.

PENFLEX AUTOMATIC BARREL FILLER.

Penflex Metal Hose.

CONSTRUCTION—Consists of a continuous length of special bronze or galvanized steel tape rolled in spiral so that the edges interlock, forming the four-wall construction shown in the illustration. As the tape is rolled, a groove is formed, containing an especially prepared asbestos packing, remaining fully protected from internal or external wear.

ADVANTAGES—Not injured by oil or heat. Does not kink, stretch, swell, rot or corrode. 30% lighter than rubber. Leakproof and flexible. Will last 10 times longer than rubber. Will convey steam, oil, hot tar, paint, water, acids, etc.



SECTION OF PENFLEX METALLIC TUBING

USES—*Blowing Boiler Tubes*—Used in most of the power plants for the past 15 years. An all-metal hose covered on one end with asbestos packing to facilitate handling. The $\frac{3}{4}$ -in. or 1-in. copper No. 2 furnished with reinforced coupling is recommended.

For Turbine Tube Cleaners—Made from specially prepared steel strip, electrogalvanized. Consists of inner and outer section of tubing. Constructed to overcome vibration of turbine cleaner. Owing to small diameter, it allows cleaner to move freely through the tubes.

Hot Air for Carburetor—Made of the best steel packed with asbestos thread, very flexible and easily attached. Used extensively by automobile manufacturers throughout the country. Made in all sizes up to $2\frac{1}{2}$ in. inside diameter.

For Automobile Tire Filling—Made in $\frac{3}{16}$ -in. (inside diameter) galvanized steel covered with wire lacing. Very flexible and will not kink. Not susceptible to oil usually found on the garage floor. Stands pressure up to 150 lbs.

Vacuum Cleaner Hose—With the use of this hose there is 30% less weight to lift and pull around, and 50% less resistance, as it is twice as flexible as rubber. Will not kink. As there is not any inner tube to blister and peel off, it will not clog or collapse. Made in sizes from $\frac{3}{4}$ in. to $1\frac{3}{4}$ in. Any special fittings desired can be furnished.



TRADE-MARK

For Marine Salvage Work—Hose specially constructed; made of tough specially hardened copper. Interlocked section renders it strong and capable of withstanding hours of steaming at high pressure.

For Oil Tanks, Cars, Wagons, Steamers, and Barges—Here Penflex will last for years as the action of the oil preserves it. Special light weight copper hose is made for use here. Its flexibility is improved by the action of liquids passing through it. In general use by oil companies, paint and varnish makers and oil refiners.



FOR UNLOADING TANK STEAMERS AND BARGES

For Gasoline Measuring Pumps—This combination interlocking joint hose with specially designed covering to protect the hose and car is the best flexible connection to a gasoline filling pump because it is perfectly tight, and being of metal is unaffected by the action of gasoline like rubber hose. With metal hose, clean gasoline can always be delivered.

OTHER USES—Penflex metal hose is used for spreading hot asphalt over highways, for exhaust connections for engine test hose, for gas stoves, irons, hot plates, radiators, air drills, for electric wire armoring, etc.

Is in daily use on over fifty railroads for such work as washout hose, hydrostatic testing, steaming coaches, sprinkling coal, etc.

Penflex Automatic Barrel Filler.

Years of experience in handling barrel fillers have enabled this company to put on the market an automatic barrel filler which is an improvement on anything heretofore used for this purpose. Guaranteed to be perfect in material and workmanship, and to operate on all liquids, hot or cold.

Co-operative Service.

Our various branch offices will be glad to supply information as to how Penflex will be adapted to your requirements. State purpose for which the hose is intended; working and test pressures required; for wet or superheated steam; inside diameter and length; style of couplings wanted on each end; kind of metal wanted.

THE BURT MANUFACTURING CO.

Manufacturers of Oil Filters

601 High Street
AKRON, OHIO

Products.

“BURT” OIL FILTERING SYSTEM; CROSS OIL FILTERS; RESERVOIRS; OIL PUMPS.

Also, American Oil Filter for use with gas or gaso- line engines; Gary Oil Filter; Double Unit Oil Filter for two kinds of oil; Warden Oil Filter for any kind of filtering material.

For “Burt” Ventilators and Exhaust Heads, see pages 304-305.

“Burt” Oil Filtering System.

In the system illustrated in Fig. 1D, the oil is fed to the different bearings by gravity from the overhead oil reservoir. After passing through the bear- ings, it is piped to the oil filter or filters in the basement, and after being purified it is again pumped to the reservoir, making the process

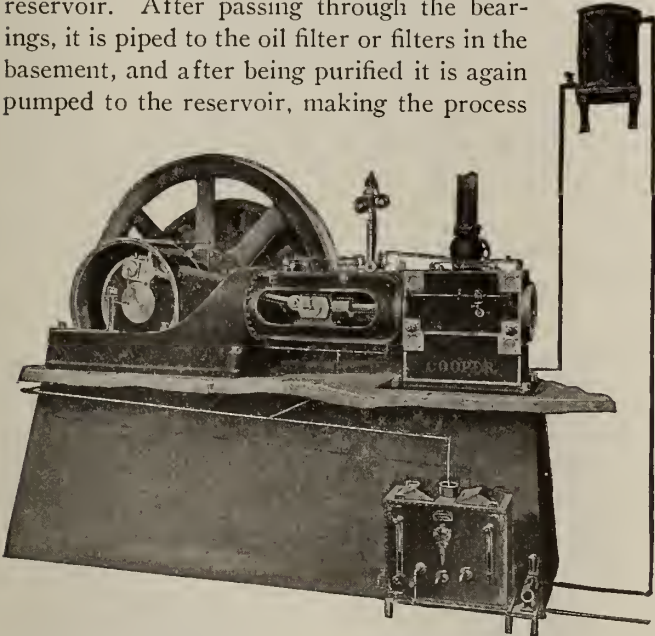


FIG. 1D. “BURT” OIL FILTERING SYSTEM
Usual method of installing gravity outlining system

automatic and requiring only very slight attention. The “Burt” oil filtering system can be constructed and put into operation by any engineer. This company will furnish the oil filters, oil reservoirs and the oil pump.

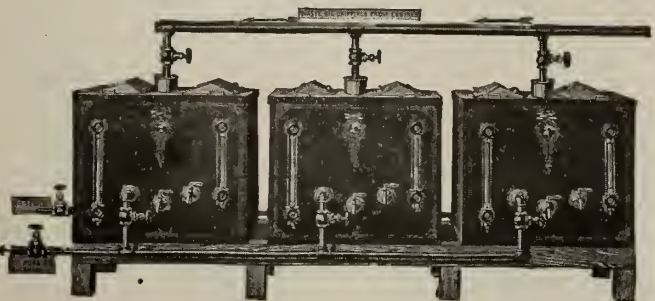


FIG. 2D. THREE FILTER UNITS CONNECTED AND OPERATED AS ONE FILTER

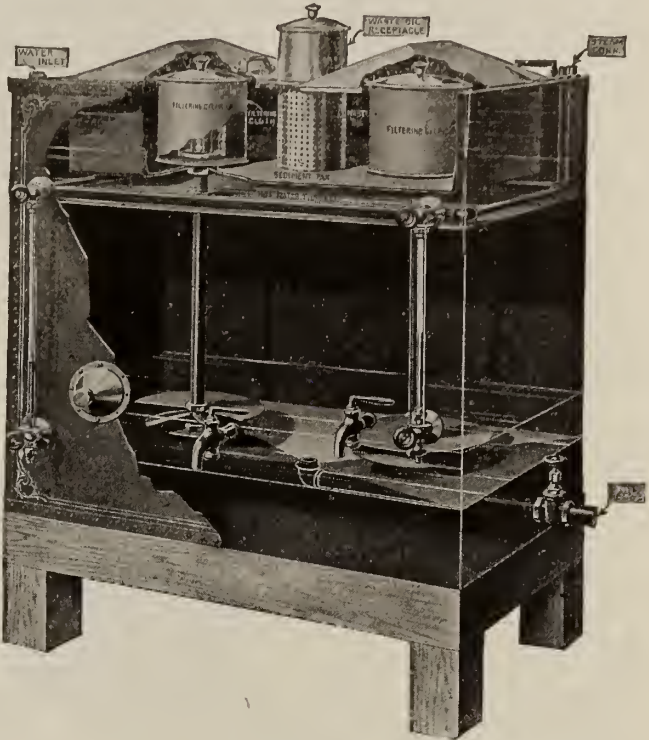


FIG. 3D. “BURT” UNIT OIL FILTER
Sectional view

DATA, “BURT” UNIT OIL FILTER

Size	Units	Filtering capacity per 24 hours, gals.	Pure oil cham- ber, gals.	Waste oil cham- ber, gals.	Water cham- ber, gals.	Dimensions			Price
						Length, in.	Width, in.	Height, in.	
No. 15 D	1	250 to 400	90	20	40	42	28	36	\$160. 00
No. 16 D	2	500 to 800	180	40	80	84	28	36	320. 00
No. 17 D	3	750 to 1200	270	60	120	126	28	36	480. 00
No. 18 D	4	1000 to 1600	360	80	160	168	28	36	640. 00
No. 19 D	5	1250 to 2000	450	100	200	210	28	36	800. 00
No. 20 D	6	1500 to 2400	540	120	240	252	28	36	960. 00

Strictly net, f. o. b. Akron, Ohio.

The Cross Oil Filter.

INTRODUCTION—The larger portion of lubricating oil is not consumed by the machinery, but passes through the bearings, drips away and is lost, except in cases where special provision has been made for gathering the waste oil by means of drip pans or buckets placed under the bearings. This waste oil frequently amounts to from 50% to 90% of the whole quantity used; but if gathered and caused to pass through one of the Burt filters, all dirt, grit and other impurities will be elimi- nated, and the waste oil can then be used over again on the finest machinery with perfect safety.

It is well known that a flowing oil, fed freely, will reduce friction to a lower point than a heavier oil fed slowly. It is true economy to have all the oil passages of liberal size, so as to provide free and copious lubri-

cation. Where a filter is employed, free flowing oil may be used with minimum waste, and a resulting extension in the life of the machinery.

The most important part of an oiling system is the filter. The Cross oil filter is recommended for filtering engine and common machinery oils. The Nos. 1R, 2R, and 3R sizes are made as shown in Fig. 1D; No. 4R and larger sizes are illustrated in Fig. 4R (without connection for oiling system). Very little steam (exhaust) is required, and if the filter is kept in a warm place it will not be necessary to make steam connections. The object of using heat is to increase speed and capacity of filter.

OPERATION—Waste oil is poured into chamber A (Fig. 4R). It then passes into chamber B, through layer of waste, which collects all the heavier impurities. Thence it passes through perforated bottom of chamber B, downward in direction shown by arrows into tube C, and from there to filter plate D, where increased weight of water has a tendency to keep oil back in tube C. However, pressure of oil in chamber B forces it down and it spreads out across underside of plate D in a *very thin film* which constantly changes surface and grows thinner as it travels from center to outer edge of plate, thus exposing every particle of waste oil to action of water. Oil then flows over and under plates 1D and 2D, going through same process in each case. When oil leaves filter plate 2D it is in a finely divided state of separation and thoroughly mixed with water, which washes it out, and, from which all the remaining impurities are separated by gravity and settle in chamber E, whence they can be removed through cock No. 3. From plate 2D, oil again filters through stratum of filtering material F, and from there it rises to chamber G, the reservoir containing the purified oil. It is then drawn off as required from cock No. 1.

In some cases the Cross filter will need to be cleaned only once in three or four months, while in others it

must be done about once a month. Filtering waste in chamber B can be instantly removed without interference with pure oil supply.

Practically no attention is required after filter is started, and first cost is the only expense, excepting a few cents per year for waste.

“STYLE A”—Recommended where lubricating oil is used in very large quantities and where, in the interest of economy, pipe connections are made by means of gate valves so that the filtered oil can be pumped to any part of the plant desired.

The “Style A” filter is used by some of the largest power plants in the world, and is so constructed that it can be used with or without an oiling system.

Filter can be used with or without water.

“STYLE B”—In many power plants water becomes mixed with waste lubricating oil, and considerable difficulty is often experienced in filtering this mixture. “Style B” filter is recommended for this problem, and is guaranteed to separate water automatically from waste oil and at the same time to clean the oil so that it can be used over and over again.

The “Style B” filter will also take condensed water and oil from oil separators and exhaust heads and successfully separate the oil from the water and filter the oil perfectly, so that the reclaimed cylinder oil will make an excellent lubricant for pumps and other machinery, but is not recommended for re-use in the cylinders of steam engines.

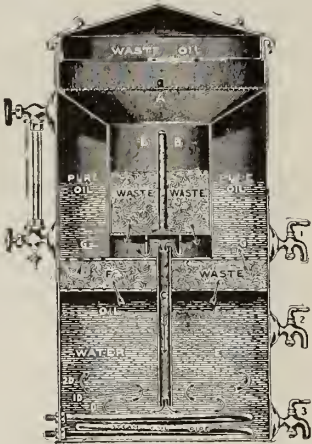


FIG. 4R. CROSS OIL FILTER
Sectional view

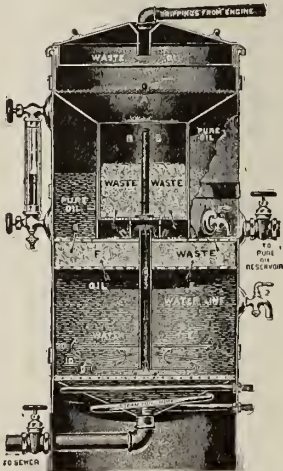


FIG. 5A. CROSS OIL FILTER,
“STYLE A”
Sectional view

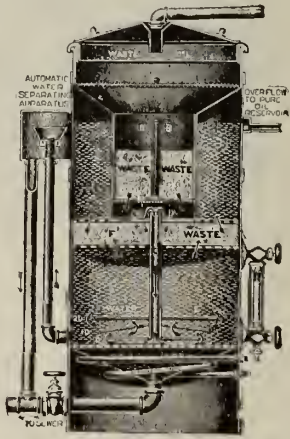


FIG. 6B. CROSS OIL FILTER,
“STYLE B”
Sectional view

DATA, CROSS OIL FILTER

Size	Filtering cap. per 24 hours, gals.	Holding cap. dirty oil, gals.	Diam., in.	H'ght., in.	Cap. pure oil chamber, gals.	Net wgt., lbs.	Gross wgt., lbs.	Diam. of crate, in.	H'ght. of crate, in.	Price
No. 1R	20 to 30	7	18	30	11	36	100	24	32	\$37.00
No. 2R	5 to 10	3	12	26	3	22	60	19	28	25.00
No. 3R	40 to 50	17	24	36	20	72	170	33	40	75.00
No. 4R	60 to 70	26	30	54	37	163	350	54	57	90.00
No. 5R	70 to 90	32	33	56	49	196	409	54	59	110.00
No. 6R	100 to 120	45	35	60	60	220	450	66	61	130.00
No. 7R	120 to 150	52	35	74	75	250	500	66	76	160.00
No. 8R	150 to 200	57	40	76	90	350	680	72	76	190.00

Strictly net, f. o. b. Akron, Ohio.

DATA, CROSS OIL FILTER, “STYLE A”

Size	Filtering cap. per 24 hours, gals.	Holding cap. dirty oil, gals.	Diam., in.	H'ght., in.	Cap. pure oil chamber, gals.	Net wgt., lbs.	Gross wgt., lbs.	Diam. of crate, in.	H'ght. of crate, in.	Price
No. 1A	20 to 30	7	18	36	11	63	108	24	38	\$45.00
No. 3A	40 to 50	17	24	42	20	100	200	33	46	80.00
No. 4A	60 to 70	26	30	54	37	163	350	54	57	100.00
No. 5A	70 to 90	32	33	56	49	196	409	54	59	120.00
No. 6A	100 to 120	45	35	60	60	220	450	66	61	135.00
No. 7A	120 to 150	52	35	74	75	250	500	66	76	165.00
No. 8A	150 to 200	57	40	76	90	350	680	72	76	200.00

Strictly net, f. o. b. Akron, Ohio.

DATA, CROSS OIL FILTER, "STYLE B"

Size	Filtering cap. per 24 hours, gals.	Holding cap. dirty oil, gals.	Diam., in.	H'ght, in.	Cap. pure oil chamber, gals.	Net wgt., lbs.	Gross wgt., lbs.	Diam. of crate, in.	Height of crate, in.	Price
No. 1B	20 to 30	7	25	36	11	70	150	31	38	\$50.00
No. 2B	5 to 10	3	18	30	3	30	78	25	32	35.00
No. 3B	40 to 50	17	31	42	20	96	246	40	46	90.00
No. 4B	60 to 70	26	37	54	37	190	410	51	57	110.00
No. 5B	70 to 90	32	40	56	49	215	348	61	59	130.00
No. 6B	100 to 120	45	42	60	60	226	484	73	61	160.00
No. 7B	120 to 150	52	42	74	75	270	500	73	76	175.00
No. 8B	150 to 200	57	47	76	90	395	730	79	76	220.00

Strictly net, f. o. b. Akron, Ohio.

Reservoirs for Oiling System.

These reservoirs are furnished by THE BURT MANUFACTURING CO. for use with their oil filters. They are made of galvanized iron (same quality as used in the oil filters), fitted with inlet and outlet pipes, overflow pipe, cover, and oil gage. Each tank is handsomely decorated in gold to correspond with filters.



FIG. 7A. "BURT" RESERVOIR FOR OILING SYSTEM

DATA, OIL RESERVOIRS

Cap., gals.	Inlet, in.	Outlet, in.	Overflow, in.	Height, in.	Diam., in.	Price
25	1/2	1/2	3/4	23	18	\$15.00
50	1/2	1/2	3/4	35	20 1/2	21.00
70	1/2	1/2	3/4	36	24	26.00
100	3/4	3/4	1	44	27 1/2	30.00
140	3/4	3/4	1	48	30	32.00
180	3/4	3/4	1	48	33 1/2	40.00
250	1	1	1 1/4	61	35	46.00
300	1	1	1 1/4	73	35	55.00
350	1	1	1 1/4	85	35	60.00

Strictly net, f. o. b. Akron, Ohio.
At prices quoted any size inlet and outlet pipes will be furnished.
If desired, steam coil pipes can be furnished at slight extra expense.

Special reservoirs of any size or shape, and of any gage iron desired, made to order. Prices and blue prints on compartment oil tanks on application.

Oil Pump for Oiling System.

This duplex oil pump is especially designed for use in connection with oiling systems. Working parts are all easy of access, and are made to gage. Rods are put in on the separate principle, and are fastened at the center by a special device which permits of one rod being easily removed without disturbing the other.

This pump is economical in the consumption of steam, can be started at any point of the stroke, and consequently there is no danger of its being on dead center. The valve arrangement is especially adapted for a continuous service.

With each pump is included a lubricator, all necessary air and drain cocks, wrenches, etc. Every pump is tested at factory and guaranteed.

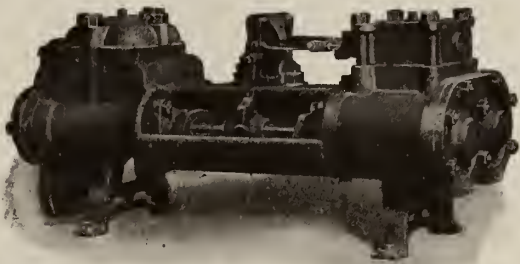


FIG. 8E. "BURT" OIL PUMP FOR USE IN OILING SYSTEM

DATA, DUPLEX OIL PUMP

No.	Size, io.	Proper strokes per min. of one piston, varying with kind of work and pressure	Gallons delivered per min. by both pistons at stated number of strokes	Steam, in.	Exhaust, in.	Suction, in.	Discharge, in.	Price
2E	2 1/4 x 1 1/4 x 2	100 to 250	2 1/4 to 6	3/8	1/2	3/4	1/2	\$100.00
3E	3 x 2 x 3	100 to 250	8 to 20	1/2	1/2	1 1/4	1	125.00
4E	3 1/2 x 2 1/4 x 4	100 to 200	14 to 28	1/2	3/4	1 1/2	1 1/4	150.00
5E	4 1/2 x 2 1/4 x 4	100 to 200	20 to 40	3/4	1	2	1 1/2	175.00
6E	4 1/2 x 3 x 4	100 to 200	25 to 50	3/4	1	2	1 1/2	200.00

Strictly net, f. o. b. Akron, Ohio.

Thirty Days' Trial.

THE BURT MANUFACTURING Co. will send one or more oil filters to any responsible house on 30 days' trial, subject to approval in every respect. If it is found, upon trial, that they do not reduce lubricating oil bills at least 50%, or that the filters fail to meet every claim made for them, they may be returned and this company will pay freight charges both ways.

Guarantee.

THE BURT MANUFACTURING Co. expressly agrees to repair or replace, free of charge, any oil filter, exhaust head or ventilator, sold by them, which shall at any time be found to have been defective in workmanship or material.

References.

A comprehensive list of satisfied users of Burt filters will gladly be sent on request.

S. F. BOWSER & CO., INC.

Gasoline and Oil Storage Systems

FORT WAYNE, IND.

CANADIAN PLANT, TORONTO, ONT., S. F. BOWSER COMPANY, LIMITED

Branch and Sales Offices in All Principal Cities of the United States and Foreign Countries

Products.

COMPLETE SYSTEMS for the STORAGE and CONTROL of OILS and GASOLINE; HAND and POWER DRIVEN SELF-MEASURING GASOLINE and OIL PUMPS; OIL and GASOLINE STORAGE TANKS; OIL FILTERING and CIRCULATING SYSTEMS, DRY CLEANERS' NAPHTHA STORAGE and DISTRIBUTING SYSTEMS.

Also, Cutting Oil Reclaiming Systems, Filling Station Equipment, Fuel Oil Systems, Self-measuring Kerosene Pumps, Tanks for Underground Storage, Paint Oil Storage and Handling Systems, Railway Oil Storage, Reclaiming Systems for Oil, Rubber Cement Tanks and Pumps, Wheel Tanks for Lubricating Oil and Gasoline.

Gasoline and Oil Pumps, Tanks and Storage Systems.

PUMPS—Pumps measure accurately quantities of 5 gals. down to 1 pt. at a stroke, intermediate quantities as desired. Designed for direct connection on tanks or to tanks installed at

BOWSER

TRADE-MARK

a distance, inside building or underground. Handle all oils that can be pumped.

TANKS—Rectangular or cylindrical, of galvanized steel; for installation inside buildings or underground; storage capacities from 65 gals. up. Specifications and quotations on large tanks, furnished on request. This company has a modern tank department, especially equipped for turning out this class of work; and builds tanks of exceptional quality.

SYSTEMS—Complete systems, designed and built for receiving, checking, storing, measuring, distributing, and recording oils of all kinds for all purposes.

FIGURE 41—Capacity, gallon, half-gallon, quart or pint; handles gasoline, lubricating or non-lubricating oils; standard with discharge register, lock, etc.; may be equipped with filter, meter and other accessories.

FIGURE 103—Capacity, 1 gal. or less; quick return type; standard with meter, discharge register, filter, lock; best and most rapid gallon gasoline pump manufactured.

FIGURE 106—Same capacity and type as Figure 103, except without filter, for lubricating oil.

FIGURE 101—Capacity, 5 gals. or less; quick return type; standard with meter, filter, discharge register, lock, hose draining attachment, hose and nozzle. Especially suited where large capacity is required.

FIGURE 105—Same capacity and type as Fig. 101, except without filter, for lubricating oil.

FIGURE 64—Battery lubricating oil outfit; one or more units as required; quart measuring pump; tanks, capacity 120 gals. and larger. Illustration shows it equipped with barrel cradle, track, dash and hoist for emptying barrels.

FIGURE 154—Portable outfit for lubricating oils. Quart measuring pump. Capacity 65 gals.

FIGURE 121—Portable outfit for gasoline. Gallon measuring pump. Capacity 50 gals.; equipped with discharge register, lock, hose, hose nozzle, hose drainer, etc.

FIGURE 109—Battery outfit for paints, lubricating and other oils; one or more units; equipped with gallon measuring pump with discharge register, computer, lock, etc. Tanks, capacity 120 gals. and larger.

FIGURE 115—Battery outfit for paints, lubricating and other oils; gallon measuring pump; basement tanks of 120 gals. capacity and larger.

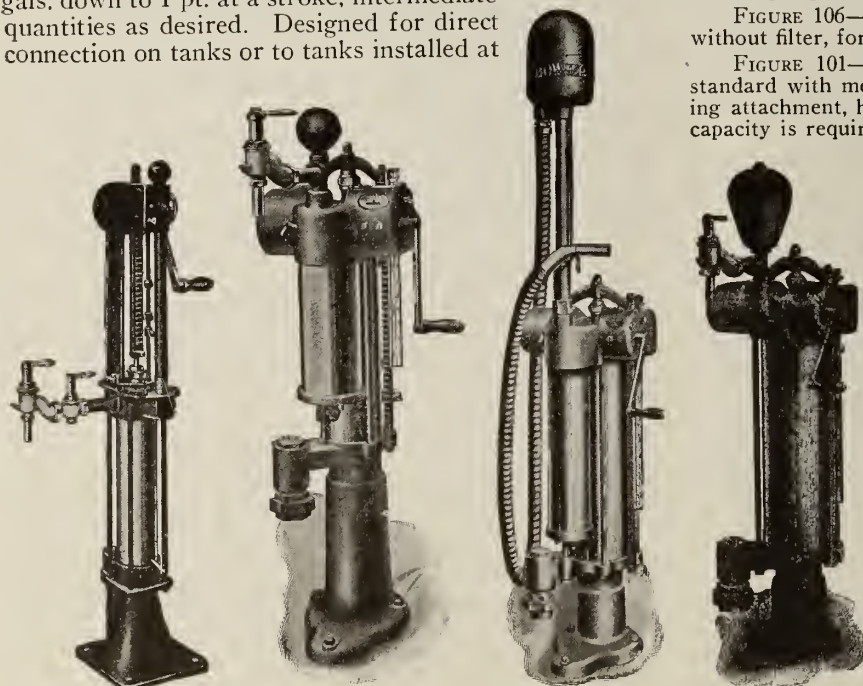


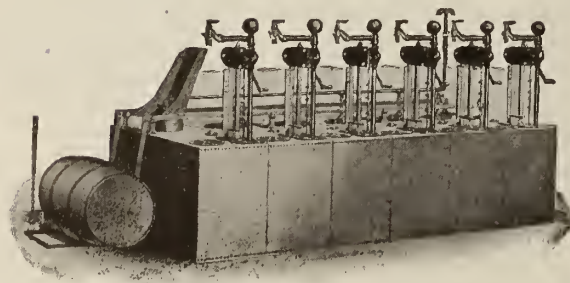
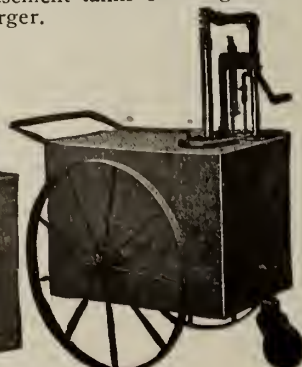
FIG. 41

FIG. 103

FIG. 101

FIG. 106

BOWSER GASOLINE AND OIL PUMPS

FIG. 109
OUTFIT FOR PAINTS OR OILSFIG. 64
LUBRICATING OIL OUTFITFIG. 154
PORTABLE OUTFIT



RECTANGULAR GALVANIZED TANK



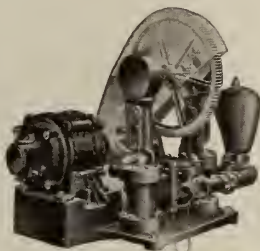
CYLINDRICAL GALVANIZED TANK

Naphtha Storage and Distributing Systems for Dry Cleaners.

"Standard" or "Premier" styles. Tanks installed underground, as many as necessary, of any desired capacity; cone bottom for settling naphtha. Pumps discharge naphtha as desired to washers, still, washer to washer, back to tanks, etc.

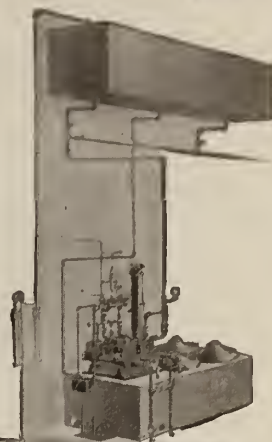
Power Pumps.

Plunger type, for operation by belt or direct motor connection; varying styles and capacities to meet existing conditions and requirements.

POWER PUMP FOR
DIRECT CONNECTION
TO MOTOR

Oil Filtering and Circulating Systems.

The system is automatic in operation. Oil is fed in continuous streams to bearing, collected, carried to the filter, cleaned, returned to overhead gravity tank and fed again to bearings. This gives a continuous round of clean oil. For reciprocating engines or similar machinery, horizontal steam turbines and other types. Also filters to take care of oil in batches only.



Engineering Service.

Assistance in planning and designing new oil houses, to include oil storage and distributing systems, oil handling equipment for buildings already constructed. Complete survey of present conditions made and recommendations given as to probable savings complete oil handling systems will effect.

This service is furnished to all manufacturing industries, mines, mills, shops, power plants, railroads, garages, filling stations, office buildings, or wherever oils are used.

Bulletins.

Bulletins illustrating and describing in detail the construction and operation of equipment, furnished on request.



OIL FILTERING AND CIRCULATING SYSTEM



OIL STORAGE AND DISTRIBUTING SYSTEM

Showing large and small tanks, portable outfits, power pumps, battery equipment, etc.

WAYNE OIL TANK & PUMP CO.

726 Canal Street
FORT WAYNE, IND.

BRANCH OFFICES

NEW YORK, N. Y., 1790 Broadway
BOSTON, MASS., Publicity Building
CHICAGO, ILL., 1400 South Michigan Avenue
PHILADELPHIA, PA., 514 Otis Building
DENVER, COLO., 1606 Broadway
KANSAS CITY, MO., 1333 McGee Street
PITTSBURGH, PA., 401 Union Arcade

ATLANTA, GA., 87 North Forsyth Street
SAN FRANCISCO, CAL., 4th and Harrison Streets
DETROIT, MICH., 874 Woodward Avenue
DALLAS, TEX., 911 Commerce Street
MINNEAPOLIS, MINN., 827 Hennepin Avenue
CLEVELAND, OHIO, 1854 Euclid Avenue
RICHMOND, VA., 524 West Broad Street

SALESMEN EVERYWHERE

Products.

MEASURING and NON-MEASURING PUMPS for Lubricating Oils and Compounds, Gasoline, Naphtha, Light Paint, Paint Oils and similar products both volatile and non-volatile.

OIL HOUSE EQUIPMENT for mills, mines, factories or railroads.

LIGHT and HEAVY METAL RIVETED and WELDED TANKS, Cylindrical and Rectangular, made from Black or Galvanized Steel for underground or above ground storage of liquids, or for vacuum pressure.

Guarantee.

All Wayne equipment is guaranteed for 2 years.

Wayne products are indorsed by leading engineers and engineering architects. They are adopted as the standard of practice by the foremost of railroads and manufacturers of the United States, and conform to the measure of safety prescribed by the National Board of Fire Underwriters.

Departmental Storage Systems, Stationary and Portable.

For storing lubricating oils in powerhouses, machine departments in mills, factories, mines, railroad

shops, etc., and for portable delivery of oils direct to machines. This Wayne equipment eliminates scored bearings and similar trouble, by protecting oil from dust, dirt and all foreign matter, which is liable to get into oils when stored in less efficient containers.

This Wayne equipment pays for itself because of its protective and labor saving features.

Tanks are built of high grade tank steel; all openings reinforced, insuring long service. Joints are spot-welded; seams flushed with solder inside and out; pump materials are carefully selected, and all Wayne materials are guaranteed the best of their kind for the service required.

Factory Equipment for Distribution from Central Supply.

For distribution of paints, paint oils, the mixing of oils and liquid products, Wayne system of central storage, with distribution to various floors of the factory, is an ideal installation, from the standpoints of labor saving, oil saving, fire protection and elimination of unauthorized use.

The central storage battery of tanks is arranged below floor level, and allows easy filling from original containers; provides adequate supply on hand at all times; pumps accurately measure and, if desired, record all dispensing on the various floors. Return pipes are part of the equipment.

Preliminary investigations and drawings for installations to suit any plant layout will be made on request.



LUBRICATING
OIL PUMP

For storage of lubricating oils in engine rooms or departments where a limited supply is in constant use. Of galvanized tank steel with roll top, which can be locked. When top is closed entrance of dust and dirt is largely prevented, keeping oil clean. Pump delivers exact measured quantities.



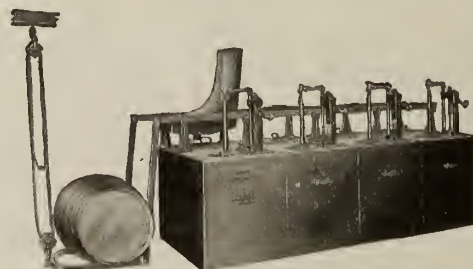
DEPARTMENTAL
OIL STORAGE
SYSTEM

Made portable by mounting on disk roller bearing castors. Tank of high grade galvanized tank steel. Seams flushed with solder inside and out. Reinforced openings. Drip pan provided with cover and extension tube which extends to discharge nozzle. Discharge nozzle of non-drip type.



PORTABLE WHEEL
TANK

Especially desirable in machine and other shops where a regular supply of oil or other fluid is required. Equipped with pump which delivers 1 qt. at a stroke, while the delivery of lesser quantities is governed by accurately placed stops.



CENTRAL STORAGE SYSTEM

For several grades of lubricating or other oils. Made in sectional units that can be added to as the needs require, width only being changed as length and height of tanks are uniform. Barrels are handled by convenient methods and completely drained. Pump delivers exact measure. Containers practically fireproof.

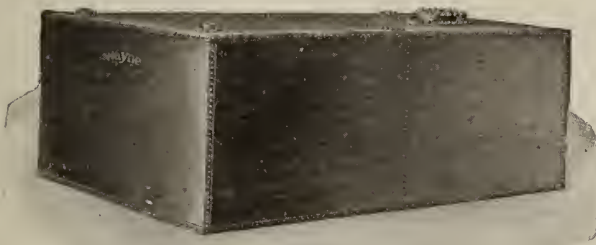
Light and Heavy Metal Storage Tanks, Black or Galvanized Steel.

Open hearth steel ranging from $\frac{3}{16}$ to $\frac{5}{8}$ in. in thickness is used for these tanks. Capacities are indicated under the illustrations. Any other reasonable specifications can be supplied.

Rigid inspection of all plates eliminates defects. Rivet holes are accurately spaced with punch press; plates are carefully rolled to true circles and accurate alignment of courses; laps conform to radius of cylindrical courses. Tanks tested with air pressure 50% greater than liquid pressure exerted on tanks.



BLACK STEEL STORAGE TANK
Capacities, 100 to 15,000 gals.



RECTANGULAR STORAGE TANK
Capacities, 100 to 10,000 gals.

Pressure and Vacuum Tanks, Riveted or Welded Type.

Riveted joints are in accordance to the specifications submitted or to such designs as are recommended by insurance or municipal requirements, or to code of A.S.M.E.

For welded tanks a weld is employed that is equal to the best riveted joint and is even as strong as the solid plate.

Subjected to a hydrostatic test of one and one-half times the allowable working pressure before leaving the factory.

Gasoline Dispensing Equipment for Public and Private Garages and Service Stations.

These systems are built to deliver exact measured quantities of gasoline from 1 qt. to 5 gals. at a stroke. Tanks can be buried outside at convenient locations or distances from the pump, while the pump may be located inside the garage or service station or at the curb as may be desired.

All pumps are heavily constructed of suitable materials and are weatherproof. They include such fea-

tures as the Wayne patented housing that minimizes space, and other carefully thought out details of construction that insure absolute service and satisfaction to the user.

Various bulletins on the different types are issued and the company is ready to help engineers in selecting the exact type for a certain purpose.

Oil Filters, Types No. CF and No. PF.

Type CF Wayne oil filter provides many exclusive features for clarifying and purifying lubricating oil, so that it may be used over and over again.

It is a scientific fact that properly filtered used oil possesses all the physical properties of new oil.

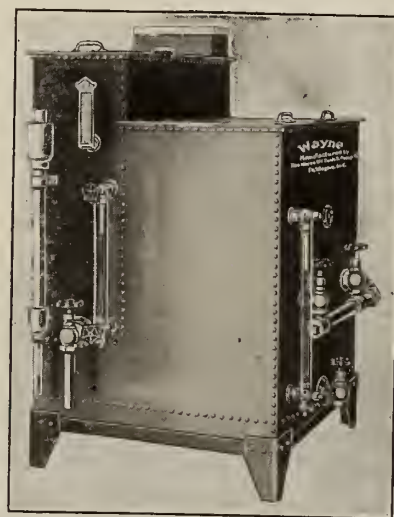
Type CF is rectangular; saves space; has small outside dimensions in relation to its rating per hour; it both precipitates and filters, the two processes removing every foreign substance heavier than the oil, and every foreign substance too light to precipitate, which is suspended in the oil.

Precipitation is effected by producing as near a state of rest as possible when the oil is in the trays. A very valuable feature.

The filter medium of special cloth, which can not fold or gather, stands vertically so that sediment works toward the bottom, and receives a constant, uniform pressure, insuring perfect filtration throughout. Construction allows ease of cleaning, with no danger of sediment falling into oil.

Type PF Wayne filter is a portable for plants not requiring a continuous system or to supplement a main oil filtering system. Has all of the advantageous features of the CF filter, with less capacity.

All Wayne oil filters combine careful construction with simplicity. Complicated appurtenances are omitted; maximum efficiency is obtained.



TYPE CF OIL FILTER

Catalogue.

The complete catalogue SI of this company illustrates and describes the Wayne line and should be in the library of every engineer. Gladly sent on request.

DOVER BOILER WORKS

Steel Plate Construction

SALES OFFICE
50 Church Street
NEW YORK, N. Y.

WORKS:
DOVER, N. J.

Products and Services.

RIVETED OR WELDED STEEL PLATE CONSTRUCTION which includes: Storage Tanks for liquids, compressed air, vacuum and heating; Stacks, Flues, Penstocks, Riveted Pipe, Flumes, Chutes, Hoppers, and all kinds of Riveted Steel and Iron Equipment.

Builders, Engineers and Contractors.

Facilities.

The plant of the DOVER BOILER WORKS is located at Dover, N. J., only 40 miles from New York, and is modern, efficient and completely equipped for turning out the work in which this company specializes.

Engineering Service.

A corps of engineers of long and successful experience in designing and constructing steel plate equipment, is maintained at the New York office of this company.

It is the work of these experts to check carefully all plans submitted and to furnish specifications, estimates and designs that meet requirements to the fullest degree. If plans submitted to this department do not seem best adapted, changes and improvements will be suggested.

This work can best be done from blue prints furnished by customers. When necessary, however, designs for equipment will be submitted, based on rough sketches by engineers or plant superintendents.

Materials.

Dover products are made of mild open hearth steel, usually referred to as soft steel. The tensile strength is from 55,000 to 65,000 lbs., and the shearing value 45,000 to 50,000 lbs. These materials are exceedingly homogeneous, invariably uniform in thickness and texture, and free from flaws and defects.

Tanks and Stacks.

LAYING OUT—The plates, heads and shapes used are laid out and all holes located on the flat, by expert layers-out, all of whom have been especially trained. Nothing is left to chance and the work assembles with surprising and gratifying exactness.

PUNCHING—All material is heavily center punched and then punched by expert punch operators.

ROLLING OR BENDING—All rolling and bending are done cold, so as not to set up heat strains in the material. Our powerful rolls will handle material up to 1-in. thickness. Cold bending is done on a 200-ton hydraulic press.

FLANGING—Standard or special flanged work is handled with ease by the flanging department, while hydraulic flanging machine and large heating furnaces enable the turning out of large work of first quality at a low cost.

RIVETING—Wherever possible, the work is riveted up on hydraulic riveters. Pressures from 50 tons to 100 tons are used, depending on the size of work. This form of riveting is the best the art affords.

CALKING—After riveting, tanks are calked with pneumatic calking machines, by skilled operators, using round nosed calking tools.

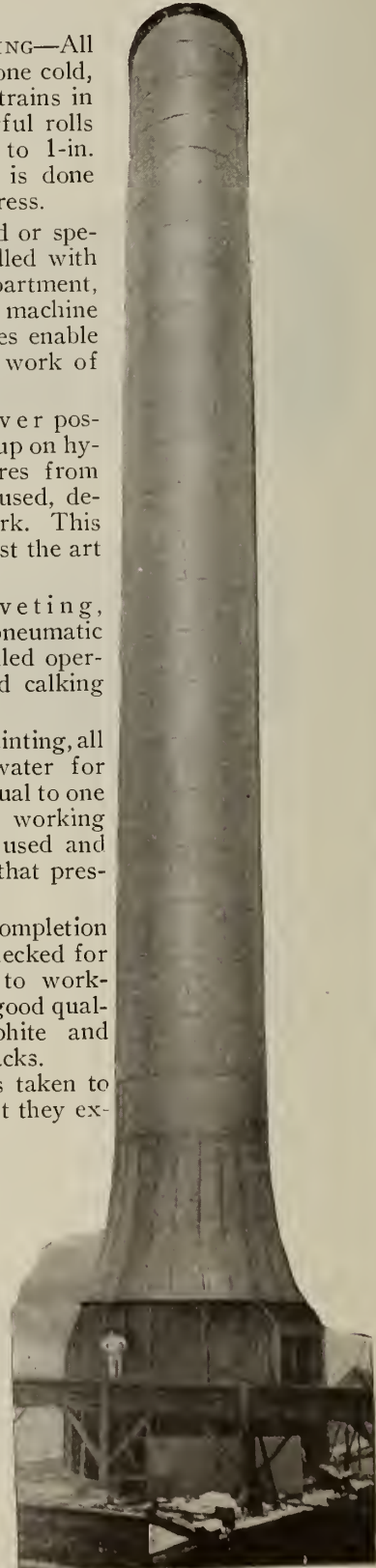
TESTING—Before painting, all tanks are tested with water for tightness. A pressure equal to one and one-half times the working pressure for the test is used and tanks are made tight at that pressure before shipment.

INSPECTION—At completion all work is thoroughly checked for accuracy, inspected as to workmanship, painted with a good quality paint usually graphite and loaded on cars on our tracks.

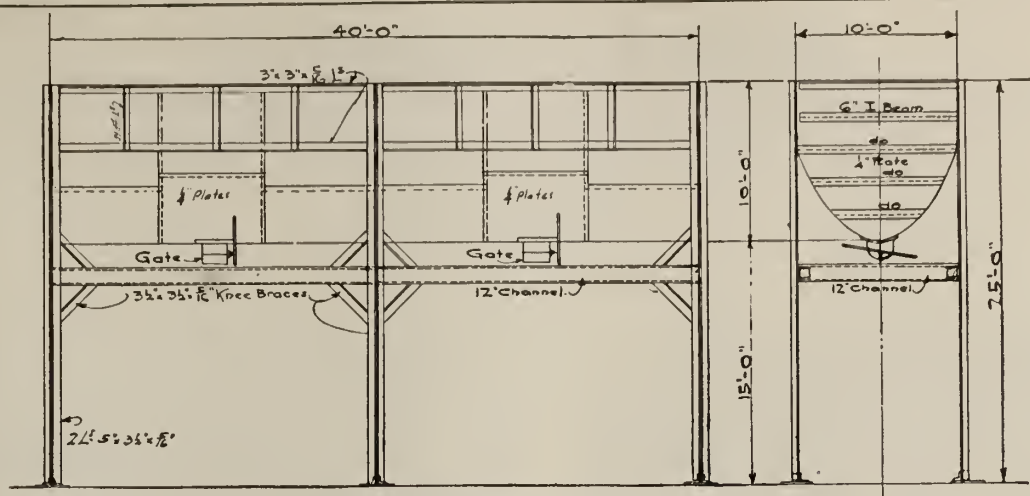
Every precaution is taken to give customers just what they expect to get.



HORIZONTAL STILL, 10 FT. IN DIAM. BY 30 FT. LONG

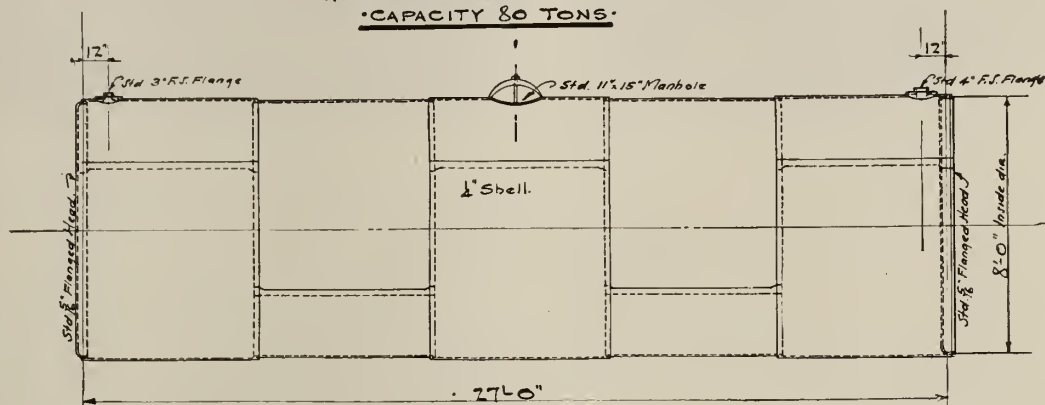


SELF-SUPPORTING STACK,
250 FT. BY 18 FT.

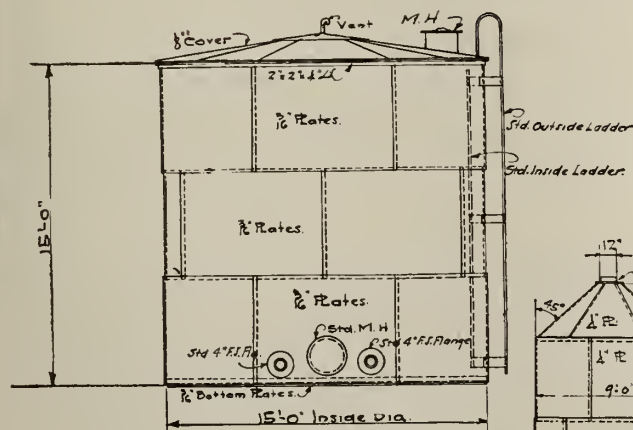


• COAL STORAGE BIN.

•CAPACITY 80 TONS.

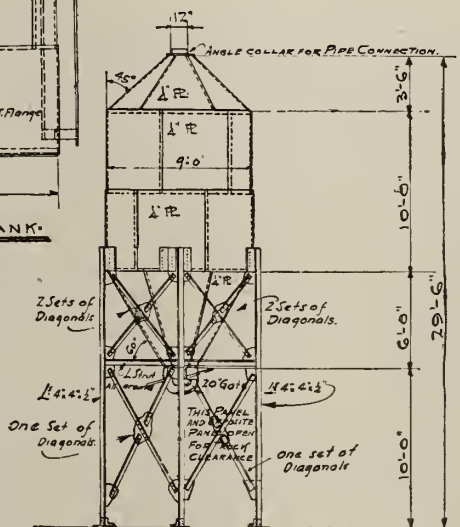


•STANDARD HORIZONTAL STORAGE TANK.



•TYPICAL STORAGE TANK•

SIZE	THICKNESS OF MATERIAL	CAPACITY IN GALLONS
8'-0" DIA. x 21'-6" LONG	Shell Heads $4 \frac{5}{8}$ "	8000
8'-0" DIA. x 27'-0" LONG	Shell Heads $4 \frac{5}{8}$ "	10000
8'-0" DIA. x 32'-0" LONG	Shell Heads $4 \frac{5}{8}$ "	12000
8'-0" DIA. x 40'-0" LONG	Shell Heads $4 \frac{5}{8}$ "	15000



ASH HOPPER.
CAPACITY 850 Cub Ft. 20 TONS

CAPACITY 850 Cub Ft. 20 TONS

SIZE	THICKNESS OF MAT.	CAPACITY IN GALLONS
12" Ø DIA. x 12" Ø DEEP	Shell & Bottom 1/8" Roof 8"	10000
15" Ø DIA. x 15" Ø DEEP	Shell & Bottom 1/8" Roof 8"	20000
18" Ø DIA. x 18" Ø DEEP	Shell & Bottom 1/8" Roof 8"	30000
18" Ø DIA. x 20" Ø DEEP	Shell & Bottom 1/8" Roof 8"	40000
20" Ø DIA. x 20" Ø DEEP	Shell & Bottom 1/8"	50000

<p align="center">SUBJECT</p> <p>ASH HOPPER, COAL BIN AND STORAGE TANKS.</p>	
<p>SCALE</p> <p>1" = 1' FOOT</p> <p>1" = 1' FOOT</p> <p>1" = 1' FOOT</p> <p>FOOT</p>	<p>CUSTOMER</p>
<p>DATE 8-28-19</p> <p>DRAWN R.</p> <p>TRACED R.</p> <p>CHECKED</p>	<p>REVISED</p>
<p align="center">DOVER BOILER WORKS</p> <p align="center">ENGINEERS & CONTRACTORS</p> <p align="center">50 CHURCH ST., NEW YORK</p> <p align="center">WORKS DOVER, N. J.</p>	
<p>ENGR GROUP</p>	<p>Drawn BY N.Y. 1331</p>

FARRAR & TREFTS, INC.

Steel Tanks, Boilers and Grey Iron Castings

Illinois and Perry Streets
BUFFALO, N. Y.



TANK AND BOILER SHOP



FOUNDRY AND MACHINESHOP

Products.

Fabricators of STEEL PLATE WORK, manufacturers of CHEMICAL APPARATUS and producers of CASTINGS.

Steel Plate Work:

Boilers, Stacks, Tanks and other Welded or Riveted Steel Plate Construction.

Chemical Apparatus:

Dryers, Stills, Evaporators, Kettles, Filter Presses, Vats, Mixers, Jacketed Tanks for steam, oil or water.

Castings:

Grey Iron, Semisteel, Acid Resistant and Municipal; Grate Bars.

Miscellaneous:

Patterns, Forgings, Blacksmithing, Machine Work, Electric or Acetylene Welding.

Service.

The Laboratory and the Engineering Departments have complete control of the operations and processes throughout the entire organization.

These two departments have at their disposal a vast

amount of valuable data which will be useful in determining exact requirements and plans.

The Plant.

The boiler and tank shop, and the foundry and machinshop are equipped with modern machinery that has proved most efficient for the execution of any work entrusted to this company. The new foundry, erected during 1917, and enlarged in 1919, has a daily capacity of 200 tons of castings. Single castings, up to 50 tons each can be poured in this foundry.

The Organization.

The executives have had many years of experience in this business, and the knowledge gained through the production of chemical apparatus and castings, and the fabrication of steel plate work insures satisfactory results to their clients.

The engineering force is made up of experienced and technically trained men.

A skilled metallurgist, in charge of the laboratory, has direct supervision of the foundry.

All operations throughout the entire plant are directed by competent superintendents.



STEAM CHEST



VALVE BODY

L. O. KOVEN & BROTHER

Engineers, Machinists, Coppersmiths, Galvanizers, Builders of Plate Steel,
Sheet Iron Work, for all Industries

154 Odgen Avenue
JERSEY CITY, N. J.

NEW YORK OFFICE, 50 Cliff Street

Products.

SPECIAL STEEL PLATE and METAL CONSTRUCTION
for all industries, including

Autoclaves.

Barrels: Tumbling and Rumbling, etc.

Bins: for Coal, Grain, etc.

Boilers: Barbers' Hot Water, Fire Engine, Galvanized Range, Glue, Heating, Small Steam.

Boxes: Waste, etc.

Buckets: Self-dumping, Tar, etc.

Cans: Ash and Garbage, Oil, Oily-waste, Powder, Refuse.

Carriers: Milk Bottle, Milk Can, Oyster.

Chemical Apparatus.

Chimneys: Iron and Steel.

Coolers: all kinds.

Digesters.

Drums: all kinds.

Dry Kilns: all kinds.

Dryers: all kinds.

Filters: all kinds.

Furnaces: Annealing, Melting, Oil and Tar Melting, Producer-gas Burning, Rivet.

Heads: for Boilers, Exhaust, Kitchen Range Boilers.

Heaters: Feed Water, Glue, Gravel.

Kettles: Mixing, Soda and Potash, Steam Jacketed, Sugar, Tar, Wax.

Kilns: Baking, China, Glass.

Milk Machinery.

Mixers: all kinds.

Ovens: Bread, Core, Enameling, Proofing.

Oyster Apparatus.

Paint Machinery.

Pans: Annealing, Drip, Gravel, Revolving.

Pasteurizers.

Pipe: Hydraulic, Riveted.

Pots: Melting, all kinds.

Receivers: for Air.

Reclaimers.

Sand Blast Machines.

Separators: Steam.

Sinks: Factory, Wrought Steel, etc.

Standpipes.

Sterilizers: all kinds.

Tanks: For Acid, Air, Automobile, Blow-off, Brine, Creosoting, Closet Tanks, Expansion, Factory, Fuel Oil, Gas, Gasoline, Grain, High Pressure, Hot Water, Melting, Mixing, Oil, Plumbers', Pneumatic, Septic, Sewage Disposal, Soda Water, Tempering, Varnish, Water Supply.

Trays: all kinds.

Tubs: all kinds.

Vulcanizers: all kinds.

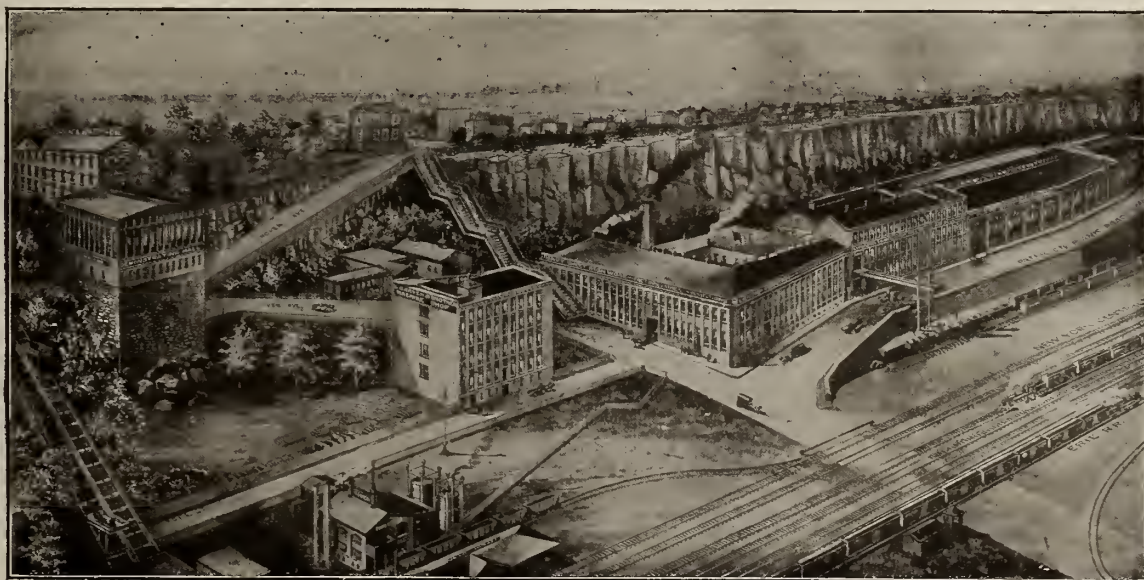
Washers: Can, Vegetable, etc.

Services.

This firm makes a specialty of the design and manufacture of machines and apparatus of all kinds for engineers and manufacturers. The partial list of products included herewith gives some idea of the variety of work which may be furnished to order.

The desired apparatus may be manufactured from the following metals: sheet iron, copper, bronze, brass, lead, block tin, zinc, monel metal, aluminum, etc.

Estimates will be furnished from specifications and drawings, or, if preferred, this firm's engineers will submit plans of work desired, on consultation as to requirements.



PLANT OF L. O. KOVEN & BROTHER, JERSEY CITY, N. J.

LOVE BROTHERS INCORPORATED

Founders and Machinists

AURORA, ILL.

Products.

GRAY IRON CASTINGS.
BRASS and BRONZE CASTINGS.
SPECIAL MACHINERY.

LOVE BROTHERS INCORPORATED are now manufacturing complete for engineering companies a wide range of products of which the following are typical:

Reversing mechanism for open hearth furnaces;
heating furnaces, soaking pits, etc.
Water cooled ports for such furnaces.
Water cooler frames, etc., for furnace work.
Steam and water valves.
Filter presses.
Metallurgical furnaces.
Gas producers.
Chemical castings and chemical apparatus.
Special alloyed irons.
Conveying machinery.
Sugar machinery.
Marine work.

History of the Business.

LOVE BROTHERS INCORPORATED have operated foundries and machinestops at Aurora for many years.

The business was originated by the men who at the present time manage the company. Their personal experience as moulders, then as overseers of a small foundry, and later as the managers of a rapidly developing business, insures that practical point of view which is essential to the successful development of every business.

The administrative ability which today characterizes the management of this corporation has grown with its opportunities and kept pace with its development.

The management is well aware that the future must see a constant increase in efficiency, and the necessary measures have been taken to insure success in this regard.

The financial strength of the company has constantly increased, and its responsibility is unquestioned.

Location of Works.

The foundries and machinestops of LOVE BROTHERS INCORPORATED are situated at Aurora, Ill., thirty-seven miles west of Chicago, a railroad center unrivalled for its facilities in supplying the necessary raw materials, and affording the promptest and most extensive shipping facilities. It is perhaps no exaggeration to say that no better location for a business of this kind could be found in the United States. Labor conditions have uniformly been good and the available skilled labor is of a stable and satisfactory character. The city of Aurora is constantly growing. Its manufactures are thoroughly well established. The location so near Chi-

cago insures the best opportunity for obtaining all necessary supplies.

Manufacturing Facilities.

The company operates gray iron foundries, brass foundry, and necessary machinestops.

The foundries are adapted to all classes of work, and the foundry experience and metallurgical knowledge which are peculiarly the characteristics of the company, offer the fullest measure of protection to customers as to quality of the work produced. Castings can be handled up to 10 tons.

The machinestops are equipped to handle the maximum size of castings which the foundries can produce. Planers, boring mills, drills and lathes are all modern, well kept up, and capable of turning out accurate work.

Manufacturing Policy.

LOVE BROTHERS INCORPORATED have long been known as a first class jobbing foundry and machinestop.

Of late years their business has rapidly developed in the manufacture of complete machines and apparatus for engineering customers. This resulted in a declared policy on the part of LOVE BROTHERS INCORPORATED whereby the facilities of the company have been to a very large extent devoted to this particular class of work.

Results of this Policy.

LOVE BROTHERS INCORPORATED have thus firmly established themselves in the business of acting as the manufacturing end of engineering concerns and in certain lines of custom work, and are constantly improving their practice, due to the development of the engineering specialties whose needs they serve.

The work is completely manufactured, fully assembled, tested where necessary, and put in condition for permanent installation.

The customers are accorded every facility to examine the progress of the work and, in the experience of the company, have expressed themselves as fully satisfied with the way in which these complete lines of manufacture have been turned out for them.

It is the natural result of such a history, such experience, and such facilities that further developments along these lines should constitute the future work which the company will undertake.

Correspondence with those who are desirous of making use of the company's facilities is solicited, and personal visits to the plant are welcomed. A New York office is maintained by the company and systematic attention is given by a competent sales staff to the needs of customers wherever located.

THE PETROLEUM IRON WORKS COMPANY

(OF OHIO)

Steel Plate Construction

SHARON, PA.

DISTRICT SALES OFFICES

NEW YORK, N. Y., 50 Church Street
HOUSTON, TEX., 1110 Carter Building

ST. LOUIS, MO., 712 Third National Bank Building
SAN FRANCISCO, CAL., 503 Market Street

Products.

All classes of LIGHT and HEAVY STEEL PLATE CONSTRUCTION for the oil, gas, chemical, iron and steel, municipal, water works, railway and allied engineering industries, including:

Tanks for every purpose—Oil storage, large and small; acid storage; water; turpentine storage; molasses; grain; tar; asphalt; hydro-pneumatic; pressure; filter; car; bleaching; distillate; benzol; drip; gasoline, naphtha, benzine, lubricating oils and all classes of petroleum products; malt; alkali, caustic soda; brine; sand; compressed air storage; evaporating; cooling; settling; mixing; gaging, etc.

Oil Refinery Equipment—"Leman" counter current condensers; condenser boxes; agitators; stills of all descriptions.

"Gem" Bilged Steel Barrels; "Presteel" Drums; Standpipes; Water Towers; Smokestacks, Guyed and Self-supporting; Penstocks; Flumes; Riveted Steel Pipe; Galvanizing Kettles; Hot Metal Ladles; Annealing Boxes, Condenser Boxes; Pulp Digesters; Creosoting Cylinders; Coal and Ash Storage Bins; Ore Storage Bins, etc.

Also, Breechings for boilers; Buckets, scrap and dredge; Lime Kilns; Coaling Towers.

Offices and Works.

The general offices and works are situated about three miles south of Sharon, Pa., on the Youngstown and Sharon Street Railway, and consist of modern, substantially built structural steel buildings, including fabricating shops, power plant, machinshops, warehouses, storage yards, etc., equipped with the most modern and most efficient machinery necessary for the fabri-



TRADE-MARK

cation of all classes of light and heavy steel plate work. The plan and general layout of buildings and manufacturing equipment is such that all P. I. W. products are efficiently, accurately and quickly fabricated.

The manufacturing equipment also includes complete welding apparatus, enabling us to furnish welded work when desired.

Shipping Facilities.

The works have direct connections with the New York Central, Erie, and Pennsylvania Railroad systems.

The present yard trackage for handling inbound and outbound freight is about three miles in length and affords ample space for car storage, and ideal facilities for making shipments, thereby eliminating car shortage and delays occurring where there is but one railroad connection, making possible prompt delivery to points in practically every direction.

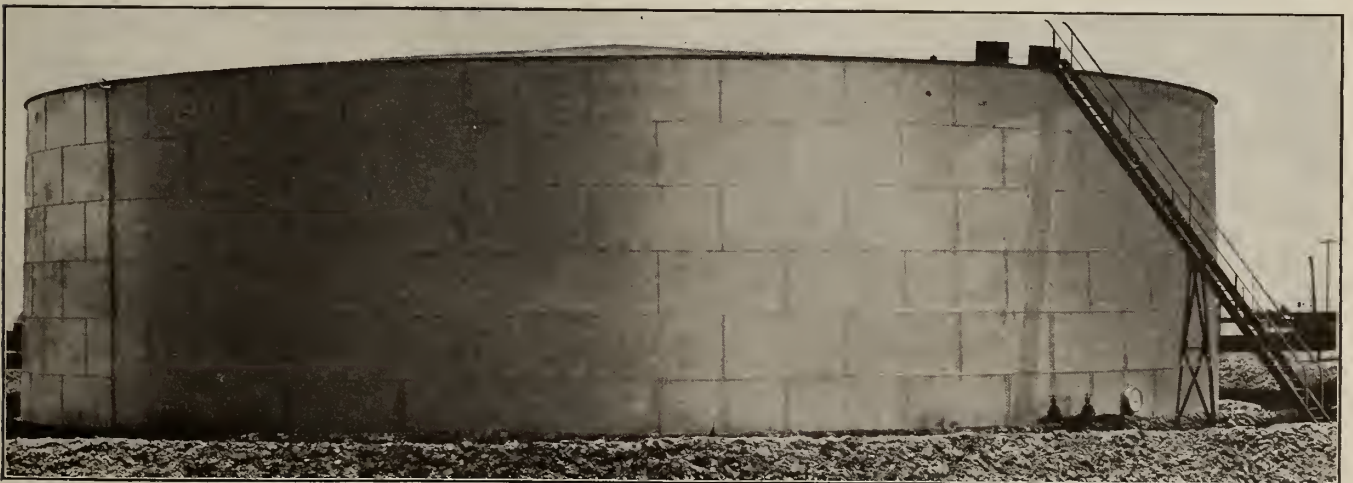
The closeness of the plant to the heart of the iron and steel district insures excellent service in obtaining raw materials and other commodities used in the fabrication of P. I. W. products.

Inspections and Tests.

During the process of manufacture inspections and tests, varying in accordance with the character of the work in hand, are applied. These are sufficiently rigid to more than meet the local field conditions to which the finished product will be subjected.

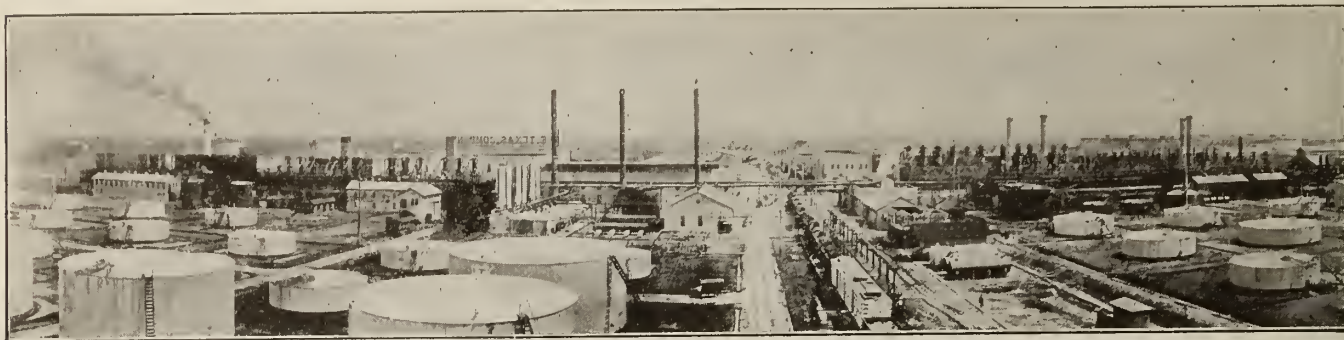
Engineering Service.

Technically trained men with many years of practical experience comprise the engineering, sales, and



55,000-BARREL OIL STORAGE TANK, 114 FT. 6 $\frac{3}{4}$ INS. DIAMETER BY 30 FT. 4 $\frac{1}{2}$ INS. HIGH

A standard size tank for oil storage and carried in stock for immediate shipment. We have designed, fabricated and erected oil storage tanks from 5 ft. to 120 ft. diameter and 5 ft. to 45 ft. high with capacities from 25 to 64,000 barrels



THE TEXAS COMPANY'S REFINERY, PORT ARTHUR, TEX. (Continuous with view on opposite page)

The above view shows a wide range of steel plate products, many of which have been fabricated and erected by THE PETROLEUM IRON WORKS COMPANY. While this company has not fabricated and erected all of the steel plate work shown in this illustration, it has fabricated and erected approximately 65 stills; 21 condenser boxes of various sizes and capacities; 18 agitators; 81 storage tanks of various sizes, from a few hundred

operating organizations. These men are prepared to design and fabricate all classes of light and heavy steel plate construction, either from rough sketches, where it is necessary to supply all detailed drawings used in manufacturing and erecting, or from working drawings furnished by customer. The thoroughness and accuracy of this engineering service is indicated by the fact that independent erecting forces experience no trouble in constructing or assembling P. I. W. products in the field, and that P. I. W. products are efficient and durable in service.

To facilitate erection, special working drawings and erecting plans that are intelligible and comprehensive are furnished, enabling any steel construction engineer or contractor to erect P. I. W. products as readily and satisfactorily as when P. I. W. field forces are employed.

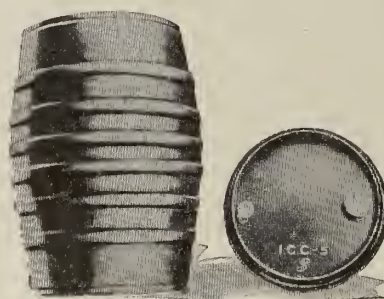
Field of Activity.

THE PETROLEUM IRON WORKS COMPANY has sold and erected its products in practically every oil field of importance in the world. This company was one of the first manufacturers of oil storage tanks, and other steel plate construction used in the petroleum industry, to enter foreign fields, and is therefore not only prepared to contract for steel plate work in the United States, but in any part of the world.

In addition to the wide scope of P. I. W. activity in the oil fields, this company has designed, fabricated and erected hundreds of other steel plate products for use in various industrial fields as evident from the list of products. P. I. W. field of service covers many classes of engineering projects such as water works, hydro-electric and other power plants, railway, iron and

steel, and practically every industry where steel plate construction is necessary.

"It is P. I. W. Service and P. I. W. Service is World Wide."



"GEM" BILGED STEEL BARREL

Showing the 6 outward hoop formations rolled into the frame of barrel.
Made only in 55-gal. capacity—black or galvanized



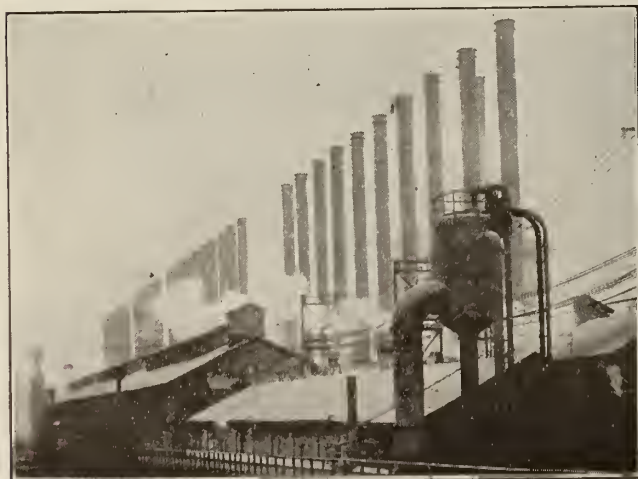
"PRESTEEL" DRUM

Conforming to all Interstate Commerce Commission's requirements for shipping containers. Capacities, 15, 30, 50, 55 and 110 gals.

Inquiries.

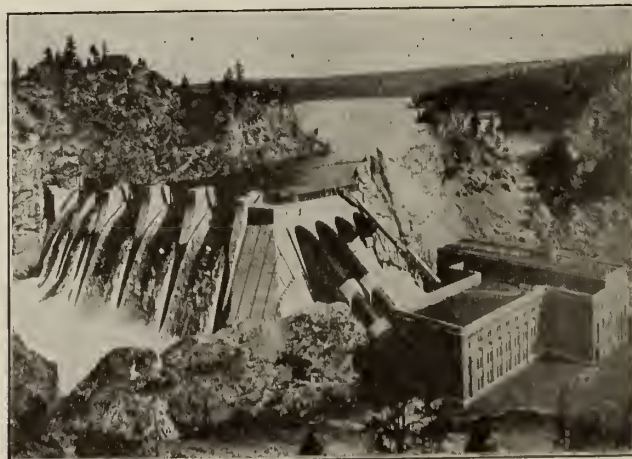
When writing for quotations, detailed information, as well as drawings and information relative to local conditions, as the haul from the nearest railroad station or siding, topography and other general field conditions of the district, accommodations for boarding erecting forces, etc., will assist in the prompt and accurate preparation of estimates.

The importance of giving complete data is self-evident. If inquiries are accompanied with detailed information, the company will be enabled to intelligently and quickly quote on requirements.



GROUP OF SMOKESTACKS

Fabricated and erected for the Youngstown Sheet & Tube Co., Youngstown, Ohio

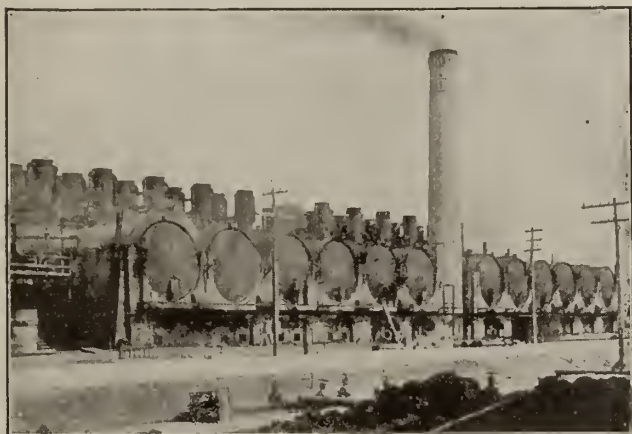


PENSTOCKS

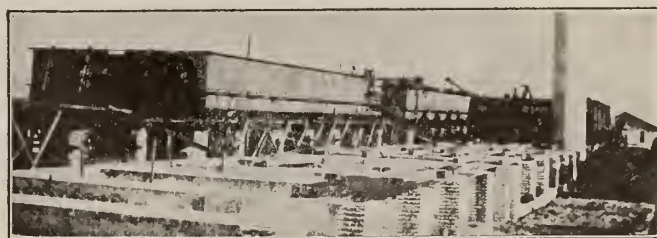
Fabricated for the Washington Water and Power Company and erected at Long Lake, near Spokane, Wash. These penstocks are 300 ft. long and convey water power from the highest spillway dam in the world—227 ft. high



THE TEXAS COMPANY'S REFINERY, PORT ARTHUR, TEX. (Continuous with view on opposite page)
barrels up to and including those of 55,000-barrel capacity; 30 filter tanks; 4 dump tanks; 2 receiving tanks; 26 filling tanks; 5 separator tanks; 22 exchanger tanks; 16 steam drums; 11 grease tanks, some steam jacketed; acid tanks, kettles, and many other steel plate products. This refinery is one of the largest in the world



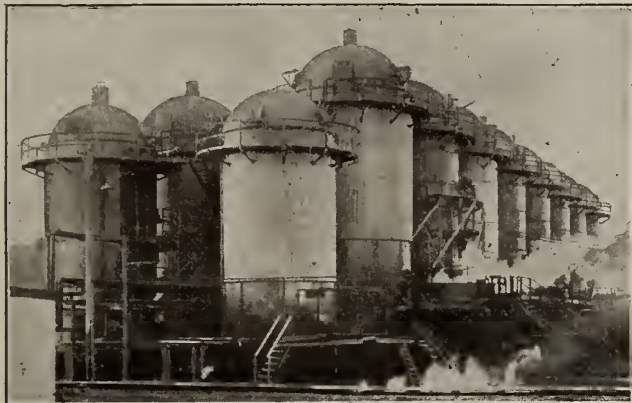
BATTERY OF PARAFFIN STILLS
Built for the Texas Company, Port Arthur, Tex.



BATTERY OF CONDENSER BOXES
In course of construction for the Texas Company, Port Arthur, Tex.



FOUR SINGLE, THREE DOUBLE AND THREE TRIPLE COMPARTMENT CYLINDRICAL, HORIZONTAL OIL STORAGE TANKS ON STRUCTURAL STEEL SUPPORTS



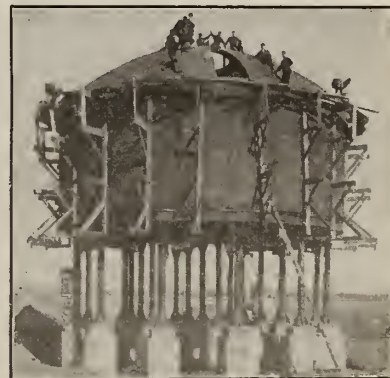
BATTERY OF 18 AGITATORS
Built for the Texas Company, Port Arthur, Tex. This is one of the largest installations of its kind yet to be erected

Illustrations.

On this and the two preceding pages are illustrated examples of steel plate work fabricated and erected by this company. They partially show the wide range of activity in many fields. The sizes and capacities of these products are not indicative of manufacturing ability or capacity, they being limited only by operating conditions of the field in which the products are to be used.



EIGHT ALUMINUM ORE BINS, 34 FT. DIAMETER BY 70 FT. HIGH
Aluminum Company of America, Massena, N. Y.



2000-TON ACID TANK
45 ft. $5\frac{3}{4}$ in. diameter by 26 ft. $7\frac{7}{8}$ in. high
One of 6 erected for the General Chemical Co., East St. Louis, Ill., Marcus Hook, Pa., Nichols, Cal., and Bayonne, N. J. We have built other acid storage tanks up to 2000 tons capacity

STRUTHERS-WELLS COMPANY

Riveted and Welded Steel Plate Construction

WARREN, PA.

NEW YORK SALES OFFICE: 50 Church Street



VIEW OF MAIN OFFICE AND WORKS

Products.

RIVETED and WELDED STEEL and IRON PLATE CONSTRUCTION of every description, with various STRUCTURAL SHAPES, FINISHED CASTINGS and FORGINGS, including Riveted and Welded Pipe; Steel Tanks (Rectangular, Circular or Oval) for storage, pressure and vacuum; Coolers; Retorts; Dryers; Jacketed Kettles for cooking, boiling and evaporating; Evaporating Pans; Cylinders for brick hardening and creosoting purposes; Stills; Heaters.

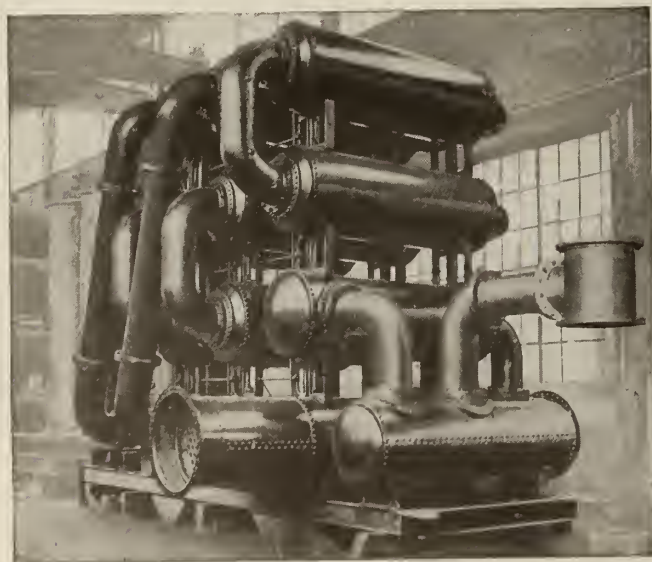
Steam Regenerators; Incinerators; Extractors; Steam Headers; Stacks; Penstocks; Exhaust Piping; Standpipes; Flumes; Condensers; Steel Plate Equipment for refining sugar and oil; for the manufacture of paper, soap, chemicals, rubber, paints, acids, powder; for use in the distillation of wood in the production of turpentine, wood alcohol and their by-products; Horizontal Tubular Boilers.

The Plant.

The workshops of this company cover seven acres and consist of a plate shop, flange and forge shop, pattern shop, foundry and machinshop; a complete unit under one ownership and management, fully equipped with most modern tools and appliances.

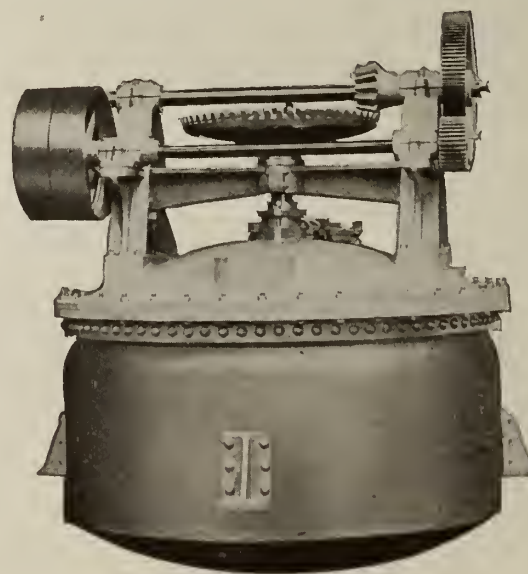
PLATE SHOP—Comprises seven sections or bays. Work starts where the steel plates are first unloaded and moves steadily in one direction to completion of product. No back-tracking; shears and punches, flange presses, bending rolls, riveters, calking and testing apparatus, etc., are so placed that each operation is performed in consecutive order. Entire floor space served by electric traveling cranes that move all work quickly.

WELDING DEPARTMENT—Occupies one entire section of plate shop, 24 by 446 ft. Oxy-acetylene welding and electric welding are both used for welding plates up to 1 in. in thickness.



NUMBER OF STEEL HEATERS AND TANKS

Connected with cast iron return bends and pipes; units separated and supported by cast iron stands, all resting on steel foundation (not illustrated). Connections are rigidly bolted joints, requiring absolute accuracy of workmanship. Length of outfit, about 45 ft.



JACKETED TANK

Welded seams in both inside and outside shells, with cast iron cover bolted on; stirring arms on inside; complete driving apparatus outside; a product of foundry, machine and plate shops

Knocked Down Work.

Knocked down fabricated material for plate construction (when too large to ship intact) furnished; working drawings supplied for guidance of erecting gangs; such material is assembled in shop before shipment, to insure accurate dimensions and to minimize work in the field. Knocked down material for export will be properly wired for ocean transportation, and nested to reduce space.

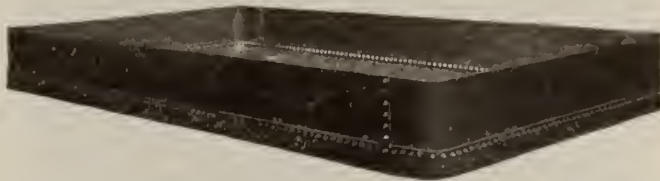
Work of Special Design for Particular Purposes.

Estimates on intricate or simple work promptly furnished. Drawings and specifications of special design for any particular purpose should be forwarded to our nearest office, in order to obtain an estimate or special report from the Engineering Department.

Responsibility Centralized.

All operations connected with Struthers-Wells serv-

ice are carried on under one roof and one responsibility, without outside assistance. Absolute secrecy is assured, as the plant contains its own Engineering Department, drafting rooms and all necessary shops. Every operation in each job is executed by our own men under our guidance and control. Full responsibility for the complete work is accepted.



EVAPORATING PAN

Steam jacket extends over entire bottom; inner and outer bottom plates are staybolted together; jacket tested to any working pressure required. Length, 16 ft.; width, 8 ft.



CHARCOAL COOLER

Used in wood alcohol and turpentine industries where destructive distillation process is employed. Made in any desired length, with airtight doors at one or both ends



RIVETED PIPE SPECIAL

Construction of this character requires expert laying out and careful workmanship in order that dimensions may be accurately maintained



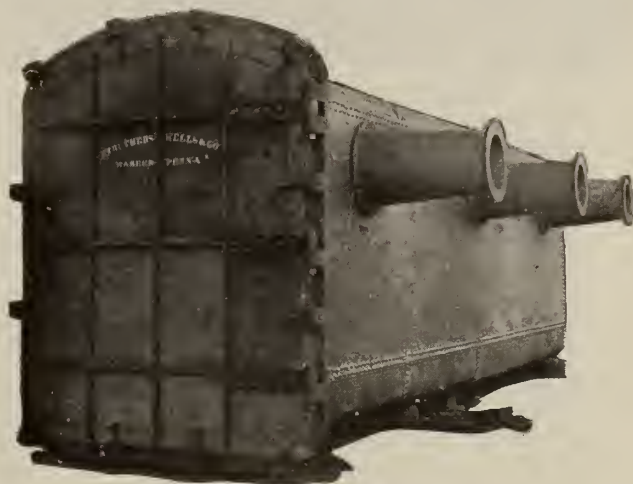
BRICK HARDENING CYLINDER

Diameter, 78 ins.; length, 75 ft.; removable heads at each end; cylinder loaded for shipment on 2 cars. Built in varying lengths up to 120 ft. and for any working pressure required. This cylinder was subjected to a cold water pressure test of 225 lbs. per sq. in.



FIRE STILL

For refining petroleum. Heads of still are flat, braced on inside to withstand required pressure; dished heads also furnished. Note pressed steel detachable lugs. Diameter, 10 ft.; length, 30 ft.



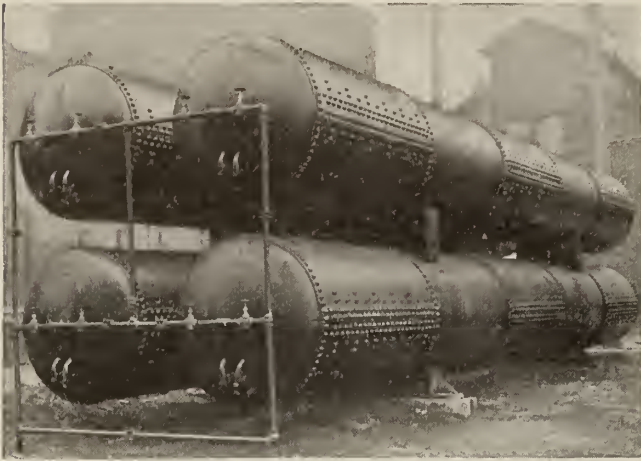
AN OVEN RETORT

Used in manufacture of wood alcohol and turpentine by the destructive distillation process. Built in any length desired, usually 26 to 56 ft.; width 6 ft., 3 ins.; height, 8 ft., 4 ins. Airtight doors on one or both ends. Installed in batteries set in brickwork, like setting of steam boilers



CARLOAD OF RIVETED PIPE

Diameter, 24 ins. Built in sections 30 ft. long, with bolting flanges at each end



FOUR PRESSURE TANKS

Diameter of each tank, 5 ft.; length, 35 ft.; made for storage of oxygen under 300 lbs. pressure per sq. in.; tested under 450 lbs. pressure per sq. in.; designed with ample factor of safety. Note high grade riveted work



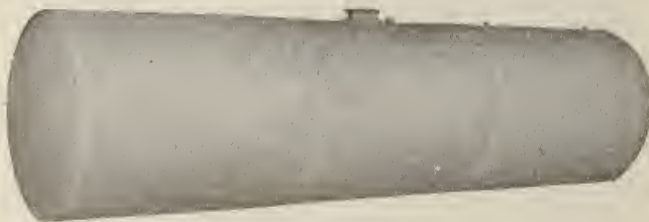
FOUR CYLINDRICAL TANKS

Tanks (for mixed character of work) of special design and construction from the Struthers-Wells shops; diameter of each, 9 ft.; length, 17 ft.; tested under 25 lbs. pressure. Note special castings for manhole openings, connections between tanks, inlet and outlet piping, steel supporting structure, etc.

Oxy-acetylene and Electric Welding.

By use of these welding processes, a number of pieces can be welded into one homogeneous whole which expands and contracts equally throughout, giving an absolutely and permanently tight job, a perfect seamless joint. Buckling, opening of seams and shearing of rivets are eliminated.

ADVANTAGES—Welded seams are vastly superior to riveted seams, (1) in tanks holding air and gas under pressure; (2) in tanks for storage of oil, gasoline and other fluids of a volatile nature; (3) evaporation, therefore, reduced to a minimum; (4) welded seams are a safeguard against fire; and (5) this process permits use of steel plate exclusively in complicated construction formerly requiring plates, forgings and castings, with expensive dies and patterns.



OXY-ACETYLENE WELDED TANK

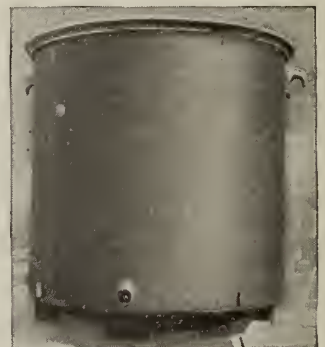
Diameter, 6 ft.; length, 25 ft.; welded seams; working pressure, 50 lbs.; tested under a pressure of 75 lbs. per sq. in.—a permanently tight tank



TRANSFORMER TANKS WITH ELECTRICALLY WELDED SEAMS

In service, these tanks contain a special oil in which the transformer is submerged. The temperature frequently runs up to 150°, making the oil difficult to hold. Welded seams properly made are absolutely and permanently tight in such service. Note that all rivets in lugs at tops of tanks are above oil level

The welded tank is rapidly supplanting the riveted tank in many requirements of plate construction, especially in those cases referred to in preceding paragraph. Plates (1 in. thick) for any kind of work can be successfully welded by means of the process followed in the Welding Department; and the experience of this company during a period of ten years is a sufficient warrant for efficient welding operations.



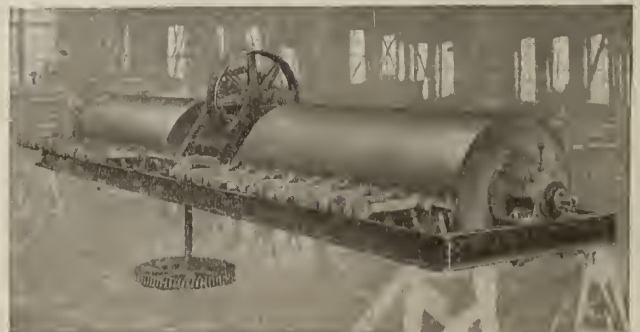
TANK

Diameter, 10 ft.; height, 10 ft. Shell in one plate, and bottom in one plate. Welded seams throughout

WELDED TANK WITH
PRESSED STEEL COMBI-
NATION BOTTOM AND
BASE

ELLIPTICAL SHAPED TANK

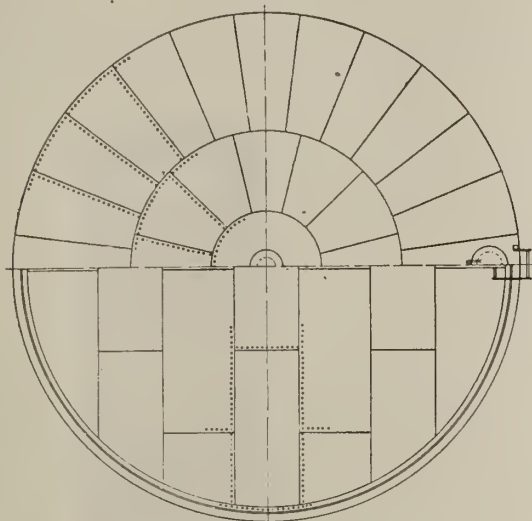
Special construction, 8 ft. wide, 15 ft. long, 11 ft. high. Tested under 30 lbs. pressure. All seams welded



A PAIR OF ROTARY DRYERS WITH SCRAPER ATTACHMENTS

Steel Storage Tanks.

Materials for storage tanks of all sizes and of any thickness of steel plates are fabricated and furnished to meet all requirements. Designs are made in accordance with character and weight of contents, with proper weight of plates and type of riveting, to give sufficient factor of safety at all heights. All parts are assembled in shop to verify accuracy of holes and other preliminary work; each piece is then plainly marked for guidance of erecting gang; material is painted, small parts boxed and entire tank is shipped knocked down. Blue prints are supplied to men in the field to facilitate erection.



PLAN AND ELEVATION OF STEEL STORAGE TANK WITH GLOBE-SHAPED ROOF

Engineering Service.

Those having jobs involving steel plate construction will find the co-operation of this efficient organization very valuable.

Difficult, intricate and apparently baffling problems in steel plate construction are solved here daily, and this accumulated experience is at the disposal of those having such problems.

If customers' ideas are fully developed, they can depend on our ability to interpret them intelligently, or, the Engineering Department will develop customers' ideas, putting them into practical shape, and the shop will fabricate the work. No job too large or difficult; none too small to receive best attention.



RECTANGULAR TANK

Width, 17 ft.; length, 22 ft.; height, 15 ft.; with welded seams, braced inside and outside for pressure and vacuum



TWO TANKS

Each 8 ft. diameter by 8 ft. high, with vertical mixing apparatus and driving gears. Tanks similar to these in construction, some of them jacketed for steam and others equipped with steam coils, are used in the manufacture of paints, in the compounding of oils and greases, in powder works, soap factories, sugar refineries, and many other lines of business



JACKETED KETTLES

Of varied shapes, both welded and riveted construction. Used for cooking, boiling and evaporating

STEACY-SCHMIDT MFG. CO.

Manufacturers of Lime Kilns and Complete Hydrating Plants
Queen Street, Hay Street, Arch Street, Mill Road and Pennsylvania Railroad
YORK, PA.

CABLE ADDRESS: "BROOMELL,"—Codes used: A. B. C. 5th Edition and Western Union

Products.

KEYSTONE LIME KILNS, COMPLETE LIME and HYDRATING PLANTS, and EQUIPMENT for ELDRED PROCESS for Lime Burning.

Also, Belgian and other type Kilns for the extraction of carbonic dioxide gas; Bag Filters, Stacks, Tanks, Castings, Turntables and Special Machinery from engineers' designs.

For Sugar Machinery, see page 1149.

Keystone Lime Kilns.

The Keystone kiln, the result of the best kiln practice, is an all-steel brick lined kiln built of very heavy steel boiler plate, beams, angles, etc., to give the strongest possible construction. May be fitted to burn either coal, wood, gas or oil as fuel.

Repeated requests have been made to this company to design the Keystone kiln so as to use a mechanical

conveyor of lime from the bottom of the cooling cone to crusher or bins instead of trucking the lime away.

This result has been accomplished by setting the furnaces at right angles to drawing shears.

Keystone kilns will in the future be furnished in this way when *specially* ordered.

GAS PRODUCER KILNS—We are prepared to furnish Keystone kiln installations, and Keystone kiln gas-fired lime kiln installations complete.

FORCED OR INDUCED DRAFT—If either forced or induced draft is desired for increased production over natural draft, this company is prepared to furnish such equipment.

CAPACITY—The capacity of lime kilns and the cost of burning are dependent on a large number of variables—the nature and quality of the rock, the kind and quality of fuel used, together with the management and skill of the burners—so that it is impossible to predict the exact amount that can be obtained from a given kiln. However, under average conditions, with a standard kiln burning coal or wood, 9 to 14 tons may be produced per day; if forced or induced draft is used these figures are exceeded. With

producer gas or oil for fuel this capacity is from 14 to 25 tons per day.

SPECIFICATIONS—Diameter of shell outside, 11 ft. Diameter of brick lining inside, 6 ft. 6 in. Total height of kiln, 47 ft. 10 in. Shipping weight, about 42,500 lbs.

Improved Keystone Kiln.

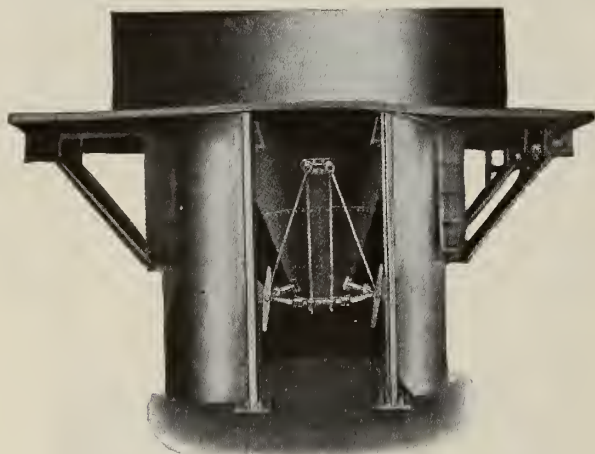
Test installations for this company's new type kiln, the Improved Keystone, have been concluded. Catalogues and claims can be had on application.

Eldred System.

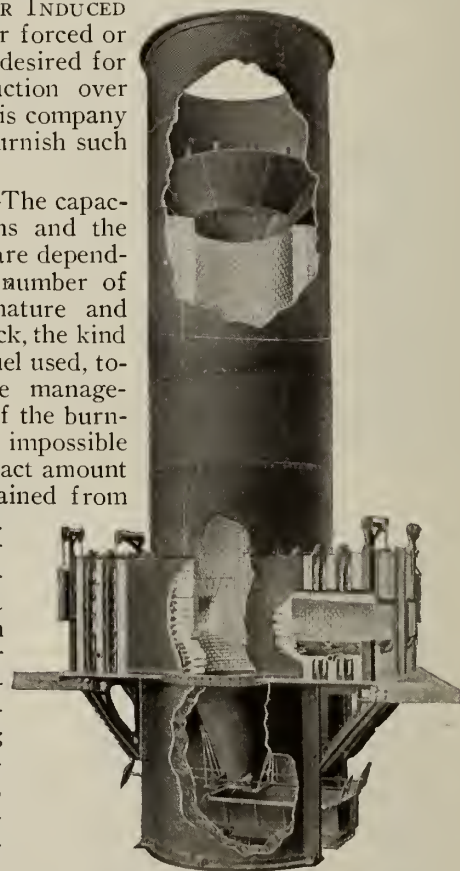
The company is prepared to install Keystone lime kilns using coal as a fuel with the Eldred process. This patented process insures a very substantial output on an economical installation.

Lime Hydrating Plants.

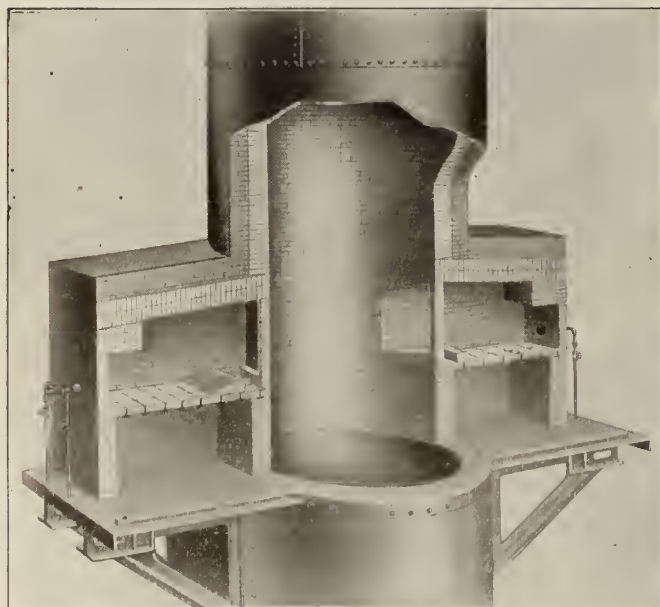
The company is prepared to furnish complete lime and hydrating plants, either from specifications or from their own designs.



VIEW SHOWING KEYSTONE KILN SET AT RIGHT ANGLES TO DRAWING SHEARS



SECTIONAL VIEW KEYSTONE LIME KILN



SECTIONAL VIEW SHOWING OIL BURNING TYPE

TIPPETT & WOOD

Designers, Manufacturers and Erectors of Steel Plate Construction

166 Howard Street
PHILLIPSBURG, N. J.

BRANCH OFFICE, Royal Building, cor. William and Fulton Streets, NEW YORK, N. Y.

Products.

STANDPIPES, WATER TOWERS and STEEL TANKS of every description and for all purposes.

Tanks: Acid, Brine, Car, Coal Tar, Creosoting, Crude Oil, Cyanide, Elevated, Filter, Fuel Oil, Galvanizing, Gasoline, Jacketed, Molasses, Pressure, Refined Oil, Soap, Storage, etc.; Smokestacks, Breechings, Flues, Flumes, Penstocks, Riveted Pipe, Cylinders, Boilers, Condensers, Ladles, Hoppers, Troughs, Pans, Dryers, Receivers, Bins, Supports, Trestles, Accumulators, Agitators, Buckets, Cable Towers, Caissons, Clarifiers, Cylinders, Desiccators, Drums, Gas Holders, Hearth Jackets, Jacketed Kettles, Railway Water and Coaling Stations, Stills, Turntables, Water Jackets, Accessories for Water Towers and Standpipes and all kinds of Plate Steel Work and Structural Steel Construction requiring unusual fabrication.

Quick Shipments.

We carry a large stock of steel plates of several

thicknesses from which we make tanks of a large range of diameters. For special requirements, permit us to make slight substitutions from our stock, and fabrication will proceed immediately. We are equipped and prepared for orders requiring concentration of effort resulting in unusually prompt completion of the work.

Facilities.

Our fifty years of experience are your benefit and assurance of proper attention and construction. Our shops, which are large and equipped with the most modern machinery, have expanded steadily during this time. We are constantly extending and installing new machinery and new methods. No work is too large for us. Send us inquiries stating when material is required. Our engineers are at all times at your service. A catalogue giving information on standpipes and water towers will be mailed on request.



STANDARD WATER TOWER



STANDPIPE FOR CONNECTICUT AGRICULTURAL COLLEGE
Diameter, 25 ft.; height, 80 ft.



ASSEMBLING SHOP

WALSH'S HOLYOKE STEAM BOILER WORKS

Steel Plate Construction

Riverside
HOLYOKE, MASS.

BRANCH OFFICE AND WORKS, DRUMMONDVILLE, QUEBEC, CAN.

Products.

All classes of LIGHT and HEAVY STEEL PLATE CONSTRUCTION, including Riveted and Welded Tanks of every description for water storage, compressed air, acid, filters, rosin, size, heaters, blow-off, receiving, oil, caustic soda, brine, molasses, fuel oil and tar.

Diffusers, Digestors, Incinerators, Barking Drums. Penstocks, Riveted Steel Pipe, Surge Pipes, Wheel Cases and Draft Tubes.

Smokestacks; Flues, Rotary Bleach Boilers, Standpipes, Kiers, Flumes, Expansion Joints for pipe lines, etc.

Fabricated Plates of every description.

Structural Steel for construction, bridges, etc.

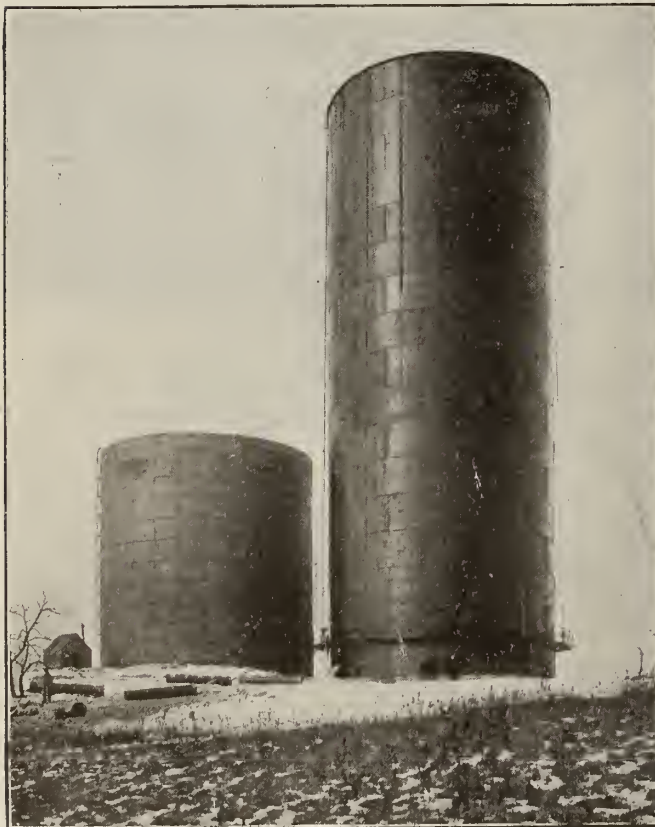
Services.

The practical experience of this company in designing, constructing and erecting is at the service of prospective customers.

The engineering department of this organization will assist in the solution of all steel plate construction problems. As satisfactory a solution is assured, as has been accomplished for many others.

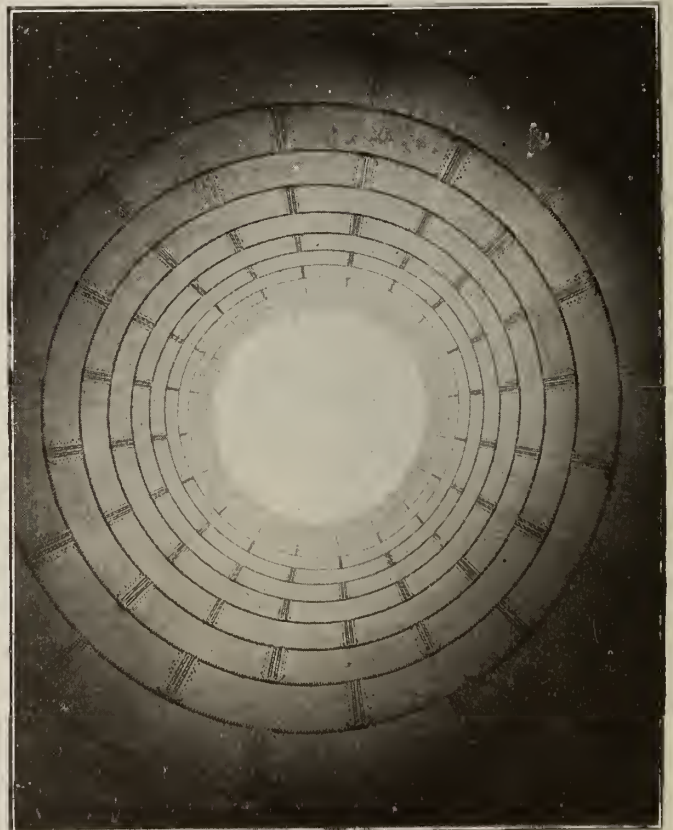
Facilities.

A corps of skilled and experienced mechanics, modern shop tools and portable field equipment insure prompt and satisfactory execution of all contracts.



STANDPIPE ERECTED FOR CITY OF CHICOPEE, MASS.

The largest proportioned standpipe in the world; 50 ft. diameter, 130 ft. high



INSIDE OF STANDPIPE ILLUSTRATED TO THE LEFT



PENSTOCKS, 15 FT. IN DIAMETER, 4,780 FT. LONG, GRAND FALLS, NEWFOUNDLAND

THE BIGGS BOILER WORKS COMPANY

Steel Pressure and Storage Tanks

East Market Street and Case Avenue
AKRON, OHIO

Products.

STEEL TANKS for Pneumatic Water Supply, Hot Water Storage, Gasoline, Fuel Oil, Kerosene, Naphtha, etc.; AIR RECEIVERS.

Jacketed Tanks.

For Vulcanizers and Devulcanizers, see page 1136.

Pneumatic Water Supply Tanks.

Recommended and guaranteed for a safe daily working pressure of 75 lbs. Materials and workmanship are the best. Rivets are closely spaced and are hydraulically driven.

Heads are flanged and dished under hydraulic pressure of 300 tons in formers which are accurately machined. Water gauge openings are tapped automatically by a special machine. Openings for pipe connection are properly reinforced, using forged steel flanges on sizes $1\frac{1}{4}$ in. in diameter and larger.

Thoroughly inspected during construction, and upon completion are subjected to a hydrostatic test pressure of 50% in excess of the safe daily working pressure. Absolutely airtight.

Price lists furnished on application.

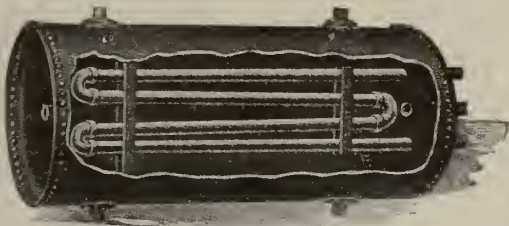


PNEUMATIC WATER SUPPLY TANKS

Extra Heavy Hot Water Storage Tanks.

Made with or without coils. Standard coils are made of four pipes connected with three return bends. They are securely fastened to the tank and properly braced. Can be equipped with special coils if desired.

Price lists furnished on application.



EXTRA HEAVY HOT WATER STORAGE TANK FOR 100 LBS. PRESSURE

Extra Heavy Gasoline Storage Tanks.

Constructed according to specifications of the National Board of Fire Underwriters, and, if desired, will be furnished with underwriters' label attached at no additional charge. Suitable for the storage of gas, fuel oil, kerosene, gasoline, naphtha, etc.

An absolutely tight joint is assured under all conditions, all rivets being closely spaced and driven hot under hydraulic pressure. All seams are lap jointed, single riveted, properly laid up and calked metal to metal without composition filler.

On tanks under 15,000-gal. capacity, heads are dished to the true radius of the diameter of the tank,

one head being riveted in convex and one concave, which materially reinforces the tank.

Material is the best open hearth steel, and workmanship is subject to the most critical inspection.

Standard sizes of oil and gasoline storage tanks are carried in stock.

Price lists furnished on application.

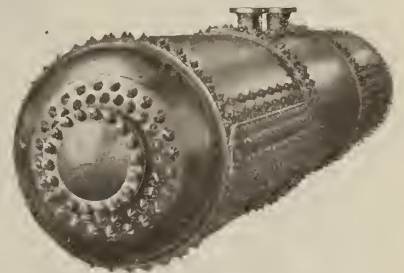


EXTRA HEAVY GASOLINE STORAGE TANK
Capacity, 84 gals. to 25,000 gals.

High Pressure Tanks.

The tank in accompanying illustration is designed for 500 lbs. working pressure. Shell plates are $1\frac{1}{2}$ in. thick. Rivets are $1\frac{5}{16}$ in. in diameter, with longitudinal seams butt joint, quadruple staggered riveted with inside and outside covering strap.

We are specialists in high pressure tank construction, and our plant is hydraulically equipped throughout, enabling us to fabricate material $1\frac{1}{2}$ in. in thickness.



STEEL STORAGE AND PRESSURE TANK

Air Receivers.

The construction of these air receivers and the selection of materials both receive the utmost care. Tested to 50% in excess of guaranteed safe working pressure. Rivets are hydraulically driven. Heads are flanged and dished to true radius of diameter of shell. Openings are reinforced with forged steel flanges.

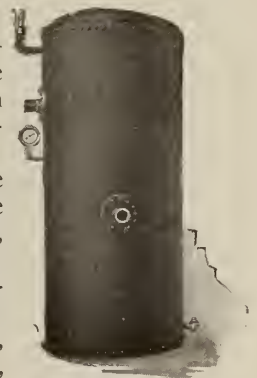
Horizontal receivers with manhead have both heads riveted in convex. Manhead is always placed in head near drain opening, unless otherwise specified.

Vertical receivers with manheads have bottom head concave and manhead is located in shell on line with outlet near bottom, unless otherwise specified.

Standard air receivers have longitudinal seams lap joint, double staggered riveted; circular seams, single riveted.

Price list furnished on application.

Prices of special air receivers, for any working pressure desired, also quoted on application.



AIR RECEIVER

W. E. CALDWELL CO., INC.

Manufacturers of Tanks and Tank Towers

2240 Brook Street
LOUISVILLE, KY.

Products.

WOOD, STEEL and GALVANIZED IRON TANKS; TANK FOUNDATIONS; TUBULAR, ANGLE or CHANNEL COLUMN and WOOD TOWERS; FRICTION CLUTCHES and PULLEYS.

Steel Stacks, Standpipes, Tank Agitators; Water Supply Systems; Gearing and General Power Transmission Machinery.

Industrial Tanks.

Tanks for industrial and special purposes, in wood or steel—round, rectangular, elliptical, or any shape.

WOOD—This company specializes in cypress, as it is the best wood for tanks for most purposes. It has great durability, minimum shrinking and swelling and does not give taste or color to drinking water.

Fir, yellow pine, white pine, white cedar and poplar are also used.

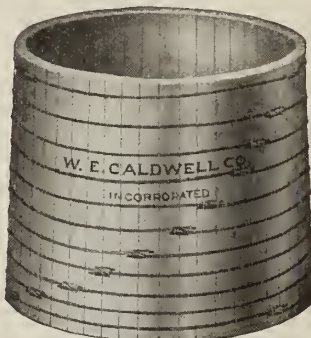
Specifications—Lumber is thoroughly dried, without loose or unsound knots, splits, shake, peck or wormholes or other defects. All heart on inside, sound sap on outside only, not to exceed one-half the thickness.

Thickness: 2 in. for 10,000 gals. and smaller; 2½ in. up to 20,000 gals.; 3 in. for larger sizes. Finished thicknesses are 1¾, 2¼ and 2¾ in., respectively.

Standard Inside Diameter: Every 6 in. from 3 ft. to 9 ft., every foot to 16 ft., and every 2 ft. above 16 ft.

Standard Inside Depth: 1 ft. 5 in.; 2 ft.; 2 ft. 5 in.; 3 ft.; 3 ft. 5 in.; 4 ft.; 4 ft. 5 in.; 5 ft.; 5 ft. 5 in.; 6 ft.; 6 ft. 5 in.; 7 ft. 5 in.; 9 ft. 5 in.; 11 ft. 5 in.; 13 ft. 5 in.; 15 ft. 4 in.; 17 ft. 4 in.; 19 ft. 4 in.; 21 ft. 4 in.; 23 ft. 4 in.

Workmanship: Staves dressed both sides. Edges machine jointed to proper bevel. Bottom dressed on top side only. Machine jointed straight and square and well doweled.



WOOD TANKS



Hoops: Round hoops of wrought iron (not steel) with malleable iron draw lugs; sizes and spacing to give a safety factor of 4 to 1.

STEEL—Thin galvanized tanks are recommended only in small sizes and for intermittent or temporary use.

Heavy steel tanks made in any shape or size.

Specifications—The standard diameters and depths are in even feet. The standard thicknesses are ⅛ in. up to and including 10 ft.; ⅜ in. up to 16 ft.; ¼ in. up to 24 ft., and ⅝ in. above 24 ft.

These can be furnished set up, in the smaller sizes, or knocked down, all punched, fitted and bent to shape with the necessary rivets.

Tank Foundations.

Plans for foundations on the ground will be furnished. Designs of, and prices on, foundations for special conditions will be submitted on receipt of a sketch with the necessary rivets.

Tank Towers.

TUBULAR COLUMN—Classes O to G built with tubular steel columns and struts, in heights of 15 ft. and every 12-ft. interval above to 100 ft.

ANGLE COLUMN—Classes CC to LL built with steel angles for columns and struts, in heights of 12 ft. and every 10-ft. interval above to 102 ft.

LATTICED COLUMN—Classes LD to LH built with latticed steel channel columns and struts (bridge construction), in heights of 20 ft. and every 5 ft. above to any height.

Note—Above types of towers are for flat bottom tanks (see table) and are furnished with either a steel or wood foundation for the tank at the top.

HEMISPHERICAL ALL-STEEL TANKS AND TOWERS—Made with latticed columns and struts in all capacities and heights.



TANK AND TOWER.
STUDEBAKER BROS.
MFG. CO.,
SOUTH BEND, IND.
150,000 gals., 206 ft. high

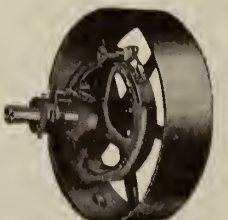
DIMENSIONS AND CAPACITIES OF STANDARD TOWER TANKS

Class towers*	Capacity, gals.	STANDARD WOOD TANKS		STANDARD STEEL OR GALVANIZED TANKS	
		Diameter ft.	Depth in.	Diameter ft.	Depth in.
O tubular, or CC angle.....	1,000 1,500	6 6	4 5	6 0	5 0
A tubular, or FF angle.....	2,800 3,000	8 0	7 5	8 0	8 0
B tubular, or HH angle.....	5,000 6,000	10 0	9 5	10 0	10 0
C tubular, or JJ angle.....	10,000 12,000	12 6	11 5	12 0	12 0
D tubular, or KK angle or LD latticed.	15,000 17,000	14 0	13 5	14 0	14 0
E tubular, or LL angle or LD latticed.	20,000 22,000	16 0	15 5	16 0	14 0
ES tubular or LES latticed.	25,000	16 0	17 4	16 0	18 0
F tubular, or LF latticed.....	30,000 33,000	18 0	15 4	18 0	18 0
FS tubular or LFS latticed.	35,000	18 0	19 4	18 0	20 0
G tubular, or LG latticed.....	36,000 40,000	19 6	17 4	20 0	18 0
LH latticed.....	50,000 55,000	22 0	17 4	22 0	18 0

*Hemispherical bottom steel tanks and towers are regularly made in capacities from 10,000 gals. up. Any of the above towers can be made to suit special conditions.

Caldwell Friction Clutch.

The basic principle of this clutch is identical with that of the standard automobile service brake; a flexible band lined with Rabestos and tightened with a single lever. There are only eleven parts. One screw adjusts it, shortening or lengthening the band which gives equal pressure everywhere around the friction ring.



CALDWELL
FRICTION CLUTCH
PULLEY

CHATTANOOGA BOILER & TANK CO.

CHATTANOOGA, TENN.

Products.

TANKS for all General and Special Purposes:

For the manufacture and storage of Sulphuric, Nitric and Mixed Acids.

For manufacture and storage of Benzol and Toluol.

Creosote Tanks.

Grain Tanks.

Ice Tanks.

Rendering Tanks.

Oil and Gasoline Tanks.

Cottonseed Storage Tanks.

Bleaching Tanks.

Kier Tanks.

Silicate Soda Tanks.

Alum Manufacturers' Tanks.

Soap Stock, Rosin and Brine Tanks.

Molasses Tanks.

Barium Process Tanks.

Tanks for manufacture and storage of Green Gum or Wood Turpentine.

Water Tanks, Towers and Standpipes; Gas Holders.

Co-operation and Service.

This company makes a specialty of tankage design and construction, and has spent and is spending much money and time on mechanical and chemical investigation.

Experience places it in a position to offer valuable advice on tanks required for all general purposes.

In the consulting department is one of the country's

most capable and successful chemical engineers, who can be consulted for special propositions.

With this service and an up-to-date shop, the company gives more value, from beginning to end, than is obtainable elsewhere.

With an immense stock of materials, quick shipments, together with other advantages, are guaranteed.

Acid Tanks.

The various steps in acid processes can not be handled with the same material. Any material from steel to lead lined tanks is furnished. Also, cooler frames of steel, or shipped complete with lead coils and lining.

Acid work is a very important subject, and the plant is specially equipped to render the latest and best practice.

Towers, Tanks and Standpipes.

The consulting department will advise whether towers and tanks, or standpipes, are the most economical for condition presented.

Gas Holders.

Will supply gas holders for any gas which can be handled by means of a holder.

For which purpose we have constructed tanks covering a wide range in capacities.

Estimates, etc.

Information and estimates will be furnished on request.



A NUMBER OF ACID TANKS ERECTED BY CHATTANOOGA BOILER & TANK COMPANY AT ONE OF THE LARGEST PLANTS IN THIS COUNTRY

CHICAGO BRIDGE & IRON WORKS

Designers, Manufacturers and Constructors of Elevated Steel Water Tanks, Storage Tanks, Self-supporting Steel Stacks; All Classes of Plate Metal Work

OFFICES

CHICAGO, ILL., 2022 Old Colony Building
NEW YORK, N. Y., 3135 Hudson Terminal Building
DALLAS, TEX., 1622 Pretorian Building
CHARLOTTE, N. C., 501 Realty Building
GREENVILLE, PA., 122 Pine Street

LOS ANGELES, CAL., Union Oil Building
SAN FRANCISCO, CAL., Call Building
SEATTLE, WASH., L. C. Smith Building
BRIDGEBURG, ONT., CAN., 127 Janet Street
MONTREAL, QUE., 260 St. James Street

EASTERN PLANT
GREENVILLE, PA.

CENTRAL PLANT
CHICAGO, ILL.

CANADIAN PLANT
BRIDGEBURG, ONT., CAN.

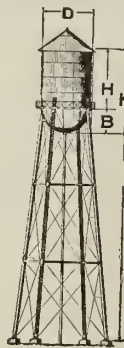
Products.

ELEVATED WATER TANKS, STORAGE TANKS, STAND-PIPES, RAILWAY TANKS, SELF-SUPPORTING STACKS, ACID TANKS.

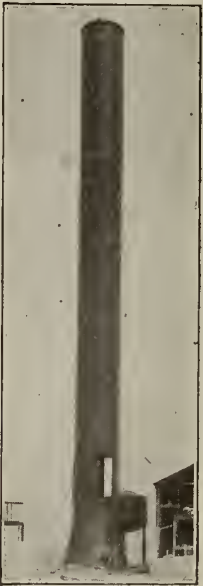
Paper and Sugar Plantation Equipment, Coaling Stations and all classes of Heavy Plate Metal Work.

DATA, ELLIPTICAL AND HEMISPHERICAL TANKS

Capacity, gals.	Elliptical bottom			Hemispherical bottom		
	D	H	K	D	H	K
5,000	10' 0"	7' 0"	9' 6"	8' 0"	12' 0"	16' 0"
10,000	13' 0"	8' 0"	11' 3"	10' 0"	14' 0"	19' 0"
15,000	15' 0"	9' 0"	12' 9"	12' 0"	14' 0"	20' 0"
20,000	16' 0"	11' 0"	15' 0"	12' 9"	17' 3"	23' 7"
25,000	17' 6"	11' 0"	15' 4"	14' 1"	17' 3"	24' 3"
30,000	18' 6"	12' 0"	16' 7"	15' 3"	17' 3"	24' 10"
35,000	19' 0"	13' 4"	18' 1"	16' 4"	17' 3"	25' 5"
40,000	20' 0"	13' 9"	18' 9"	17' 4"	17' 3"	25' 11"
45,000	22' 0"	12' 4"	17' 10"	18' 3"	17' 3"	26' 4"
50,000	22' 0"	14' 0"	19' 6"	19' 0"	17' 6"	27' 0"
60,000	24' 0"	14' 0"	20' 0"	19' 0"	22' 3"	27' 9"
65,000	24' 0"	15' 6"	21' 6"	20' 0"	21' 3"	31' 3"
70,000	25' 0"	15' 0"	21' 3"	21' 0"	20' 3"	30' 9"
75,000	26' 0"	15' 0"	21' 6"	22' 0"	19' 4"	30' 4"
80,000	26' 0"	16' 0"	22' 6"	22' 0"	21' 1"	32' 1"
90,000	28' 8"	14' 0"	21' 2"	22' 0"	24' 6"	35' 6"
100,000	28' 8"	16' 0"	23' 2"	22' 0"	28' 0"	39' 0"
120,000	32' 0"	14' 8"	22' 8"	24' 0"	28' 0"	40' 0"
125,000	32' 0"	15' 6"	23' 6"	24' 0"	29' 0"	41' 0"
150,000	34' 0"	16' 6"	25' 0"	26' 0"	29' 3"	42' 3"
175,000	36' 0"	17' 6"	26' 6"	26' 0"	35' 0"	48' 0"
200,000	38' 0"	17' 6"	27' 0"	28' 0"	35' 0"	49' 0"
250,000	40' 0"	20' 0"	30' 0"	30' 0"	37' 0"	52' 0"
300,000	41' 0"	23' 9"	34' 0"	32' 0"	40' 0"	56' 0"
400,000	47' 0"	23' 0"	34' 9"	35' 0"	44' 0"	61' 6"
500,000	51' 0"	24' 3"	37' 0"	38' 0"	46' 6"	65' 6"



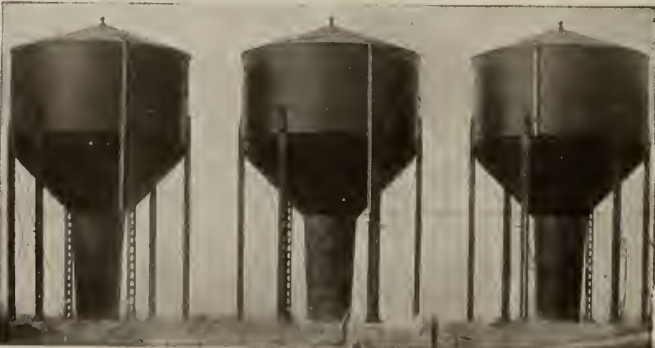
TANK OF PROC-TER & GAMBLE, HAMILTON, ONT.
Capacities, 50,000 and 100,000 gals.
Heights, 100 and 50 ft. to bottom



STEEL STACK, UNITED VERDE COPPER CO., JEROME, ARIZ.
Diameter, 31 ft.; height, 400 ft.



MOLASSES TANKS, GREAT WESTERN SUGAR CO., GERING, NEBR.
Diameter, 35 ft.; height, 23 ft.



150,000-GAL. CONICAL BOTTOM TANKS, CHICAGO & NORTH WESTERN RY., CHICAGO TERMINAL

Information Required in Making Quotations on Elevated Water Tanks.

- (1) Capacity of tank required in gallons.
- (2) Height of tower, which should be given to the lowest point of bottom of tank above top of foundations.
- (3) If tank is used for sprinkler service, state whether stock company or mutual.
- (4) Which, if any, of the following accessories manufacturer is to furnish: riser pipe, frost casing, overflow, indicator, pressure gage tank heater, heater house, foot elbow, gate valve, float valve. Not one of these accessories is included in quotations except when expressly so stated.

STANDARD SIZES CYLINDRICAL VERTICAL STORAGE TANKS

Capacity, gals.	Diam.	Height	Capacity, gals.	Diam.	Height	Capacity, gals.	Diam.	Height
10,000	12' 3"	11' 9"	75,000	23' 9"	23' 3"	225,000	36' 6"	29' 0"
15,000	15' 0"	11' 9"	90,000	26' 0"	23' 3"	250,000	38' 6"	29' 0"
20,000	17' 4"	11' 9"	100,000	27' 3"	23' 3"	300,000	42' 0"	29' 0"
25,000	16' 0"	17' 6"	120,000	30' 0"	23' 3"	400,000	49' 0"	29' 0"
30,000	17' 4"	17' 6"	125,000	27' 6"	29' 0"	500,000	54' 3"	29' 0"
40,000	20' 0"	17' 6"	150,000	30' 0"	29' 0"	600,000	60' 0"	29' 0"
50,000	22' 3"	17' 6"	175,000	32' 3"	29' 0"	750,000	66' 3"	29' 0"
60,000	21' 3"	23' 3"	200,000	34' 6"	29' 0"	1,000,000	77' 0"	29' 0"

Catalogue.

Catalogue No. 50 mailed on request.

ESTABLISHED 1865

A. J. CORCORAN, INC.

Manufacturers of Tanks, Towers, Pumps and Windmills

OFFICE

766 Jersey Avenue

JERSEY CITY, N. J.

WORKS: JERSEY CITY, N. J., Jersey Avenue and 13th Street—Telephone, Montgomery 238

Products.

Manufacturers of "CORCORAN" TANKS which include: Ink and Blacking Tanks; Tanks for Acids and Chemicals; Rectangular and Oval Tanks; Frostproof Tanks; Sprinkler Tanks; Developing Tanks; Dye Tubs; Vats; Tumbling Barrels; Drums; Tanks for Special Purposes.

Machinery made and fitted in tanks, including Manhole and Handhole Frames and Covers to order.

Agitators for Wooden Tanks; Windmills; Towers; Pumps.

Experience and Prestige.

Fifty years of practical experience in the manufacture and erection of tanks and windmills have made this house an authority on the essentials that tanks and windmills should possess for general utility.

Acid Tanks.

A. J. CORCORAN, INC., were pioneers in constructing acid tanks and are among the leaders in this important industry. Tanks of this kind are made of extra heavy

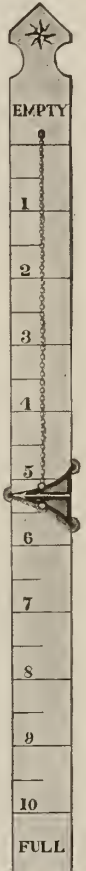
6-, 8- and 10-in. yellow pine, dressed so as to resist the corrosive influences of acids and other chemicals. They have replaced lead lined tanks, because they last longer and cost less.

The Corcoran factory is equipped for making all types of acid tanks, and special tools and fittings have been installed for making rectangular acid tanks in the best manner and by the most improved methods.

Advantages.

All Corcoran tanks are warranted to be absolutely watertight; and while the initial cost may be slightly higher than numerous unknown tanks, they are always cheaper in the end.

Corcoran tanks are indorsed by the New York Building and Fire Departments, Fire Insurance Exchange and the Associated Factory Mutual Fire Insurance Companies.



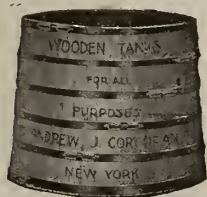
CORCORAN
STANDARD
TANK
GAUGE



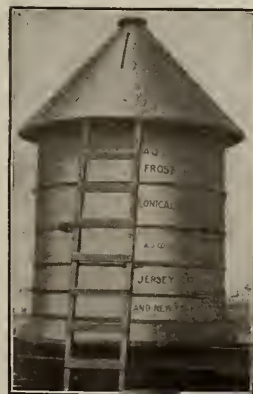
GRAVITY OR SPRINKLER
TANK FOR FACTORIES



ACID OR CHEMICAL TANK



TANK FOR VIL-
LAGE WATER
WORKS



CORCORAN FROST-
PROOF TANK



CORCORAN WATER TOWER
FOR COUNTRY ESTATE



FOR CONNECTING
PIPES TO TANK

GRAVER CORPORATION

(WM. GRAVER TANK WORKS)

Steel Tanks and General Steel Plate Construction
Engineers, Manufacturers, Builders

EAST CHICAGO, IND.

SALES OFFICE AND RAILROAD DEPARTMENT, Steger Building, CHICAGO, ILL.
BRANCH OFFICES
FORT WORTH, TEX. DENVER, COLO.

Products.

STEEL TANKS and GENERAL STEEL PLATE CONSTRUCTION.
OIL REFINING EQUIPMENT, including Stills, Condenser Boxes, Agitators, Filters, Bleacher Tanks, Rundown Tanks, Storage Tanks, etc.
For Water Softening, Purifying, Sterilizing, Filtering and Heating Apparatus see page 802.



GRAVER QUALITY STEEL TANKS

Facilities.

Since 1857 the GRAVER CORPORATION has given high class designing and construction service to the largest users of steel storage and steel plate work in the United States.
It completely equips oil refineries, gas plants, water works, mines, railroads, and builds a line of tanks of standard size for every storage purpose.
Standard Riveted and Welded Tanks, Horizontal and Vertical.
Very few buyers of steel storage realize that they probably could find in the Graver storage yard a standard tank that would meet their requirements as fully as the specially constructed tank they had in mind. This would mean not only a material saving in the first cost of the tank, but also quicker delivery than could be effected if the tank had been constructed according to their own specifications.

The storage yard is one of the features of Graver service which enables the organization to give to customers prompt shipment and to provide them with tanks to meet their requirements, without the delay always incident to special construction.

ECONOMY—Most important economies in tank manufacture have been effected by GRAVER CORPORATION. The immense business and intelligent standardization of sizes and specifications permit reasonable prices to be quoted on tanks singly or in lots. Other sizes of tanks than the standardized line will be made to order.
Location in the heart of the Chicago industrial district makes it possible to place at the disposal of customers unexcelled railroad facilities for quick shipment at moderate rates.

Oil Refining Equipment.

The same high standard of construction which characterizes other Graver products is maintained in the manufacture of Graver stills, condenser boxes, agitators, filters, bleacher tanks, rundown tanks and storage tanks.

STANDARD RIVETED HORIZONTAL CYLINDRICAL TANKS

FLAT HEADS 1/4 IN. SHELL 1/4 IN.					FLAT HEADS 1/4 IN. SHELL 3/8 IN.				
Capacity, gals.	Size		Shipping weight, lbs.		Capacity, gals.	Size		Shipping weight, lbs.	
	Diam.	Length				Diam.	Length		
4,000	8'	10' 9 1/2"	5,500		4,000	8'	10' 9 1/2"	3,800	
5,000	8'	13' 6"	4,400		5,000	8'	13' 6"	4,400	
6,000	8'	16' 3/4"	6,200		6,000	8'	16' 3/4"	5,000	
7,000	8'	19'	7,000		7,000	8'	19'	5,700	
8,000	8'	21' 4"	7,700		8,000	8'	21' 4"	6,200	
9,000	8'	24'	8,500		9,000	8'	24'	6,800	
10,000	8'	26' 7 1/4"	9,200		10,000	8'	26' 7 1/4"	7,300	
11,000	8'	29' 4"	10,000		11,000	8'	29' 4"	7,900	
12,000	8'	31' 10 1/2"	10,800		12,000	8'	31' 10 1/2"	8,500	
13,000	8'	34' 8"	11,500		13,000	8'	34' 8"	9,100	
14,000	8'	37' 1 3/4"	12,300		14,000	8'	37' 1 3/4"	9,700	
15,000	8'	40'	13,300		15,000	8'	40'	10,400	
16,000	8'	42' 6"	13,900		16,000	8'	42' 6"	10,900	
7,700	10' 6"	11' 11"	6,900		6,200	9'	13' 1 1/2"	5,000	
11,500	10' 6"	17' 0"	9,000		9,300	9'	19' 5 1/2"	6,500	
15,200	10' 6"	23' 7"	11,300		12,300	9'	25' 10"	8,100	
19,200	10' 6"	29' 5"	13,500		15,300	9'	32' 2 3/4"	9,700	
24,600	10' 6"	38' 1"	16,900		18,200	9'	38' 7 1/2"	11,300	
3/8-IN. METAL THROUGHOUT					Fitted with one 16-in. manhead with bolted or screw cover and three 2-in. flanges or equivalent for pipe connections.				
550	4'	6'	800		7,700	10' 6"	11' 11"	5,800	
1,000	5' 5"	6'	1,200		11,500	10' 6"	17' 0"	7,400	
1,500	5' 5"	9'	1,600		15,200	10' 6"	23' 7"	9,100	
2,000	5' 5"	12'	2,100		19,200	10' 6"	29' 5"	10,800	
2,500	5' 5"	15'	2,600		24,600	10' 6"	38' 1"	13,400	
3,000	5' 5"	18'	3,000						

Fitted with three 2-in. flanges or equivalent for pipe connections. 16-in. manhead furnished extra when desired.

STANDARD RIVETED VERTICAL CYLINDRICAL TANKS
Bottom 3/8-in., First Ring 1/4-in. Remainder, Including Roof, No. 10 gage

Capacity, gals.	Size		Shipping weight, lbs.
	Diameter	Length	
6,000	10' 6"	9' 5"	4,100
9,000	10' 6"	14'	5,200
10,600	10' 6"	16' 6"	5,600
12,000	10' 6"	18' 4 3/4"	6,300
15,000	10' 6"	22' 10"	7,000
15,500	10' 6"	23' 11"	7,300
16,300	10' 6"	25' 4"	8,000

Fitted with one 16-in. manhead with bolted or screw cover and three 2-in. flanges or equivalent for pipe connections. Corrected sizes and dimensions.

Whether the need is for tanks of only a few hundred gallons' capacity or for complete equipment for the largest refinery, asphalt plant, acid plant, grain elevator, packing house, creosote plant or chemical plant, it will pay to get a Graver estimate. Address nearest office for information and prices.

ORGANIZED 1867

INCORPORATED 1889

KALAMAZOO TANK & SILO CO.

KALAMAZOO, MICH.

Products.

WOOD TANKS for all purposes, including Storage Tanks, Railroad Tanks, Manufacturing Tanks, Paper and Pulp Mill Tanks, Blow Pits, etc.; STEEL TOWERS; TANNERS' DRUMS, VAT TRUCKS.

Special Tanks, Wood Vats, Agitators, Vinegar Generators, Frostproofing for Pipes.

Services.

This company maintains a staff of engineers whose experiences in the manufacture of tanks and tank structures cover a period of many years. They have acquired valuable information for the solution of all tank problems, which they will gladly furnish to prospective buyers.

Kalamazoo Wood Tanks.

For 50 years the KALAMAZOO TANK & SILO CO. have manufactured wood tanks of the best grade of lumber and workmanship. Their plant is equipped with the latest machinery for the manufacture of wood tanks.

ROUND WOOD TANKS—Tank staves accurately sawed and jointed on true and radial lines, with proper regard for diameter of tank. The crozing at bottom of stave is cut circular with proper regard to stave when set in position and assures same to be completely filled by tank bottom when staves are driven up. Outside surfaces of staves finished convex, giving full bearing to hoop over entire face of stave. Tanks furnished with correct number of round steel hoops and malleable iron lugs for tightening.

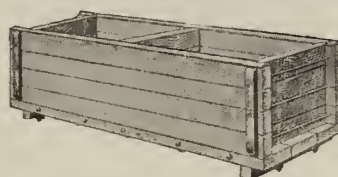
Size of tank determines hoopage, and factor of safety allowed to make ample allowance for pressure of water, and swelling of staves.

RECTANGULAR WOOD TANKS—Carefully machined and jointed in workmanlike manner. Built in any size required, with or without partitions, false bottoms, etc. The vertical rodding runs through the lumber and tops of rods are countersunk and covered with rounded piece of maple wood, giving smooth and finished top. Shipped knocked down, all pieces match marked for easy assembly, or shipped set up if convenient or required.

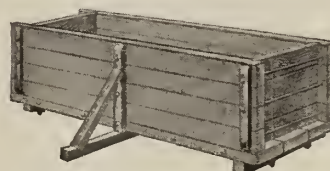
GRAVITY WOOD TANKS—Furnished with or without steel towers and are suitable for supply or sprinkler systems. They can be furnished complete with pitched or flat roof, ladders, indicator and float. Built to requirements of National Board of Fire Underwriters and local authorities.



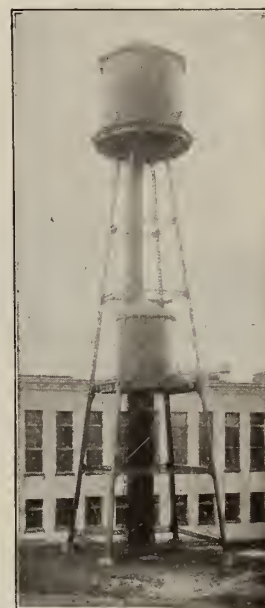
ROUND WOOD TANK

ELEVATED STORAGE
RAILROAD TANKGRAVITY TANK
Finial ornament omitted

TANK DIVIDED BY PARTITION



TANK WITH OUTSIDE BRACE



TANKS AND TOWER



VAT TRUCK

HALF ROUND TANK
Open top with braceTANNERS' DRUM
DRIVEN WITH CHAIN
AND SPROCKETELLIPTICAL
TANK
All sizes

NEW ENGLAND TANK & TOWER CO.

EVERETT, MASS.

(Boston Postal District)

Products.

WOOD TANKS; STEEL TOWERS; AGITATOR DRIVES, with or without stirrers.

Also, Wood Vats, Dye Tubs, special Tanks for any purpose, and special Mixing Machines.



TRADE-MARK

Pressure Tanks.

Wood pressure tanks are designed and tested for 50 lbs. pressure per sq. in.



PRESSURE TANKS

Round Tanks.

Round tanks up to 100,000 gals. capacity, built of 1½-, 2-, 3- or 4-in. stock.

Cypress, redwood, Douglas fir, white pine, yellow pine or oak can be furnished.



ROUND TANK

Settling Tanks.

Cone bottom settling tanks, used by paper and board mills, can be furnished in capacities from 1000 to 35,000 gals., with either wood or steel supports.

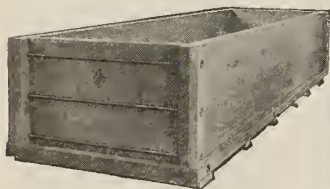


SETTLING TANK

Rectangular Tanks.

Rectangular tanks are built in desired sizes of 1½- to 4-in. stock.

Rectangular compartment tanks are furnished with dovetailed grooving on inside to provide anchorage for lining with cement.



RECTANGULAR TANK



COMPARTMENT TANK

Pickling Tanks.

Pickling tanks are designed especially for handling wire in coils.



PICKLING TANKS



SPECIAL MIXING TANK WITH STEEL SPIRAL STIRRERS

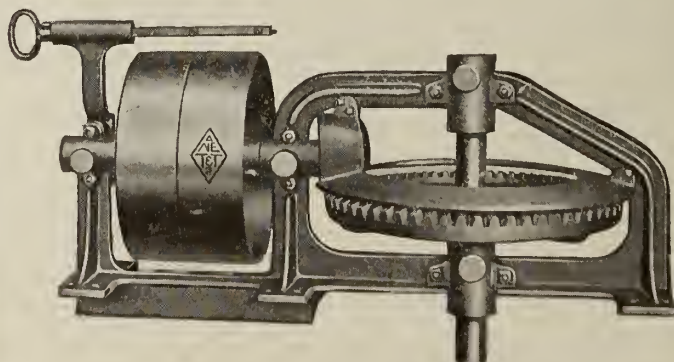
Tanks and Towers.

Sprinkler tanks and steel towers are furnished and installed to meet insurance requirements.

Tanks can be furnished of cypress, redwood, yellow pine or Douglas fir.



SPRINKLER TANKS AND STEEL TOWERS



BALL THRUST AGITATOR DRIVE
DIMENSIONS

Size no.	Pinion shaft, in.	Gear shaft, in.	Gear, in.		Pinion, in.		Tight and loose pulleys, in.	Length over all, ft. in.	
			P. diam.	Face	P. diam.	Face			
0	1 1/8	1 3/8	8	1 1/4	2	1 1/4	8x3	1	11
1	1 1/8	1 3/8	13.37	2	3.34	2	12x4	2	9
1 1/2	1 1/8	1 3/8	16	2 1/2	4	2 1/2	12x4	3	2
2	1 1/8	2 1/8	23.87	3	5.97	3	18x5	4	2

PITTSBURGH-DES MOINES STEEL COMPANY

Elevated Steel Tanks, Storage Tanks and Structural Steel

750 Curry Building
PITTSBURGH, PA.

BRANCH OFFICES

NEW YORK, N. Y., 46 Church Street
SAN FRANCISCO, CAL., 380 Rialto Building
DES MOINES, IOWA, 950 Tuttle Street

CHICAGO, ILL., 70 West Monroe Street
DALLAS, TEX., 1239 Praetorian Building
WASHINGTON, D. C., 969 Munsey Building

SHOPS: PITTSBURGH, PA., DES MOINES, IOWA

CHATHAM, ONTARIO, CAN., CANADIAN DES MOINES STEEL CO., LTD., 292 Inshes Avenue

Products and Services.

Engineers, manufacturers and erectors of ELEVATED STEEL TANKS and STORAGE TANKS of all types for industrial, municipal and railway service; REFINERY CONDENSERS; OIL STILLs.

Also, Standpipes, Smokestacks, Steel Pipe Lines, Coal Bins, Barges, Dredges, Coaling Stations, Wireless Towers, Steel Structures and General Plate Work.

Elevated Steel Tanks.

This company has made a specialty for many years of the manufacture of elevated steel tanks. It is the most satisfactory means of supplying water to a sprinkler system, and in connection with private or municipal water works, it furnishes a reliable, long lived, watertight structure of simple lines and pleasing appearance.



ELEVATED STEEL TANK, EAST YORK, PA., AMERICAN CHAIN CO. Capacity, 100,000 gals., height, 100 ft.



ERECTED AT THREE RIVERS, QUE. Capacity 50,000 gals., height, 149 ft. Capacity 120,000 gals., height, 100 ft.

Railway Locomotive Service.

Engineers who build for the future have adopted as their standard this permanent all-steel, fire-proof construction.

The peculiar requirements of the railway water tank are met by the large diameter mud drum and antifreeze design.

This company has special designs which are most satisfactory and economical.



LIGONIER VALLEY RAILROAD COMPANY, LIGONIER, PA. 30,000 gals., 15 ft. to bottom

DIMENSIONS, STANDARD ELEVATED STEEL TANKS

Rated cap. U. S. gals.	Diam.	Dist.	Cylinder	Rated cap. U. S. gals.	Diam.	Dist.	Cylinder
10,000	11'	4'-0"	10'-11"	70,000	21'	7'-7"	21'-10"
15,000	13'	6'-0"	10'-11"	75,000	21'	8'-0"	22'-6"
20,000	15'	5'-5"	10'-9"	80,000	21'	8'-11"	24'-2"
25,000	15'	5'-4"	14'-7"	90,000	21'	8'-0"	28'-4"
30,000	15'	5'-3"	18'-5"	100,000	24'	8'-6"	22'-6"
35,000	17'	6'-4"	15'-7"	125,000	24'	8'-4"	30'-0"
40,000	17'	6'-8"	18'-5"	150,000	28'	10'-5"	24'-2"
45,000	19'	6'-5"	15'-11"	200,000	28'	10'-5"	35'-0"
50,000	19'	8'-0"	17'-7"	250,000	32'	13'-11"	33'-0"
60,000	19'	7'-3"	22'-6"	300,000	32'	15'-0"	40'-3"

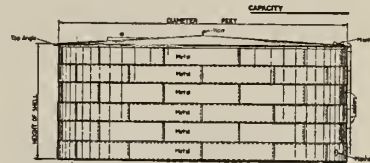
Refinery Equipment.

The company fabricates complete refinery equipment including stills, agitators and condensers.



Storage Tanks.

Steel storage tanks of any description are manufactured by this company. They may be used for storage of oil, acid, gasoline, water, molasses, grain, etc.



DETAIL OF STORAGE TANK

DIMENSIONS AND CAPACITIES, STANDARD STORAGE TANKS

No.	Capacity, bb's.	Capacity, gals.	Height	Diam.
12	10,000	428,000	25'	54'
13	10,000	423,000	30'	49'
14	15,000	640,000	25'	66'
15	15,000	635,000	30'	60'
16	20,000	848,000	25'	76'
17	20,000	841,000	30'	69'
18	25,000	1,050,000	30'	77'
19	30,000	1,273,000	30'	85'
20	35,000	1,492,000	30'	92'
21	37,500	1,590,000	30'	95'
22	40,000	1,692,000	30'	98'
23	45,000	1,906,000	30'	104'
24	50,000	2,132,000	30'	110'
25	55,000	2,330,000	30'	115'

Co-operative Service.

This company maintains an expert engineering and contracting staff. If the problems of design are complicated a wire or letter to the nearest office will bring a competent man before you without expense or obligation.

Upon receipt of inquiry, the engineering department will gladly prepare plans and prepare estimates and submit quotations with no obligation on the part of the prospective purchaser.

It is recommended that specifications of tanks be given in accordance with standard dimensions.

Write the nearest sales office for catalogue.

RIVERSIDE BOILER WORKS, INC.

Manufacturers of Steel Tanks

CAMBRIDGE, MASS.

PACIFIC COAST OFFICE, 461 Market Street, SAN FRANCISCO, CAL.

NEW YORK OFFICE, 48 East 41st Street

Products.

BLACK and GALVANIZED STEEL TANKS.

RECTANGULAR TANKS of different sizes for water, oil and other storage.

Also, Air and Gasoline Tanks; Ship, Expansion and Pressure Tanks; Range Boilers; Welded Headers.

Special Riveted and Brazed Construction.

The strongest, tightest and safest tank construction today is the "Riverside" riveted and brazed construction. The riveted and brazed seam is a specialty with this company and is used on all possible work.

Tanks.

The tanks listed can be made up from sheets regularly carried in stock. Tappings placed in any location desired.

Manholes and handholes are extra and furnished on request. Net prices f. o. b. Boston will be quoted promptly.

Sizes range from 5 to 2260 gals. capacity, with diameters ranging from 6 to 48 ins., inclusive, suitable for all purposes where working pressures do not exceed 300 lbs. per sq. in.

Rectangular or odd shaped tanks, riveted or welded, black or galvanized, from $\frac{3}{8}$ to $\frac{1}{4}$ in. thickness, inclusive, are made to order.

Galvanizing.

Tanks are galvanized inside and out by the hot-dip process.

Heads.

Regularly furnished with one convex and one concave. Welded tanks can be made up with both heads convex or concave, if desired.

Estimates.

The 32 years' experience of the company is of value. State the problem and the tank will be designed and quotations submitted promptly.

On receipt of inquiry, quotations on square and rectangular storage tanks, or any tanks of special dimensions, will be furnished.

Table.

The table is to be used in specifying "Riverside" steel tanks, and represents the best tank practice for purposes stated.

DIMENSIONS—First figures shown are inside diameters; second figures show lengths on shell.

Facilities.

A well equipped and up-to-date plant guarantees the prompt construction of steel tank work of riveted, riveted and brazed, and welded construction, the oxy-acetylene method being employed.



STORAGE TANKS FOR HOT WATER, FUEL OIL, GASOLINE, ETC.

AIR TANKS

GALVANIZED ONLY, WITH RIVETED AND BRAZED SEAMS				BLACK OR GALVANIZED, WITH ALL WELDED SEAMS		
Capacity, gals.	Dimensions, ins.	Gauge shell		Gauge shell		List price
		75 lbs. working pressure	100 lbs. working pressure	125 lbs. or less working pressure	126 lbs. up to 200 lbs. working pressure	
5	9x16	14	12	11	11	\$6.00
6	10x16	14	12	11	11	6.50
7	10x20	14	12	11	11	7.00
8	12x16	14	12	11	11	7.50
9	12x18	14	12	11	11	8.00
10	12x20	14	12	11	11	8.25
11	12x22	14	12	11	11	8.50
12	12x24	14	12	11	11	8.75
15	12x30	14	12	11	11	9.00
18	12x36	14	12	11	11	9.50
20	14x30	14	12	11	11	12.50
21	12x42	14	12	11	11	15.50
24	12x48	14	12	11	11	15.75
27	12x54	14	12	11	11	18.50
28	14x42	14	12	11	11	20.25
30	12x60	14	11	11	7	19.00
32	14x48	14	12	11	11	21.00
36	14.54	14	12	11	11	21.50
40	14x60	14	11	11	7	24.00
42	16x48	13	12	11	11	26.00
47	16x54	13	12	11	11	30.00
52	16x60	12	11	7	7	31.00
53	18x48	12	11	7	7	31.50
66	18x60	12	11	7	7	38.00
82	20x60	12	11	7	7	45.50
100	22x60	12	11	7	7	63.50
120	24x60	12	11	7	7	72.50
144	24x72	11	10	7	7	103.00
168	24x84	11	10	7	7	120.00
192	24x96	11	10	7	7	132.00
235	24x120	7	7	7	7	152.00

BLACK OR GALVANIZED				BLACK OR GALVANIZED		
Capacity, gals.	Dimensions, ins.	Gauge shell	Approximate weight, lbs.	Gauge shell	Approximate weight, lbs., 100 lbs. working pressure, only	List price
86	30x30	7	300	7	300	\$58.00
105	30x36	7	365	7	365	64.00
139	30x48	7	430	7	430	76.00
175	30x60	7	495	7	495	85.00
209	30x72	7	558	7	558	94.00
245	30x84	7	640	7	640	102.00
281	30x96	7	690	7	690	104.00
314	30x108	7	770	7	770	108.00
347	30x120	7	819	7	819	116.00
383	30x132	7	910	7	910	127.00
418	30x144	7	933	7	933	130.00

BLACK ONLY, ALL SEAMS RIVETED*				BLACK ONLY, ALL SEAMS WELDED		
Capacity, gals.	Dimensions, ins.	Gauge shell	Approximate weight, lbs.	Gauge shell	Approximate weight, lbs., 100 lbs. working pressure, only	List price
300	36x 72	7	699	7	699	\$112.00
399	36x 96	7	872	7	872	126.00
499	36x120	7	1018	7	1018	142.00
599	36x144	3	1264	3	1264	156.00
699	36x168	3	1330	3	1330	175.00
547	42x 96	3	1375	3	1375	170.00
684	42x120	3	1818	3	1818	178.00
822	42x144	3	1960	3	1960	196.00
950	42x168	3	2200	3	2200	218.00
1093	42x192	3	2480	3	2480	236.00
950	48x120	3	2060	3	2060	240.00
1074	48x144	3	2320	3	2320	250.00
1235	48x168	3	2610	3	2610	274.00
1425	48x192	3	2900	3	2900	304.00
1615	48x216	3	3600	3	3600	352.00
1786	48x288	3	3950	3	3950	393.00
2147	48x288	3	4650	3	4650	438.00

*Double riveted longitudinal seams and single riveted girth seams.

AIR REDUCTION SALES COMPANY

Manufacturers of Airco Oxygen, Acetylene, and Welding and Cutting Apparatus

GENERAL OFFICES

120 Broadway

NEW YORK, N.Y.

DISTRICT OFFICES AND DISTRIBUTING STATIONS THROUGHOUT THE UNITED STATES

Products.

OXYGEN; ACETYLENE; WELDING and CUTTING APPARATUS and SUPPLIES; ACETYLENE GENERATORS.

Carbide, Nitrogen.

Airco Engineering Service.

The AIR REDUCTION SALES COMPANY maintains a corps of specialists on oxy-acetylene welding and cutting. These experts are employed to assist in solving oxy-acetylene welding or cutting problems or in training welders in the art.

Airco Oxygen.

Airco Oxygen is of a uniform high quality. It is shipped to users from Airco plants and distributing stations located at important centers. There is a distributing station conveniently near every Airco user. Each plant is equipped with sufficient capacity, as to cylinders, to take care of the user's requirements on short notice. Airco oxygen cylinders are of two sizes—containing approximately 110 cu. ft. and 220 cu. ft. of Airco oxygen.

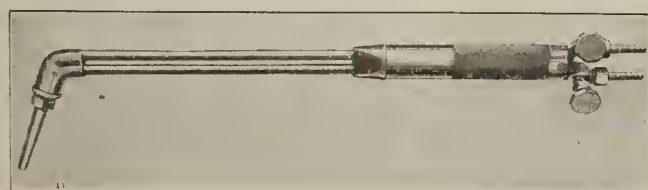
Airco Acetylene.

Airco acetylene is manufactured from calcium carbide at the Airco acetylene plants located throughout the United States. Airco acetylene cylinders are of a special design which insures maximum safety and fulfils all the requirements of the Interstate Commerce Commission and the various Safety Councils.

Airco acetylene cylinder policy represents the greatest economy to the user. The same excellent methods prevail in the distribution of Airco acetylene as for Airco oxygen.

Airco "A" Welding Torch.

The Airco "A" welding torch is designed for welding material from $\frac{1}{32}$ in. thick to the thickest



AIRCO "A" WELDING TORCH



TRADE-MARK

metal practical to weld with the oxy-acetylene process. The torch is furnished in lengths of 16, 20, 26 or 34 in., with 45°, 67½°, or 90° angle head, and 10 sizes of welding tips. The standard length, 20 in., weighs only 31 oz.

Airco "B" Welding Torch. (Sheet Metal Torch.)

The Airco "B" welding torch is manufactured to meet the demand for a light, well balanced, substantially built torch for use in manufacturing plants where the same operation is done day in and day out and where the thickness of material does not exceed approximately $\frac{1}{4}$ in.

The torch is furnished with 3 angles of head, namely: 45°, 75° and 90°; and weighs only 15 oz. It is furnished with five interchangeable tips designed for use in welding metal from $\frac{1}{32}$ in. to approximately $\frac{1}{4}$ in.

Airco "C" Welding Torch. (Lead Welding Torch.)

The Airco "C" welding torch is manufactured to meet the demand for a torch with a hot, concentrated flame for delicate operations, such as very light sheet metal, dental and jewelry work. The torch is furnished with 4 interchangeable tips for welding material from $\frac{1}{32}$ in. to approximately $\frac{1}{8}$ in. and weighs only 13 oz.



AIRCO "C" WELDING TORCH

Airco "D" Cutting Torches.

Airco cutting torches are designed along the same principles as the Airco welding torches. The "D" torch is furnished with three angles of head, namely: 67½°, 90° and 180° and with six interchangeable tips for use in cutting material up to the maximum cut capable of being made with the oxy-acetylene flame. The torch weighs 47 oz. with tips and hose connections attached.



AIRCO "D" CUTTING TORCH

Airco Carbon Burning Torch.

This torch is used for removing carbon from the cylinders of internal combustion motors. It is simply and strongly constructed and will more than pay for itself in a very short time, by the saving made over the usual costs of removing carbon from motor cylinders. The torch is very popular in garage and automobile repair plants.



AIRCO CARBON BURNING TORCH

Airco Acetylene Generators.

Airco acetylene generators are manufactured to meet the demand of large users of acetylene who desire to obtain a constant supply of acetylene generated on their own premises. Airco acetylene generators are manufactured in sizes ranging from a capacity of 25 cu. ft. of acetylene per hour to 300 cu. ft. per hour. Every effort has been made in the design and construction to make the generators foolproof by means of interlocking levers and other simple safety devices.

ELECTRIC ARC CUTTING AND WELDING CO.

222 Halsey Street
NEWARK, N. J.

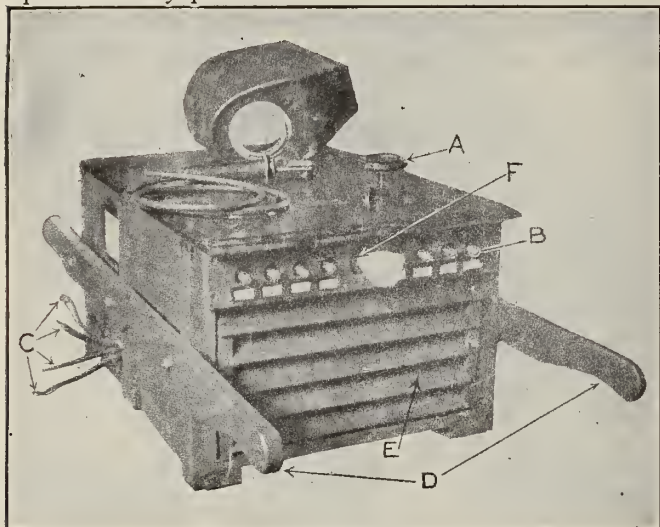
Products and Services.

STANDARD PORTABLE ALTERNATING CURRENT WELDER; WELDING ACCESSORIES: Welding and Cutting Electrodes, Welding Handles, Welding Operators' and Inspectors' Masks and Shields, Aprons, Gloves and all other Welding Supplies.

WELDING SCHOOL and SHOP for Training Men to meet all around welding problems.

Description and Notable Features of Welder.

The standard portable A. C. Welder is a special transformer which delivers the arc voltage of the necessary characteristics at the terminals of the apparatus, and is made to meet any A.C. primary power supply voltage or frequency. The complete apparatus weighs 265 pounds, is equipped with two handles and will operate in any position.



STANDARD A.C. WELDER SHOWING TYPE 17 MASK AND TYPE A WELDING HANDLE

A—flux diverter which gives the small increments of current to give exact conditions of heat.

B—secondary taps, either side may be grounded. These give the larger increments to current for heat conditions.

Brass plates under each tap designates kind of work to be done. Light work, slag coated electrode, flux coated electrode, bare wire, light work, medium work, heavy work, cutting.

C—primary connections, taps for 10% below normal.

D—handles for carrying welder. E—ventilator. F—lamp socket for light grinder. G—oak case

SHORT, CLOSE ARC—It is definitely known that a short, close arc must be held to obtain a good weld. The standard A. C. Welder holds a close arc through its automatic regulation of current and voltage, which is obtained not by reducing voltage but by inherent qualities of the machine, thus maintaining a high penetrative quality.

HEAT AND TEMPERATURE OF ARC—For sound metallurgical rea-



WELDED BOILER TUBE SHOWING PERFECT FUSION OF METAL

sons the fusing of metal to be welded should be done with an agent that is extremely local and extremely hot. This is exactly the result obtained with the standard A.C. Welder. Large gradations of current are obtained by various plugs on the front of the machine, the finer adjustments by moving the flux diverter up or down. Watts or heat is held constant.

OVER ALL EFFICIENCY—This is best represented by the kilowatt hours per pound of metal deposited. In the case of standard A.C. Welder this is 1½ kw. to 2 kw. hours per lb. of metal deposited as against 8 kw. to 25 kw. hours on other type welders.

SPEED—Alternating current provides a faster speed than any system with a polarity electrode. In tests where voltage and current conditions were similar the alternating current system was 20% to 30% faster than any other system in the deposition of metal.

POWER FACTOR—This is the ratio of kilovolt-amperes asked for to kilowatt used. Our power factor in welding runs from 35% to 65%, a fair average being 50%; while the power factor in cutting runs from 65% to 90%, a fair average on heavy cutting being 80%. Our demand for the heaviest sort of welding is 5 kw., and the demand for the heaviest cutting is 50 kw.

Summary of Advantages.

(1) Low first cost. (2) 1 kwh. per pound of metal, which is less power consumption than any other machine. (3) Cost of maintenance, none. (4) Inherent short arc insures reliability of weld. Constant heat is automatically held at arc. (5) Speed in welding is greater than any other machine. (6) Portable, weighs 265 pounds. (7) Low comparative cost of installation. (8) Power factor equal to, or better than, any induction motor generator set. (9) Uses any type of electrode. (10) Absolutely weatherproof, permitting work outdoors in any weather.

Accessories.

HANDLES—Welding handles are made of manganese bronze. Grip is of bakelite delecto, self-aligning spring. Electrode released by squeeze of hand.

MASK and SHIELDS—Made of especially light weight, reinforced material complete with glasses. Designed to protect operator's eyes and to shield all parts of head from burns and falling objects. Mask is generally used by welder, shield by inspector or observer.



HANDLE, TYPE 7



Exterior Interior
MASK, TYPE 17



Exterior Interior
SHIELD, TYPE 41

WILSON WELDER & METALS CO., INC.

Welding Apparatus and Metals

2 Rector Street
NEW YORK, N. Y.

Products and Service.

WILSON PLASTIC-ARC WELDER and PLASTIC-ARC CERTIFIED WELDING METALS.

Welding of every description done by the Wilson Plastic-Arc welding system.

Wilson Plastic-Arc Welding System.

This system employs a flat, compound wound, 35-volt, direct current generator, in connection with a panel containing an automatic control mechanism. This combination gives 18 to 22 volts at the arc, the rest of the power being used in the line and in the automatic power regulation. The advantage of the low voltage is that it prohibits the operator from making a long arc between the electrode and the work, which slags the metal deposit. If the arc is lengthened it is weakened and must be brought back to a proper distance to make the weld, thus limiting the operator.

Low voltage insures better penetration of the original metal by the concentrated arc than with a longer diffused arc of higher voltage.

Proper welding is accomplished by fusing the parent and new metal with a uniform welding heat. The heat is kept constant by the Wilson automatic control mechanism mounted on the panelboard, an exclusive feature of the Plastic-Arc system.

Plastic-Arc outfits are built in one-, two- and four-arc units, and four operators can draw energy from the same generator, each using a different heat as required on different metals without interference. A separate panel is required for each operator. The Plastic-Arc will weld practically any metal: copper, brass, aluminum, and cast iron.

Damage on 20 German vessels consisting of 118 major breaks which would have necessitated the renewal of 70 cast iron cylinders, some as large as 9 ft. in diameter, were repaired with the Plastic-Arc system. The saving to the United States government amounted to \$20,000,000.00 and twelve months of time, during which time ships transported over 500,000 troops overseas.

Plastic-Arc "Certified" Welding Metals.

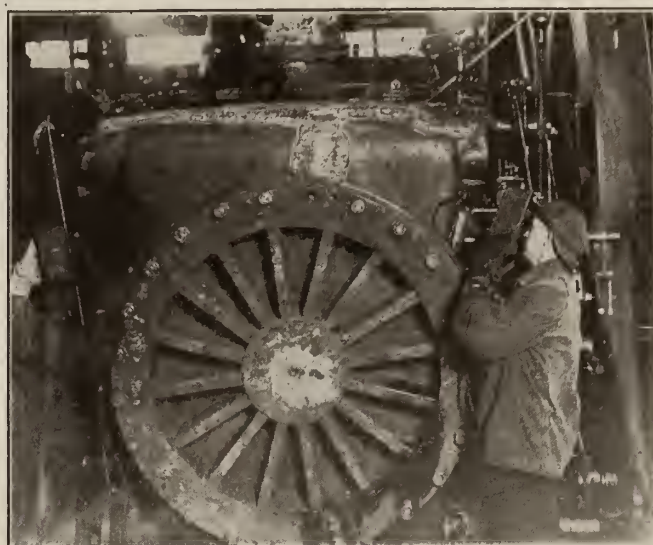
There are 8 grades of Plastic-Arc "Certified" Welding Metals and each can be depended upon, being guaranteed to give satisfactory results when employed upon the type of work it is designed for.

GRADE NO. 6—For work where ductility and high tensile strength is required.

Plastic-Arc
TRADE-MARK



ONE-ARC, DYNAMOTOR TYPE,
PORTABLE OUTFIT



WELDING REPAIR ON STEAM ENGINE

A steam engine broken practically into two parts welded and put into service by Plastic-Arc System

*GRADE 8—Useful for building up worn places where high tensile strength is not required.

GRADE 9—For use on all cast steel parts requiring high strength in the weld.

GRADE 17—For filling in blowholes in steel and gray iron castings and all work where parts are not subjected to undue strains and tensile strength is not an important factor.

GRADE 20—Bronze alloy for all brass, copper and bronze work.

GRADE 30—Standard diameter, $\frac{1}{8}$ in. An exceptionally easy and fast flowing electrode which lays flat where deposited; of medium tensile strength; specially designed for welding thin cast iron.

GRADE 31—High tensile strength and conductivity with very smooth flowing, specially designed for overhead welding with deep penetration. The $\frac{1}{8}$ -in. size particularly recommended for boiler flue work.

GRADE 33—Exceptionally smooth flowing qualities. Designed for overhead welding.

To give the best results, the arc-welding system should employ both the welder and welding metals manufactured by the WILSON WELDER & METALS CO., INC.

Commercial Welding.

This company solicits commercial welding of any description.

Catalogue.

The system and its uses are fully described in an 80-page manual and catalogue, number 5, copies of which will be supplied on request.



TRADE-MARK

AMERICAN CHIMNEY CONSTRUCTION CO.

(Not Incorporated)

SUCCESSORS TO FRED HILLESHEIM CHIMNEY CONSTRUCTION CO.

Radial and Common Brick Chimneys

TELEPHONES:

FRANKLIN 2594, 2595

118 North La Salle Street

CHICAGO, ILL.

BRANCH OFFICE: CLEVELAND, OHIO, 505 Superior Building

Products and Services.

Designers and Builders of PERFORATED RADIAL and COMMON BRICK CHIMNEYS with Foundations and Flues, of all sizes and for all purposes; FURNACES and KILNS; COAL SAVING and SMOKE ABATEMENT DEVICES.

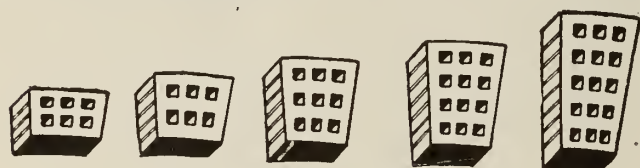
OLD CHIMNEYS EXTENDED, REPAIRED, STRAIGHTENED and POINTED while in operation; REPORTS and RECOMMENDATIONS on condition of old chimneys; STEEL STACKS LINED.

Facilities.

The AMERICAN CHIMNEY CONSTRUCTION Co., through its 25 years of experience, is in a position to give expert advice as to the proper size and shape of any kind of chimney for any purpose, as well as to make, through its efficient engineers, recommendations regarding boiler layouts, size, shape and design of furnaces, coal to be used, temperatures, gases generated, geographical location and any other conditions affecting the determination of the most economical and efficient sizes of furnaces and chimneys needed.

Perforated Radial Chimneys.

The perforated radial blocks are made only from the purest materials selected for high refractory powers and high crushing strength. Special attention is given in the brickyards to making the proper mix of clays in the right proportion to produce a radial brick chimney which will resist contraction and expansion of heat strains to a great extent, as well as strains from weight and wind. All the radial blocks are formed to suit the circular and radial lines of each part of the chimney, so that they can be laid with thin, even joints and produce a regular, smooth surface.



PERFORATED RADIAL BLOCKS

Common Brick Chimneys.

The AMERICAN CHIMNEY CONSTRUCTION Co. also builds round common brick chimneys of inside diameter from 3 ft. 6 in. and up. These chimneys are just as good looking and durable as the radial chimneys; they have been in use for many years and have given universally good results and satisfaction.

Data Required for Chimney Designs and Estimates.

In general, state conditions and result desired; the Engineering Department will promptly give the correct, efficient and economical size of chimney and furnaces and will make recommendations, not from theoretical tables but from 25 years of practical experience; they will give data from users of their chimneys, collected from actual working conditions in American installations in all parts of the world.

Also, give all possible information regarding place, transportation, dimensions of chimney required, boiler horsepower, probable temperatures, etc. State nature of soil where chimney will be erected. Give local prices for necessary building material.

In accordance with the above information, designs and lowest estimates of the chimney needed will be submitted.

Chimney Repairing.

Old chimneys can be extended without any interruption to the plant.

Send a plan of the old chimney, or the height, inside diameter, width at base and wall thickness. The Engineering Department will furnish design and figure on extending the same.

This company repairs, straightens and points old chimneys while in operation. They inspect old chimneys and make reports and recommendations on their condition, etc.

Furnaces and Kilns.

This company designs and constructs kilns and furnaces. It makes a specialty of building kilns of all kinds.

Miscellaneous Fuel and Smoke Equipment.

Steel stacks, etc., lined. Devices for smoke abatement and fuel saving with high or low pressure boilers furnished or installed complete.



COMMON BRICK CHIMNEY 125 FT. HIGH
BUILT BY AMERICAN CHIMNEY
CONSTRUCTION CO. FOR THE
LOVINGTON COAL MINING CO.,
LOVINGTON, ILL.

AMERICAN CHIMNEY CORPORATION

Designers and Builders of Chimneys

TELEPHONE:
STUYVESANT 3735

147 Fourth Avenue
NEW YORK, N. Y.

BRANCHES

PHILADELPHIA, PA., Stephen Girard Building
CHICAGO, ILL., 1101 Security Building

CLEVELAND, OHIO, 919 American Trust Building
BOSTON, MASS., 141 Milk Street

Products.

PERFORATED RADIAL BRICK CHIMNEYS; COMMON BRICK CHIMNEYS.

Ornamental Chimneys for boiler operation, smelter plants, chemical plant (acid gases), crematories, incinerators (high temperature).

Perforated Radial Brick Chimneys.

The AMERICAN CHIMNEY CORPORATION constructs their chimneys of special bricks which are perforated and are shaped to the circular and radial lines of the chimney, producing, when in place, smooth and true inner and outer surfaces.

The perforations in the brick permit a thorough burning.

In the wall they form insulating dead air spaces which reduce radiation, resulting in fuel economy.

The mortar extends into the perforations, thoroughly bonding the bricks together and adding greatly to the stability of the chimney.

Steel bands are provided for in the wall as safeguards against cracking.

Joints are broken in every course, horizontally and vertically.

Chimneys are built from inside without scaffolding, greatly reducing the cost and time of erection.

Common Brick Chimneys.

This company is prepared to erect chimneys of common brick, round, square or octagonal, to suit special architectural requirements.

Estimates.

When asking for information or estimates, kindly advise on the following points:

(1) Intended use of chimney (boiler furnace, smelter, chemical plant, incinerator).

(2) Height above foundation and diameter or boiler horsepower or number and dimensions of boilers.

(3) If a bid is desired on foundation, give character of soil.

(4) Does chimney stand independent of building? If it is a part of the building, state for what height.

(5) Give hauling distance from purchaser's railroad siding or nearest railroad freight yard.

(6) If possible, give approximate prices of building materials and wage scale of local common labor.

(7) Color of bricks desired.



CHIMNEY BUILT FOR ERIE DYEING COMPANY, CLEVELAND, OHIO

ALPHONS CUSTODIS CHIMNEY CONSTRUCTION CO.

TELEPHONE:
CORTLANDT 8428

Bennett Building—95 Nassau Street
NEW YORK, N. Y.

CABLE ADDRESS:
"CUSTOS, NEW YORK"

ATLANTA, GA., Healey Building
BOSTON, MASS., 261 Franklin Street
CHICAGO, ILL., Marquette Building
CLEVELAND, OHIO, Guardian Building

AMERICAN BRANCH OFFICES
DETROIT, MICH., Moffat Building
MILWAUKEE, WIS., Wells Building
PHILADELPHIA, PA., Pennsylvania Building

PITTSBURGH, PA., Empire building
RICHMOND, VA., American National Bank Building
SEATTLE, WASH., Colman Building

CANADIAN BRANCH OFFICES
MONTREAL, P. Q., 10 Cathcart Street
TORONTO, ONT., 1011 Kent Building
VANCOUVER, B. C.

Products and Services.

Designers and Builders of PERFORATED RADIAL BRICK CHIMNEYS, with FOUNDATIONS and FLUES, of all sizes, for boilers, furnaces, crematories and ovens; CHIMNEYS for smelters, hotels and office buildings; ACIDPROOF CHIMNEYS for paint works and chemical plants; HIGH TEMPERATURE CHIMNEYS for garbage destructors and incinerators; KILNS, BOILER SETTINGS, etc.

Specifications, plans, designs and data furnished free on request.

The ALPHONS CUSTODIS CHIMNEY CONSTRUCTION Co., through its forty years of experience, is equipped to give expert advice as to the size and shape of any kind of a chimney, for any purpose, as well as make recommendations through its engineers regarding boiler layouts, size, shape and design of flues.

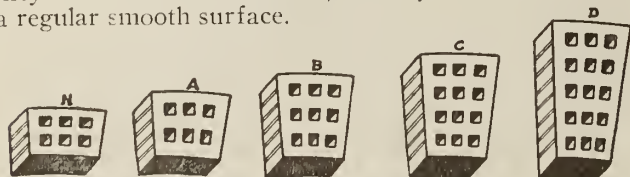
The boilers, the coal used, temperatures, gases generated, geographical location and many other conditions affect the determination of the most economical and efficient size of a chimney. State conditions and the results desired, and the engineers of this company will promptly give the correct, efficient and economical size of chimney, and will make recommendations, not from theoretical tables, but from over forty years' experience and unpublished data collected from actual working conditions of our chimneys all over the world.

The fact that over 7000 Custodis radial brick chimneys are now in successful operation is conclusive proof of their efficiency, permanency and economy.

Description.

The perforated radial blocks are made only from the purest clays, selected for high refractory powers and high crushing strength. Special attention is given in the brickyards to making the proper mix of clays in the right proportion to produce a radial brick chimney which will resist heat strains, as well as strains from weight and wind.

All the radial blocks are formed to suit the circular and radial lines of each part of the chimney, so that they can be laid with thin, even joints and produce a regular smooth surface.



PERFORATED RADIAL BLOCKS

Manufactured in sizes and shapes suitable for all chimney diameters

The blocks are larger than common bricks, making the number of mortar joints in a radial brick chimney one-third of those in a common brick chimney of the same size.

Moulded with vertical perforations, as shown in the illustration, the radial blocks are most thoroughly



and uniformly burned, increasing, to a marked degree, their density and strength. The

perforations form a dead air space around the chimney, insulating the hot column of rising gases on the inside from sudden changes of temperature of the outer air, resulting in a maximum draft under all conditions.

Flues and Kilns.

This company designs and constructs flues and furnaces. It makes a specialty of building kilns of all kinds. Steel stacks, etc., lined.

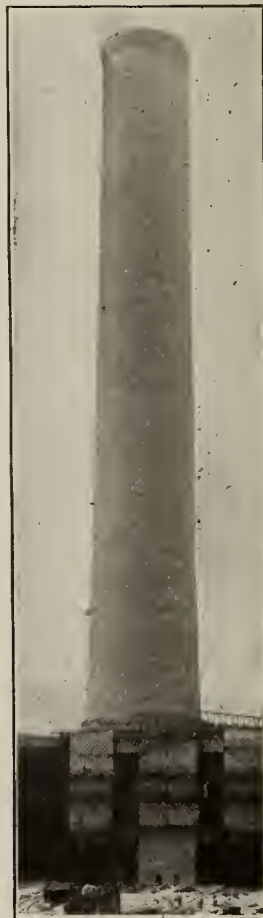
Remodeling and Repairing.

Old chimneys can be heightened without any interruption to the plant.

Send the height, inside diameter, width at base and wall thickness, or a plan of the old chimney. The engineering department will furnish design, and figure on heightening it. Old brick chimneys can be removed without danger. We repair, straighten and point them while in operation, if necessary. We inspect old chimneys and make reports and recommendations on their condition.

Information Required.

When requesting estimates, please give the following information:
Name of place where chimney is to be erected.
On what railroad siding is same located.
Distance from siding delivery to chimney site.
Is chimney to be used for boiler drafts or other purposes.
Give probable temperatures of the flue gases.
If for boiler draft, what is total horsepower.
Kind of fuel or coal to be used.
Amount consumed per horsepower or total per hour.
Dimensions of chimney required—diameter; height.
Is arrangement for overhead or underground flue.
Give dimensions and shape of flue opening desired in chimney.
Give height of same above or below foundation top.
What is nature of soil where chimney will stand.
What is estimated safe load per square foot.
What depth of excavation is necessary to reach good soil.
What is latest date allowed for erection of chimney.
Sketch showing arrangement of building, boiler and chimney.
Local prices—red brick, lime, cement and sand.



TALLEST AND LARGEST CHIMNEY IN THE WORLD BUILT FOR ANACONDA COPPER MINING COMPANY, ANACONDA, MONT. Height above grade, 585 ft. Inside diameter at top, 60 ft. Built in 1918

THE HEINE CHIMNEY CO.

Engineers and Builders of Radial Brick and Concrete Chimneys

NEW YORK, N.Y.

CHICAGO, ILL.

BRANCH OFFICES

PHILADELPHIA, P.A., 1328 Chestnut Street
BOSTON, MASS., 141 Milk Street
PITTSBURGH, P.A., 705 May Building
CLEVELAND, OHIO, Citizens Building
CINCINNATI, OHIO, Mercantile Library Building
TOLEDO, OHIO, 950 Nicholas Building

INDIANAPOLIS, IND., Fletcher-American Bank Building
SAN FRANCISCO, CAL., Claus-Spreckles Building
ST. LOUIS, MO., 1548 Pierce Building
MINNEAPOLIS, MINN., Builders Exchange Building
KANSAS CITY, MO., American Bank Building
DALLAS, TEX., Southwestern Life Building
ATLANTA, GA., Healy Building

Products.

Engineers and builders of RADIAL BRICK and CONCRETE CHIMNEYS.

Also Concrete Tanks and Towers for all industrial purposes.

Services.

THE HEINE CHIMNEY CO. have a skilled and experienced organization for the designing and construction of chimneys, tanks and towers. As a result of close application for many years in radial brick and concrete construction, our engineers are in a position to render a most valuable consulting service to engineers who are intending to build either chimneys, tanks or towers. A vast accumulation of data in our possession, and which is not available elsewhere, is at the disposal of our engineers for their use in determining the most efficient type and size of chimney required to meet any existing conditions.

Heine Radial Brick Chimneys.

Heine radial brick chimneys are built with perforated radial brick, manufactured from clays specially selected for high refractory qualities and crushing strength.

Heine Concrete Chimneys.

Heine concrete chimneys are constructed with all steel outer and inner forms, covered by patents, assuring a true and concentric chimney with uni-

form taper. They are built with a wet mixture and reinforced with steel bars and triangular wire mesh as manufactured by American Steel & Wire Company.

Information Required for Preparation of Estimates.

Name of party and place of erection.

Distance from railroad track to chimney site.

Will chimney be built in the open or within a building?

Is chimney to be used for boiler drafts or other purposes?

State probable temperature of the flue gases.

Give number and total horsepower of boilers.

Give number of flue openings.

Give approximate distance from grade to bottom of flue opening; whether chimney is arranged for overhead or underground flue.

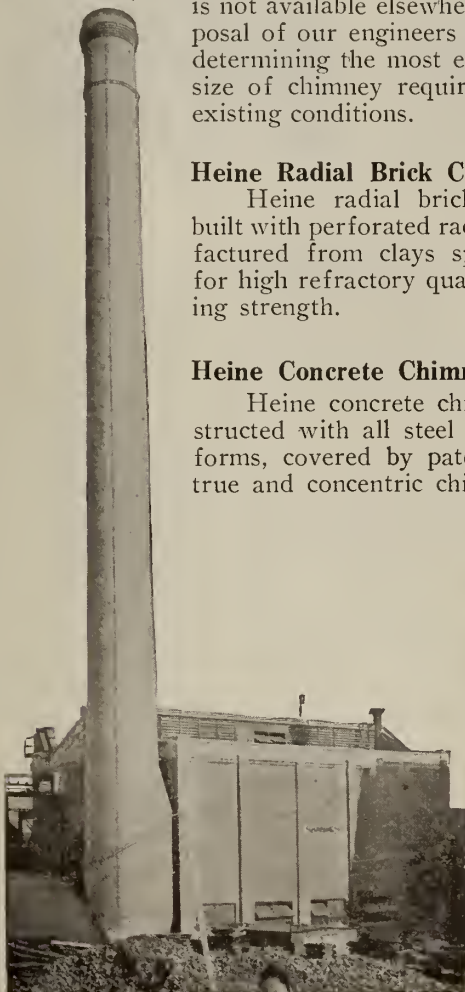
Height and diameter of chimney.

Present local prices for the following delivered at job:

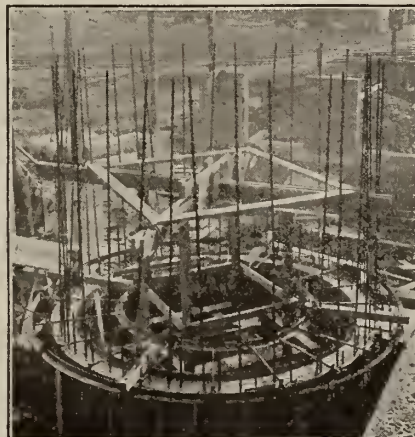
Cement, lime, sand, stone or gravel, and common brick.

Representative Clients.

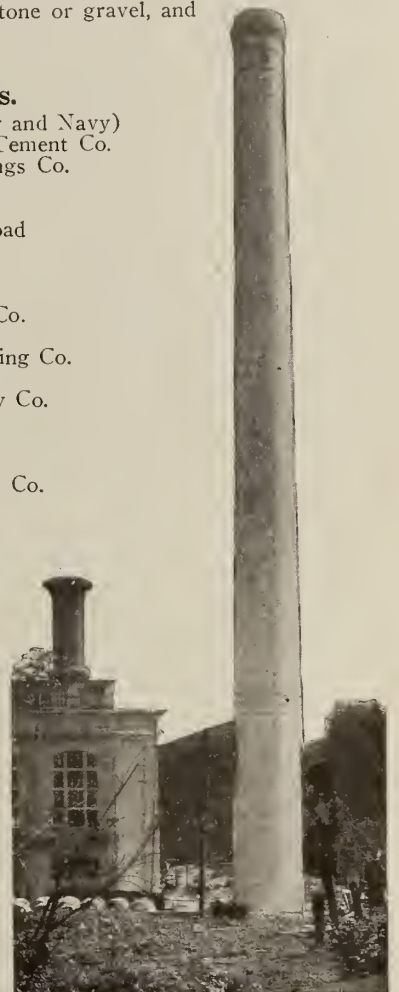
U. S. Government (Army and Navy)
Knickerbocker Portland Cement Co.
National Malleable Castings Co.
Standard Oil Co.
Morton Salt Co.
New York Central Railroad
Pennsylvania Railroad
Barrett Co.
Heinz Co.
American Steel & Wire Co.
Stone & Webster Corp.
Harry M. Hope Engineering Co.
Jas. Stewart & Co.
American Car & Foundry Co.
General Electric Co.
Snare & Triest
Pressed Steel Car Co.
United Gas Improvement Co.



HEINE RADIAL BRICK CHIMNEY CONSTRUCTED FOR THE BETHLEHEM STEEL CO.



VIEW LOOKING DOWN ON STEEL FORM IN PLACE FILLED WITH CONCRETE



HEINE CONCRETE CHIMNEY CONSTRUCTED FOR THE AMERICAN ROLLING MILL CO.

THE M. W. KELLOGG COMPANY

Manufacturers of Perforated Radial Brick Chimneys

140 Cedar Street
NEW YORK, N. Y.

BRANCH OFFICES

BOSTON PHILADELPHIA CHICAGO PITTSBURGH SAN FRANCISCO LOS ANGELES
MONTREAL, TORONTO, WINNIPEG, CAN., CANADIAN KELLOGG Co., LTD.

Products.

PERFORATED RADIAL BRICK CHIMNEYS.

For Welded Pipe, Flanges, Tanks, Fittings and Seamless Welded Work of all descriptions, see pages 420-21.

Service.

THE M. W. KELLOGG COMPANY has erected some of the finest chimneys in the United States during the last sixteen years, and is ready to share the results of that experience with engineers and architects who are engaged in problems where chimney construction is required. This company's engineers will be glad to advise on types, sizes, shapes, etc., of chimneys for any condition that may arise.

Kellogg Perforated Radial Brick Chimneys.

No artificially produced material for the construction of the modern factory chimney compares with refractory clay. This raw material is put through a variety of scientific treatments by skilled hands and especially designed machines before it comes from the kilns in the form of perforated radial brick ready for shipment, and for use in chimney construction.

Each brick is formed to occupy a certain position in the circular and radial lines of the chimney, as shown by the drawing on this page, and is sound ringing, hard, well burned and free from checks.

Bricks are made to conform closely with the circular and radial lines of the shaft and are weatherproof and acidproof.

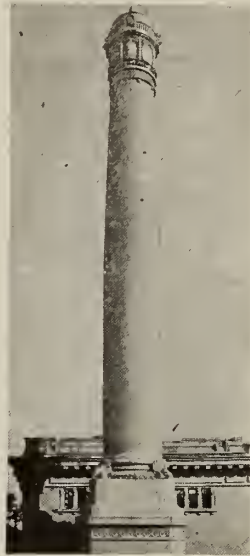
Total amount of perforations does not exceed one-fourth of the cross area of the brick, which are tested to a crushing strength of not less than 6000 lbs. per sq. in.

The perforations in the radial bricks form a dead air space about the core of the chimney. This has a marked effect in reducing amount of fuel used, in preventing sudden changes of temperature within the chimney, and in reducing radiation. Thus a uniformly maximum draft is maintained in any kind of weather.

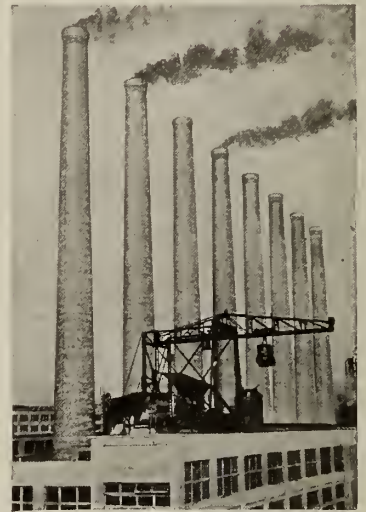
A trained superintendent of construction, familiar with all the details of the plans and specifications of the chimney, accompanies each shipment of radial brick, to supervise unloading and stacking in the order of their use. Throughout the entire construction the bricks of each tier reach their final place under his direction.

An expert mortar man supervises the preparation and use of all of the mortar. The tensile strength of the chimney, its ability to withstand heat and cold and to defy all sorts of weather from without and all sorts of gases from within, depend largely upon this mortar. Each brick is laid in so full a bed of mortar that the latter enters the perforations of the brick from 1 in. to 1½ ins. The joints are struck both inside and out.

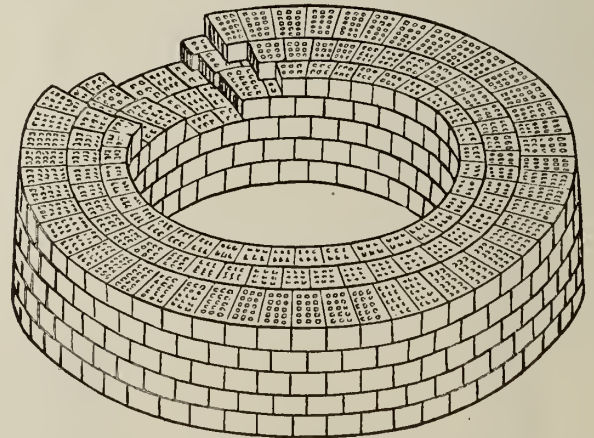
A crew of trained men in scientific chimney con-



QUEEN LANE FILTER
PLANT,
PHILADELPHIA, PA.



CORN PRODUCTS REFINING CO.,
ARGO, ILL.



METHOD OF USING M. W. KELLOGG'S PERFORATED RADIAL
BRICK IN CHIMNEY CONSTRUCTION

struction carry forward the erection of the chimney from start to finish, insuring careful construction and the proper grading and matching of brick throughout.

Standard Specifications for Perforated Radial Brick Chimneys.

SCOPE—The work included under this contract is to consist of all labor and material necessary for the erection complete of one radial brick chimney in accordance with this specification, which shall become a part of the contract. The proposal shall include all scaffolding, cartage, unloading of material and removal of rubbish necessary to leave the chimney in a first class condition ready for operation.

DELIVERY—The chimney will be built at.....
located on the.....
railroad.

Material may be unloaded on owner's siding, which is within.....of the chimney site.

SPACE—Sufficient storage room for chimney contractor's materials will be provided adjacent to chimney as well as unobstructed access from transportation delivery to the site of chimney for delivery and removal of materials and tools. At least one side of chimney will be left free and open by the owners for hoisting and working space until the chimney is completed.

WATER—The owners will provide the chimney contractor with necessary water within 50 ft. of the site of the chimney free of expense to the chimney contractor. From this point the chimney contractor will make his own hose connections, if required.

WORKMANSHIP AND MATERIALS—All workmanship and materials shall be first class.

The chimney contractor shall furnish a competent foreman under whose supervision the chimney will be built. Chimney must be built in a thorough, complete and workmanlike manner.

TIME OF COMPLETION—The chimney contractor shall state in bid the guaranteed number of working days in which he will finish the chimney after receipt of signed contract and approved drawings.

FOUNDATION—Proper foundation will be built by the owner from plans and specifications to be furnished by the chimney contractor, who will, upon completion, give in writing his approval of the foundation as being sufficient to sustain the chimney and fulfil the guarantee.

Note—In case, however, it is desired to have chimney contractor build the foundation, the following may be used:

The chimney contractor shall furnish a concrete foundation of proper depth and spread to safely sustain the chimney. The foundation shall be not loaded to more than.....tons per sq. ft., which is the safe bearing value as determined for this work.

Excavating shall be done by contractor for foundation.

The concrete shall be composed of cement, sand, stone or gravel in the proportion of 1 part cement to 2½ parts sand and 5 parts of stone or gravel. It shall be deposited in the forms in layers not to exceed 6 in. in thickness and thoroughly rammed into place. Concrete shall be a wet mixture.

DESIGN—The design of the chimney shall conform to the following dimensions as shown on drawing attached:

Height above top of foundation.....ft.....ins.

Minimum internal diameter.....ft.....ins.

The wall of the column shall have one straight and true batter from top to bottom. The wall thickness and section lengths to be as shown on drawing. In case the contractor's standard wall thickness should not be exactly as shown, a variation of 3% will be allowed in either direction.

BASE—If chimney is to be built with base and column construction, use the following:

The base of the chimney shall be built [here fill in shape of base] in shape.....ft. high, of the dimensions shown on drawing, of straight, hard, well burned, well shaped common building brick laid in full bed of cement lime mortar as herein specified.

Note—If round for the entire height, specify as follows:

The chimney shall be built of perforated radial brick for the entire height, as hereinafter specified.

RADIAL BRICK—All radial brick shall be best quality, moulded from refractory clay, sound ringing, hard, well burned, well shaped, of reasonably even color and free from checks; made to closely conform with the circular and radial lines of the shaft, and shall be weatherproof and acidproof. They shall have a water absorption of not less than 5% nor more than 12% of their dry weight after immersion for a period of 24 hours; and shall have a crushing strength of not less than 6000 lbs. per sq. in. The total amount of perforations shall not exceed one-fourth of the cross area of the brick. One cu. ft. of radial brickwork shall weigh not less than 120 lbs. The outside faces of the brick shall be of regular size, so that the general appearance of the brickwork will be neat and uniform.

LINING—The chimney shall have an expansion lining built of perforated radial fire brick 4¼ ins. thick.....ft. high from a point 2 ft. below the bottom of the flue opening. The lining prevents flue gases from coming in contact with the solid masonry of which the shell is built, and shall be separated from same by an air space of not less than 2 ins.

The lining shall be built after the chimney is finished, and exceptional care must be taken to keep the air space clear and free of loose mortar and other dirt.

Rack out the shell of the chimney approximately 2 ins. above lining, to form a ledge for the purpose of diverting the falling soot when the chimney is in operation.

MORTAR—All brickwork shall be laid in cement lime mortar, as hereinafter specified, with courses level and with full joints throughout. Face brickwork and backing to be laid up at the same time with joints of reasonably even thickness, not exceeding ½ in. The mortar to be used in the chimney shall consist of 1 part Portland cement, 2 parts fresh burnt limp lime mortar and 5 parts clean, sharp sand. The cement to be added to the sand and lime mortar as the mortar is required, and no mortar having taken an initial set is to be used. The cement must not be added until the lime is cool. The sand shall be clean and sharp, free from loam, vegetable matter and large pebbles. If necessary, it must be both screened and washed.

BOND—All common brickwork shall have every fourth course a header course.

Radial brickwork shall be bonded every three courses.

BREACHING OPENING—One opening shall be provided in chimney. The opening to be lined on the reveals with refractory material. The masonry above the opening to be supported by heavy I-beams set on steel plates, with air spaces at each end for expansion. Under these I-beams a flat masonry arch shall be built to properly protect the beams from the effect of the gases. The flue opening shall be reinforced laterally by heavy tie rods and plates over the top and at the bottom.

Three-eighths by 3-in. steel bands to be placed in the masonry above and below opening.

The opening shall be.....wide by.....high, the bottom of which shall be approximately.....above foundation.

REINFORCING RINGS—The chimney contractor shall place in the brickwork at every change in wall thickness steel bands ¾ in. thick by 3 ins. wide.

If the contractor should furnish perforated radial brick having corrugated sides, these bands may be omitted.

HEAD—The head of the chimney shall be neatly corbeled out and fitted with a heavy annular retaining ring set in full bed of cement mortar.

CLEAN-OUT DOOR—Provide and place in base of chimney where directed by owner a cast iron clean-out door and frame properly hinged and fitted with latch. Said door to be approximately 24 ins. wide by 36 ins. high.

LADDER—Build on the interior of the chimney a ladder to consist of ¾-in. galvanized iron rungs, spaced approximately 15 ins. center to center and securely anchored to the masonry from top to bottom. These ladder irons to be in the shape of a "U" with hooked ends.

LIGHTNING CONDUCTOR—The lightning conductor is to consist of.....copper points, ¾ in. in diameter by 8 ft. long, with 1½-in. platinum tips. The points to be anchored to the top of the column and extend from the bottom of the corbeling upward. The lower ends of the points to be connected by a loop of copper cable encircling the chimney. From this loop there is to be 1½-in. 7-strand No. 10 Stubbs' wire gauge copper cable, carried down the side of the chimney and connected to copper ground plate of the 3-winged type as best for the proper distribution of charge. The points to be securely fastened to the top of the chimney and the cable to be anchored every 7 ft. in height with brass anchors, so designed that they will support the weight of the cable. The ground plate shall be buried by the contractor for the foundation when it is built.

LETTERING (WHEN DESIRED)—Work into the column on [one or two] sides as directed the letters [here insert the desired legend] to be made in permanently colored kiln burnt brick. Letters to be true to size and shape and to be in a true vertical line.

TRIMMINGS (IF ANY)—All necessary stone or terra cotta shown on drawing will be furnished without charge by the building contractor to the chimney contractor, who will set same. No one piece should weigh over 200 lbs.

INSURANCE—The chimney contractor shall carry at his own expense, during the entire period of construction, liability insurance, insuring the men in his employ and the public in general, in case of damage due to accidents.

GUARANTEE—The chimney contractor shall guarantee the chimney for a period of 5 years from date of completion. The guarantee shall cover any defects that may arise within this period due to faulty design, construction, material, weather, and the products of combustion up to 800° Fahr.; and shall further guarantee to make good at his own expense all defects that may arise from any of the above conditions within the specified period.

The chimney shall be designed for a wind velocity of not less than 100 miles per hour.

NOTE—The chimney shall be built according to THE M. W. KELLOGG COMPANY [or equal] system of construction.

The insertion of this clause would be greatly appreciated on account of the advertising value to us on future work.

H. R. HEINICKE, INC.

Builders of Radial Brick Chimneys

TELEPHONES:
STUYVESANT 2686
STUYVESANT 2855

147 Fourth Avenue
NEW YORK, N. Y.

CONNECTIONS THROUGHOUT THE UNITED STATES

FACTORY
NEWCOMERSTOWN, OHIO

Products and Services.

Specialists for 35 years in the design and construction of PERFORATED RADIAL BRICK CHIMNEYS and accessory structural members, including Foundations, Boiler Setting and Brick Furnaces.

Manufacturers of PERFORATED RADIAL BRICK.

Also, Grain Elevators, Tanks and Silos.

Rush work a specialty. Material always ready for immediate shipment from the factory.

Heinicke Radial Bricks and Chimneys.

Heinicke chimneys are constructed of specially formed perforated bricks manufactured by Heinicke themselves. These bricks are shaped to the circular and radial lines of the chimney, producing, when in place, smooth and true inner and outer surfaces.

They are hard burned, regular in shape, sound ringing, and weatherproof and acidproof.

All Heinicke radial bricks are produced from selected, chemically tested and carefully proportioned refractory fire clay and shale.

The perforations permit of thorough burning of the bricks, assuring a product which is highly resistant to acids, heat, weather and other deteriorating influences.

The brick plant is run as a part of this business and not as a separate enterprise. It is the only brick plant in the United States which makes a specialty of radial bricks. Radial bricks are produced by other brick makers simply as a side line in connection with their regular business. Such concerns can not be expected to give the care and attention to the manufacture of radials as will be exerted by the chimney builder himself.

The Heinicke bricks are superior to the brick ordinarily used and are made by this company to maintain a high standard of excellency.

Since we manufacture the brick and erect the chimneys in our own organization, full responsibility is assumed for results without question or argument. There can be no division of responsibility.

The experience and organization of H. R. Heinicke should be worth something to you.

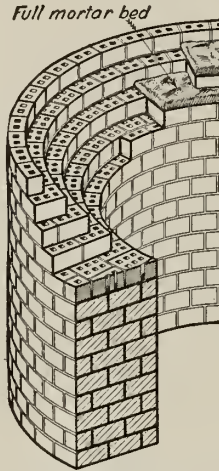
Heinicke chimneys are bonded in every direction at all courses. This with the concealed reinforcement employed enables us to absolutely guarantee the chimneys against cracking, except from unusual cause or abuse.

The H. R. HEINICKE, INC. has successfully erected thousands of chimneys both in the old world and in the new. As specialists in the engineering and designing of chimneys, their experience is available to engineers and contractors.

Features of Design and Workmanship.

(A) The perforations in radial bricks form insulating dead air spaces in the wall of the chimney, which reduce radiation and prevent sudden temperature changes within the chimney, resulting in a considerable saving in fuel. The mortar slightly extends into the perforations, forming an anchorage that adds greatly to the stability of the chimney.

(B) Concealed steel bands are used in reinforcing the chimney; these add materially to the strength of the stack in resisting stresses due to expansion, and insure safety against cracking.



SECTIONAL DETAIL
OF CHIMNEY, SHOW-
ING HEINICKE BOND



HEINICKE CHIMNEY SERVING
A SMELTER
Height, 460 ft.; clear diameter at
top, 8 ft. Built 1889

(C) The Heinicke system of bonding provides for the breaking of joints between courses, so that no vertical joint is higher than one brick. Every course is thoroughly bonded through the use of bricks varying in length from 4 to 10 in. (See sectional detail.) This method of bonding gives greater compressive strength and resistance to lateral stresses than other systems; the increase in strength over the common bond amounting to about 300%.

(D) The erection of the chimney is done from the inside, thus doing away with outside scaffolding and eliminating accompanying dangers to workmen as well as unnecessary cost.

Estimates.

In writing for information or estimates, please advise on the following points:

(1) Distance from nearest railroad siding or team track.

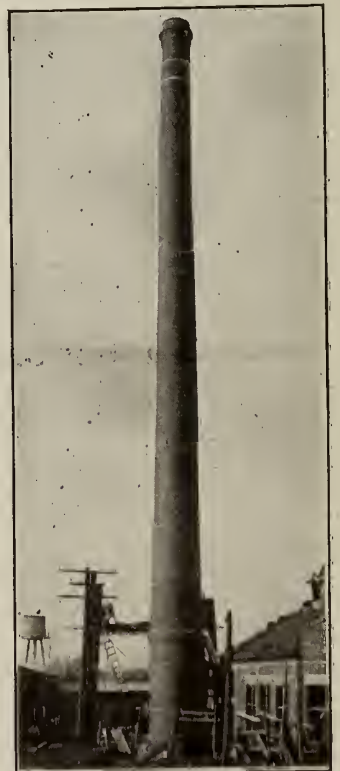
(2) Intended use of chimney (boilers, furnaces, incinerators, smelters).

(3) Height and diameter, or boiler horsepower, or type, number and dimensions of boilers.

(4) Kind of fuel to be used.

(5) Character of soil for foundation.

(6) Approximate price of cement, lime, sand, gravel, crushed stone and common hard brick, delivered at the chimney site.



PASSAIC METAL WARE CO.,
PASSAIC, N. J.
Height, 125 ft.; clear diameter at
top, 3 ft.

THE RUST ENGINEERING COMPANY

Designers and Builders of Chimneys

DISTRICT OFFICE

Jenkins Arcade
PITTSBURGH, PA.

BRANCHES

CHICAGO, ILL.
MONTREAL, QUE., CAN.
SEATTLE, WASH., L. C. Smith Building

DISTRICT OFFICE

District Bank Building
WASHINGTON, D. C.

BRANCHES

BOSTON, MASS., 10 High Street
CHARLOTTE, N. C., 1130 Realty Building
NEW YORK, N. Y., 21 Park Row
PHILADELPHIA, PA., Girard Building

DISTRICT OFFICE

Woodward Building
BIRMINGHAM, ALA.

BRANCHES

ATLANTA, GA., 1521 Candler Building
NEW ORLEANS, LA., 533 Baronne Street

Products.

PERFORATED RADIAL BRICK
and REINFORCED CONCRETE
CHIMNEYS, with FOUNDATIONS
and FLUES, for powerhouses,
furnaces, factories, smelters and ovens.

Acidproof Chimneys for chemical
plants.

For Reinforced Concrete, Brick and
General Construction, see page 19.



Service.

The design and construction of tall
chimneys call for special care and special
methods. Nothing in the line of large con-
struction calls for greater exactitude. It is
an art in itself; and efficiency, combined
with safety and economy, is assured only
where the work is managed by highly spe-
cialized engineers.

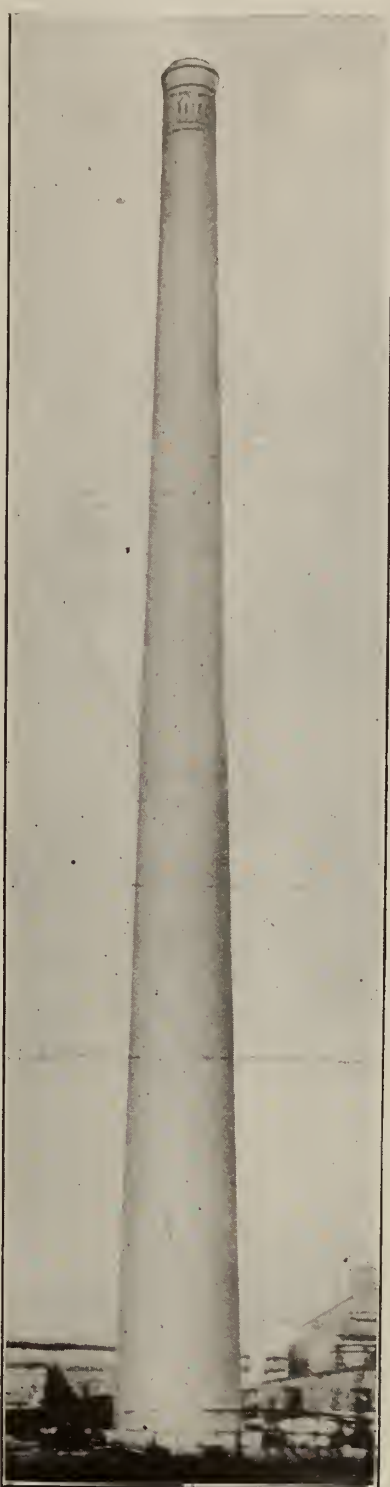
THE RUST ENGINEERING COMPANY
possesses every facility for the successful
design and construction of tall chimneys.
With offices located at convenient points
throughout the United States, with com-
plete construction plants immediately avail-
able, with office and field forces ready to
act on instant notice, this company is pre-
pared to undertake the design and construc-
tion of chimneys any place in the United
States, Canada and Cuba.

The design is prepared by expert chim-
ney engineers. Efficient and economical
proportions are determined through a rigid
mathematical investigation which takes into
consideration the fuel, method of firing,
boiler layout, outside temperature, elevation
and geographical location.

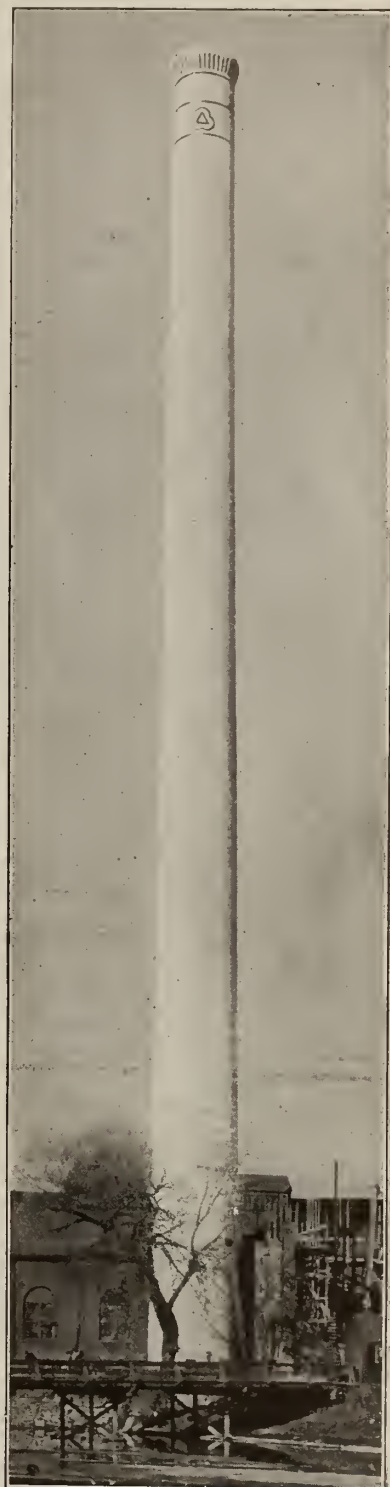
Construction is in charge of trained
field superintendents; and in consequence,
the finished chimney is in strict conformity
with the plans and specifications.

The wide experience of THE RUST EN-
GINEERING COMPANY in chimney design and
construction, together with the consistent
use of first grade materials, insures results
that are practical and uniformly satisfac-
tory.

Correspondence invited.



PERFORATED RADIAL BRICK CHIM-
NEY, BETHLEHEM STEEL CO., SOUTH
BETHLEHEM, PA.
250 ft. high, 9 ft. diameter



REINFORCED CONCRETE CHIMNEY,
DENVER GAS & ELECTRIC CO.,
DENVER, COLO.
300 ft. high, 12 ft. diameter

ARROW CONDUCTOR & MANUFACTURING CO.

Lightning Conductors

1536 West Adams Street
CHICAGO, ILL.

Products and Services.

Manufacturers and contractors for LIGHTNING CONDUCTORS for chimneys, towers and all types of high and exposed buildings.

Electrical Grounding Terminals.

Chimney Banding and Repairing.

Steeple Jacks furnished for hazardous work.

Specification.

For the convenience of architects and engineers, a brief specification is given for a safe and lasting system of lightning protection for power plant chimneys, as is specified by architects and engineers.

POINTS—Preferably multiple reinforced type made of special high heat resisting copper bronze, main center point 6 in. long, $1\frac{1}{2}$ in. at base, tapering to $\frac{1}{2}$ in., then sudden sharp point. Five small points with reinforced tips 3 in. by $\frac{1}{8}$ in. set at angle of 45° at base of large point. Main and small points to be sleeved with shell of pure platinum $\frac{1}{500}$ in. thick. Point mounted on solid copper bar $\frac{3}{4}$ in. in diameter. Round "V" bends between points and circuit cable conductor.

CABLE CONDUCTOR—At least two cable down conductors after forming a cable circuit with round "V" bends, to be 99% pure copper, 300,000 C.M. cross section with all cable joints interwoven.

LEAD ARMOR—To protect the system against acids and gases emitted through top of stack, all parts of system from platinum to 25 ft. below top of stack to be covered with chemically pure lead $\frac{1}{8}$ in. thick with all joints lead burned.

GROUND TERMINALS—Two pure perforated copper ground reservoirs, 24 by 4 in., with No. 19 B. & S. gage wall metal, 4-in. bronze conical cap, tube center, and filled with pea size charcoal, should be attached to each cable.

FASTENERS—Heavy copper bronze, 2-bolt type anchors, lead coated in the armor zone, of the Arrow pegged anchor type, to be built in as the masonry progresses, 5 ft. apart vertically and 18 in. horizontally.

LIGHTNING INDICATOR AND TEST GAGE—An efficient instrument incased in aluminum with a regulating attachment on the face, so that it can be used for testing the system, should be attached to one of the cables without cutting the cable conductor.

PROTECTION PIPES—To prevent theft, brass pipes 8 ft. above ground level and 1 ft. below, properly anchored to wall with heavy brass anchors.

GUARANTEE—The contractor to guarantee a structure equipped with this system against damage by lightning for a period of

10 years and assume liability for accidents and damages during installation.

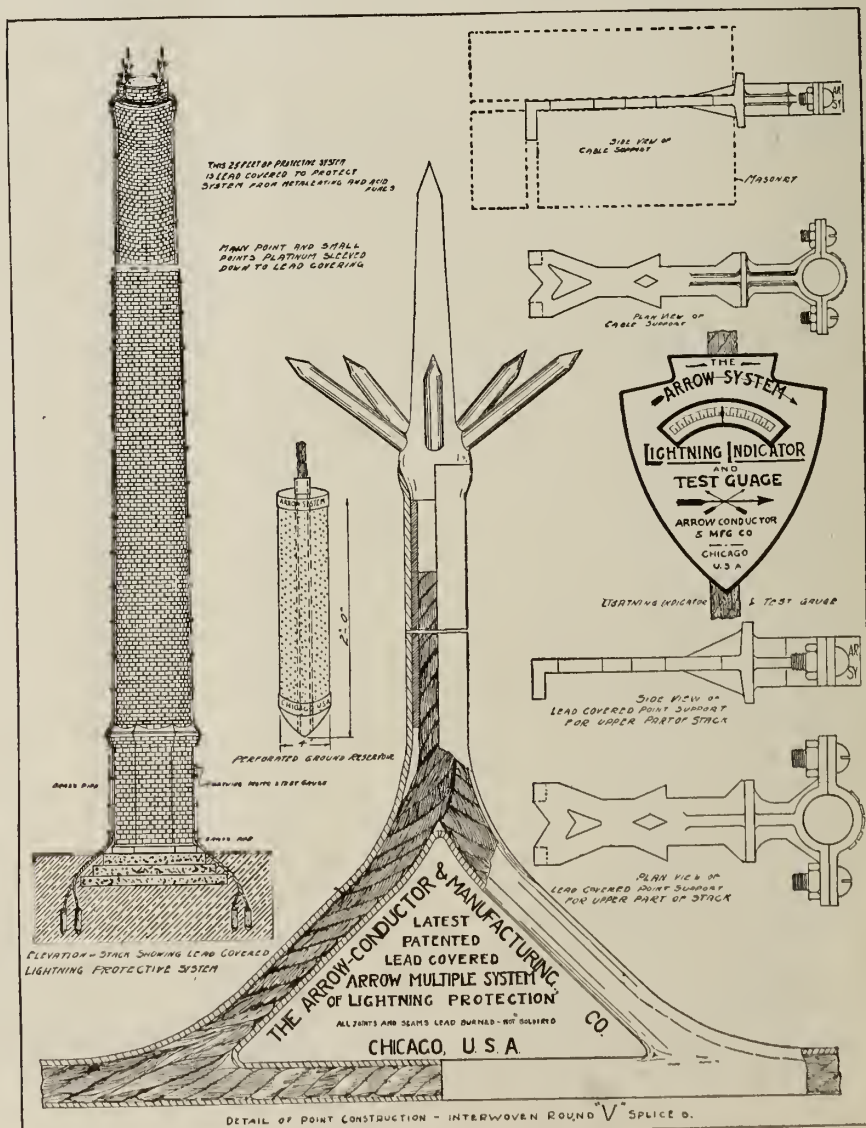
Official Approval.

The Arrow patented system embodies all of the preceding qualities and more. Approved and labeled by the National Board of Fire Underwriters and their Laboratories.

Installations and Co-operative Service.

Installed on United States and Canadian Government stacks, on municipal and industrial structures everywhere. Prominent state, city and corporation stacks in nearly every State in the United States and Canada equipped with the Arrow system.

A complete specification, blue print and other valuable information mailed free on request.



DETAILS ARROW SYSTEM LIGHTNING PROTECTION FOR CHIMNEYS

BADENHAUSEN CO.

Manufacturers of Boilers and Superheaters

1425 Chestnut Street
PHILADELPHIA, PA.

SALES OFFICES

NEW YORK, N. Y., 111 Broadway
PITTSBURGH, PA., Jenkins Building
CHICAGO, ILL., Marquette Building

DENVER, COLO., Tramway Building
BIRMINGHAM, ALA., Brown-Marx Building
SAN FRANCISCO, CAL., Rialto Building

WORKS: CORNWELLS, PHILADELPHIA, PA., and BOUND BROOK, N. J.

Products.

BADENHAUSEN STATIONARY and MARINE WATER TUBE BOILERS.

Scotch Marine Boilers, Simplex Superheaters.

For Steam Engines, see page 697.

Badenhausen Stationary and Marine Water Tube Boilers.

ADVANTAGES—The Badenhausen water tube boiler in all its forms was designed and perfected by John P. Badenhausen, M.M.E., whose expert knowledge and thorough experience in economical and efficient steam production enabled him to build a boiler having positive, continuous and unrestricted circulation, thereby making possible daily high efficiency and instantaneous and long-continued overloads without heat waste or boiler injury. To make a good boiler better, he added the ability to deliver at the boiler outlet steam guaranteed to be dry and superheated to an average of not less than 10° Fahr. thus eliminating wet and dirty steam troubles and removing the necessity for installing superheaters unless high degrees are desired.

CONSTRUCTION—The principle of perfect circulation is shown in Fig. 1. The boiler construction is shown in Fig. 2. Note that curved tubes connect drums to form an unrestricted path of equal area throughout. In the tubes connecting drum 3 and drum 4 the steam is dried and superheated. When high degrees of superheat are desired, Simplex superheaters are installed as shown in Fig. 2.

Figs. 1 and 2 show the 4-drum design of the Badenhausen boiler. Fig. 3, the preheater design. It is also built in double ended form. The dimensions and horsepower per unit vary to meet various steam requirements.



FIG. 1. BADENHAUSEN WATER TUBE BOILER, STANDARD 4-DRUM DESIGN

Arranged for hand firing. Glass ring superimposed thereon has been proven to be proper shape of vessel for perfect generation of steam. Note how clearly boiler coincides with glass ring showing that "The Best and Soundest Circulation Theory is Carried Out Practically"; that, regardless of intensity of heat applied to heating surfaces, no part of Badenhausen water tube boiler is left dry to the action of fire

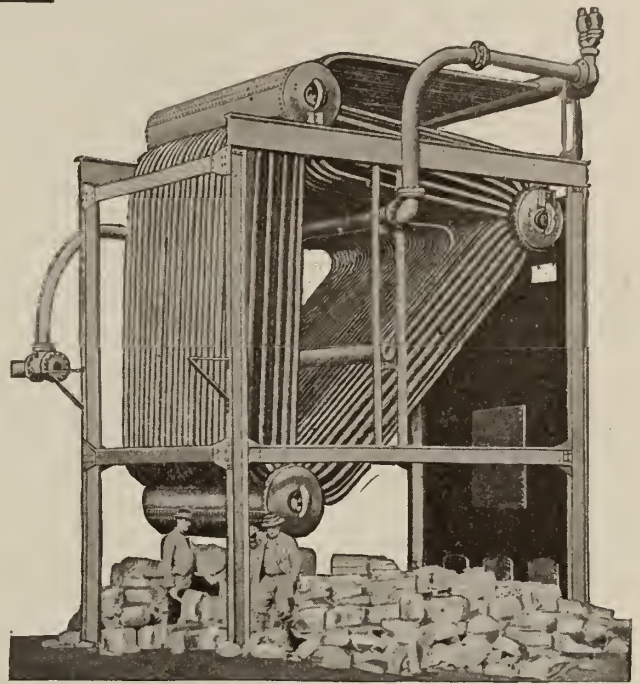


FIG. 2. BADENHAUSEN WATER TUBE BOILER READY FOR BRICK WORK

To be equipped for both coal and oil firing. Note strong steel frame-work, also Simplex superheaters

Units are built up to 6000 h.p. each. Whether stoker or hand fired with bituminous or anthracite coals, whether using oil or natural gas, lignite or bagasse; wood working offal or any kind of waste heat, whether in land or marine service, the best furnace design is assured to meet the varying conditions.

The Badenhausen water tube boiler is supported independent of brickwork and is adequately flexible; thereby insuring long boiler life. All parts of boiler, superheaters, baffles, etc., are easily accessible and inexpensively kept in first class condition.

The design, construction and operation conform to the requirements of the boiler code of the A.S.M.E. and of both land and marine inspection requirements of reputable inspection and insurance companies.

Write for catalogues.

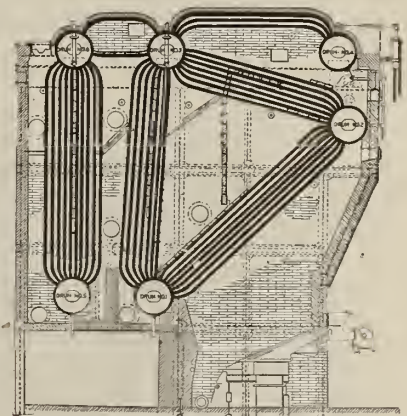


FIG. 3. BADENHAUSEN HIGH EFFICIENCY PREHEATER TYPE BOILER

Equipped with stoker for soft coal firing. In this 6-drum type, exit gas temperatures are extremely low, and the usual daily efficiency is 85%

JAMES BEGGS & CO.

Manufacturer of Worthington Water Tube Boilers

OFFICE AND SALESROOM

42 Warren Street
NEW YORK, N. Y.

WORKS: SOUTH NORWALK, CONN.

Products.

WORTHINGTON WATER TUBE BOILERS, built in units from 50 to 600 h.p., A.S.M.E. Code.

For Grates and Steam Blowers, see page 663.

Beggs Worthington Water Tube Boiler.

The Beggs Worthington water tube boiler is of the sectional type with steam and mud drums, headers and steel or iron tubes. The construction is clearly shown in the illustration. The circulation is from the steam drum through the downtake tubes to the lower headers, front and rear, through the tubes over the grates to the upper headers, front and rear, and thence through the connecting tubes to the steam drum again.

Points of Superiority.

FACILITY OF DELIVERY—By reason of its sectional character this boiler can be delivered in places wholly inaccessible to other desirable boilers. A boiler of 200 h.p. can be passed through an ordinary window or side-walk opening.

SETTING—The Worthington boiler is entirely enclosed in a steel casing provided with the necessary doors to make the interior accessible for cleaning and repairs. The casing is lined with non-conducting material which reduces the heat radiated to almost nothing.

COMPACTNESS—As a result of doing away with the brick setting and of grouping the tubes in the firebox, a large aggregate of heating surface is concentrated in a small space. The boiler, therefore, has a greater capacity per cubic foot of space than many other boilers in the market.

CIRCULATION—Short tubes and headers produce rapid and positive circulations, which is recognized as the best method of preventing deposits of scale or sediment.

The tubes of the Beggs Worthington boiler will be cleaner than those of many other boilers, evaporating a like quantity of the same water per square foot.

DRY STEAM—Each section has its own independent outlet discharging into the steam drum against a baffle. As a result of the separation obtained going around this baffle, priming is avoided and dry steam obtained.

HEATING SURFACE—All tubes are in the fire and are exposed to the radiant heat of the fire; every square inch is therefore employed as active heating surface.

GRATE SURFACE—The grate extends under the entire heating surface, giving an exceedingly liberal proportion of grate surface to heating surface.

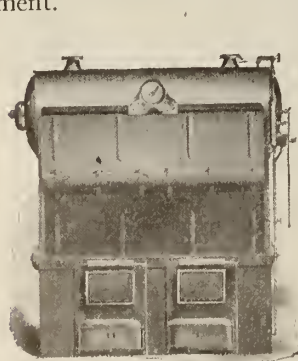
OVERLOAD CAPACITY—As a result of the ample grate surface and the large amount of active heating surface, the Worthington boiler is able to respond quickly to any sudden overload demands.

BAFFLE REPAIRS—As there are no baffles in the Worthington boiler, the expense resulting from baffles falling down, together with the increased coal consumption resulting from the short circuiting of the gases, is entirely avoided.

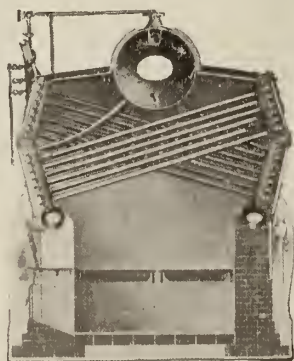
CLEANING—Openings are provided front and rear between the upper and lower header sections for the insertion of a steam nozzle between the vertical rows of tubes, for the purpose of blowing the soot and dust from the outside of the tubes.

Adaptability for Stokers and Grates.

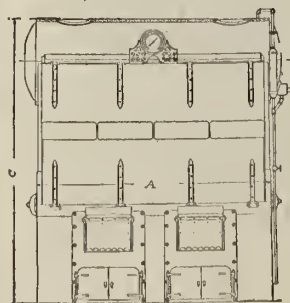
The standard sizes are adapted to fit all types of stokers and grates, particularly the McClave improved cut-off and dumping, also shaking grates. Special designs and settings can be made to fit any unusual requirements of space, stokers or grates.



Front Elevation

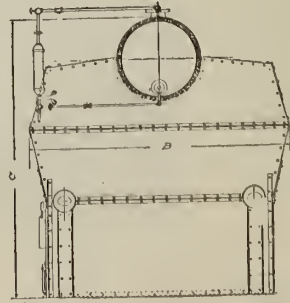


Vertical Cross Section



DETAILS OF WORTHINGTON WATER TUBE BOILERS

Dimension sheet applying to above sent on application



THE BROWNELL COMPANY

Manufacturers of Boilers, Engines and Feed Water Heaters

DAYTON, OHIO

SALES REPRESENTATIVES IN ALL SECTIONS OF THE COUNTRY

Products.

BOILERS: Horizontal Return Tubular, Locomotive Type Portable, Scotch, Vertical Tubular, Firebox Heating, Oil Country.

ENGINES: Automatic, Throttling, Fan, Variable Speed Duplex, Oil Country Drilling.

Feed Water Heaters: Open and Closed Types.

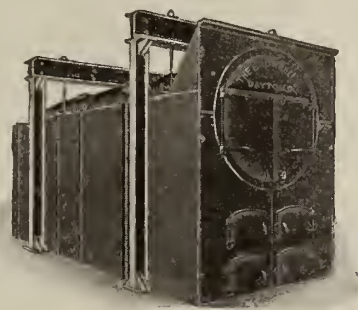
Brownell Boilers.

Material used is of the best quality—plate being open hearth steel, and tubes being A.S.M.E. standard, of best quality of American manufacture. Workmanship is the best and according to the latest known practice.

Brownell boilers are built to pass the most rigid inspection requirements. The company is prepared to build boilers according to the A.S.M.E. Code, or laws of the different states and municipalities.

Types of Boilers.

HORIZONTAL RETURN TUBULAR BOILERS—Designed with a factor of safety of 5; the longitudinal seams being butt jointed and double, triple, or quadruple riveted, according to the size and pressure carried. Where possible, rivets are driven by hydraulic pressure. Built in sizes from 15 to 250 h.p. for working pressures from 100 to 150 lbs., and for lower pressures for heating purposes. For details, refer to Bulletin B-1.



HORIZONTAL RETURN TUBULAR
BOILER, WITH BOX TYPE
STEEL CASING

BOX TYPE STEEL CASING—Steel casings entirely surround brickwork and thereby eliminate losses due to imperfections in brickwork, decrease radiation losses and insure maximum draft. It is, without doubt, the most satisfactory type of boiler setting. For other types of steel casings, see Bulletin B-4.

FIREBOX HEATING BOILERS—Smokeless firebox boilers are built with a down-draft furnace to meet the most rigid smoke ordinances. The down-draft furnace not only eliminates the smoke but increases the efficiency of the boiler.

Firebox boilers are built without down-draft furnace for use where no smoke ordinance is in effect.

Firebox heating boilers are suitable for heating all large public buildings, churches, schools, office buildings, factories, etc. Detailed information in Bulletin B-6.



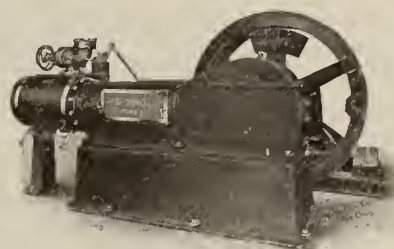
SMOKELESS FIREBOX HEATING BOILER

Brownell Side Crank Steam Engines.

The engines are well built throughout, only the best material being used in the construction. They are designed for severe and continuous service.

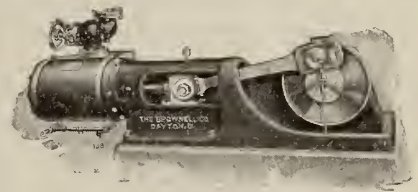
Types of Engines.

HIGH SPEED AUTOMATIC ENGINES—Built in either open or closed type. The automatic governor is of the inertia flywheel type, guaranteed to regulate the speed of engine within 2% from friction to full load. All enclosed automatic engines are furnished with quarter box main bearing. Open type automatic engines furnished in either angle or quarter box type main bearing when shaft is 6 in. in diameter, or less. On engines where shaft is over 6 in. in diameter, main bearing is always quarter box type. Further information in Bulletins E-1 and E-2.



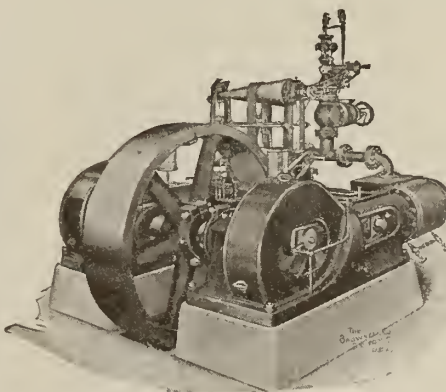
HIGH SPEED AUTOMATIC ENGINE

FAN ENGINES—Built in either open or closed type. Provided with hand adjustable *variable cut-off* device, when desired. Fan engines always have quarter box main bearings. Furnished with shaft extended for direct connection to fan or arranged for coupling to fan shaft. Additional information in Bulletin E-5.



OPEN TYPE FAN ENGINE

VARIABLE SPEED DUPLEX ENGINES—Especially designed for paper mill drive, giving long, dependable service, simple operation and perfect speed control. All variable speed engines have quarter box main bearings. A special speed limiting device prevents overspeeding. A special riding cut-off valve has been designed for use with these engines, in order to secure exceptional steam economy. Bulletin E-4 gives further information.



VARIABLE SPEED DUPLEX ENGINE

THE D. CONNELLY BOILER CO.

Ivanhoe Road and N. Y., C. & St. L. R. R.
CLEVELAND, OHIO

Products.

CONNELLY WATER TUBE STEAM BOILERS.

Design of Boilers.

The Connelly water tube boilers are built in two general designs: one being the 4-drum type for units up to about 1500 h.p., equipped with stokers on one side only; the other being a 7-drum type for units from 1000 to 4000 h.p., equipped with stokers on two sides. Pressure parts are designed and built to conform with A.S.M.E. boiler code.

These two general designs are each made in a number of classes to meet the conditions of available space and can be fired with coal, gas, oil, waste heat, or blast furnace gases.

Advantages.

(1) Designed so as to be capable of manufacture in units up to 4000 h.p.

(2) Simple in design and has no flat surfaces.

(3) Free from complications of hundreds of joints; no handholes at end of tubes.

(4) Has no staybolted surfaces.

(5) Boiler contains a large amount of water in proportion to its size.

(6) Boiler has a large amount of steam liberating surface, and also large steam space.

(7) All stress due to expansion and contraction is provided for (both water drums being suspended).

(8) Boiler tubes are so spaced that any tube can be removed without removing any other tube.

(9) Boiler is designed so as to get the greatest horsepower in the smallest cubical space.

(10) All baffling is simple, and easy to replace or re-adjust.

(11) Boiler has free and unrestricted circulation, owing to the same tube area between drums in the path of water circulation.

(12) The large volume of water, liberal steam space, abundant steam liberating surface, and unrestricted circulation, mean high efficiency, large overload capacity, and minimum repair expense, or loss of tubes.

(13) Water is fed into rear upper drum, so that coldest water meets the coldest gases. This means low temperature of gases entering stack.

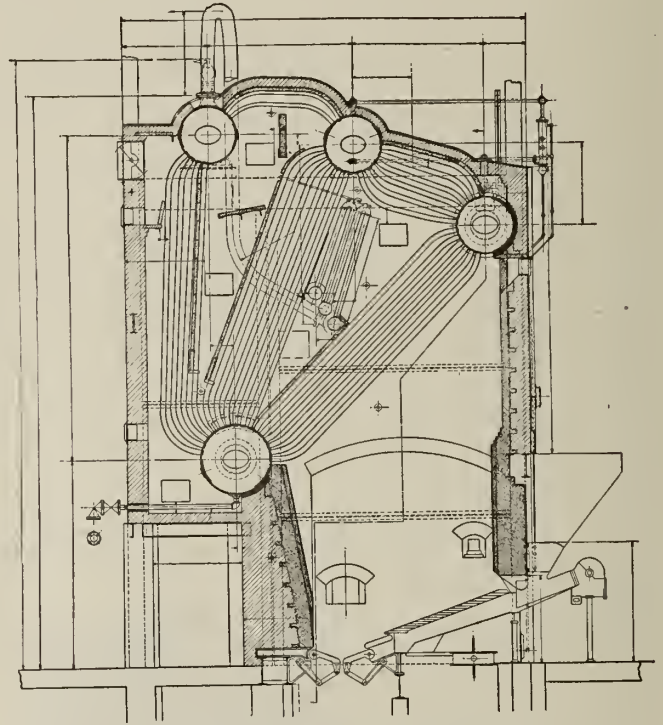
(14) Every pressure part of boiler is made of high quality steel (no cast iron used).

(15) Boiler is so designed that it will deliver not only commercially dry steam, but will deliver superheated steam.

(16) Entire boiler is swung from a steel frame (independent of brickwork) so as to provide against undue stresses on the brick setting.

Shop Facilities.

The plant occupies a site of 6 acres on the main line of the New York, Chicago & St. Louis R. R. The



CROSS SECTION, CONNELLY BOILER EQUIPPED WITH UNDER-FEED STOKER OF TAYLOR TYPE

main building is 140 ft. wide, divided into 3 bays (40 ft. on each side and 60 ft. in center). Each side bay is equipped with a 10-ton electric overhead traveling crane, and the center aisle is equipped with a 25-ton electric traveling crane. All cranes operate full length of building.

Riveting plant consists of a 15-ft. gap hydraulic riveter, exerting a maximum pressure of 150 tons. This machine is served by an overhead hydraulic crane of 25-ton capacity. Riveter stake is equipped with a special type top, by which it is possible to rivet heads of drums or boilers into the shell under hydraulic pressure. Another hydraulic riveter, 10 ft. 6-in. gap, with a capacity of 80 tons pressure on the rivet is also installed.

A modern plate planer with a capacity of 22 ft. cut on 1½-in. metal at one setting is used for planing edges of all heavy shell plates and butt straps.

The plant is well equipped with modern drills for cutting rivet and tube holes.

Flanging department has a 500-ton hydraulic press of the 4-post type, also a 150-ton Universal type hydraulic press, capacity up to 160-in. heads, and a modern spinning machine for flanging flat heads up to 108-in. diameter.

In addition there is also a complete line of punches, shears, rolls, a complete pneumatic equipment, and all modern tools for producing highest quality of work.

A modern tube bending machine is installed and tubes for any boiler can be furnished within a few hours after notice to ship.

HEINE SAFETY BOILER CO.

Manufacturers of Water Tube Boilers and Superheaters

5330 Marcus Avenue
ST. LOUIS, MO.

BRANCH OFFICES

NEW YORK, 11 Broadway
CHICAGO, First National Bank Building
PHILADELPHIA, Pennsylvania Building

CINCINNATI, Union Trust Building
PITTSBURGH, Park Building
BOSTON, 50 Congress Street

NEW ORLEANS, Godchaux Building
DETROIT, Dime Bank Building
CLEVELAND, Schofield Building

AGENCIES

DENVER, STEARNS-ROGERS MFG. CO.
SAN FRANCISCO, DORWARD ENG. CO.

DALLAS, SMITH & WHITNEY
CHARLOTTE, ALEXANDER & GARSED

HAVANA, CUBA, OSCAR B. CINTAS
YOKAHAMA, JAPAN, TAKATA & CO.

Products.

WATER TUBE BOILERS; SUPERHEATERS.
Steel Stacks, Housings, Flues, etc.

Facilities.

Two complete plants, at St. Louis, Mo. and Phoenixville, Pa. The HEINE SAFETY BOILER CO. has been building boilers since 1882 and is fitted by long experience to provide steam boiler equipment. A special branch of the Heine engineering department handles applications for special purposes, such as the utilization of waste heat.

Heine Standard (Longitudinal) Boilers for Land Service.

These boilers are built with drums from 30- to 48-in. diameter and from 12 to 18 ft. long. In every particular they conform with the requirements of the A. S. M. E. Boiler Code, this being the most advanced standard for boiler construction. The Heine standard boiler consists of three main parts.

DRUM—Three sheets with riveted heads at each end; reinforcements for manholes, steam outlets and other openings; inside main drum is a mud drum, acting as feed water purifier. Deflection plate near front throws down water that may be entrained with the steam.

WATERLEGS—Formed of two plates, called tube sheets, and handhole sheet, joined, except at top, by a butt strap. Stayed to withstand internal pressure by hollow staybolts screwed into tapped holes of the two sheets. Waterlegs riveted to drum at throat openings.

TUBES—Extend between the two waterlegs and expanded into tube sheets by roller expanders. Ends are slightly flared to increase holding power.

Heine Superheater.

Placed alongside of drum of standard boiler, toward front and just above last passage of gases. May be

single and placed only on one side; or in two parts, one on each side of boiler, according to boiler sizes.

Temperature is automatically controlled by varying the flow of hot gases over the superheater tubes, damper at the outlet being opened or closed by a thermostatic device keeping superheat within 5° Fahr. of the desired temperature.

Heine Cross Drum Boiler for Land Service.

The Heine cross drum boilers have the general advantages of the standard (longitudinal drum) type, and in addition the headers, tubes and drum can be packed in minimum space for shipment.

The large combustion chamber gives ample space for the gases to mix and burn. The design—two simple headers, plain cylindrical drum, and straight tubes—is ideal for free circulation and for high efficiency.

Heine Marine Water Tube Boiler.

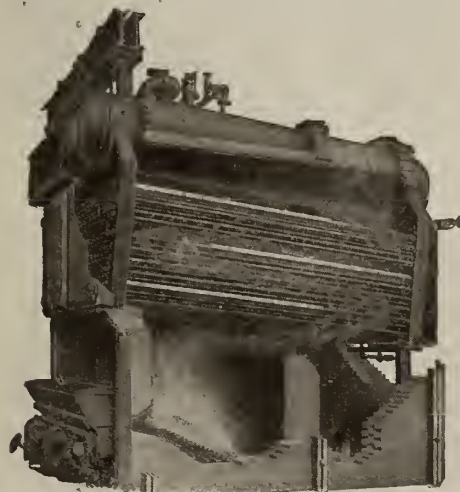
These boilers are made with either longitudinal or cross drums. For marine service, however, the cross drum type is recommended. Several hundred thousand horsepower of cross drum boilers have been built for the U. S. Emergency Fleet Corporation alone.

For low and medium superheat temperature Heine marine boilers are fitted with superheaters of the "waste heat" type placed in the base of uptake. For higher temperature, superheater elements are built up of tubes passing through main bank of tubes, just below middle baffle.

References and Literature.

The best references for Heine boilers are the hundreds of installations in central stations, office and public buildings, and industrial plants.

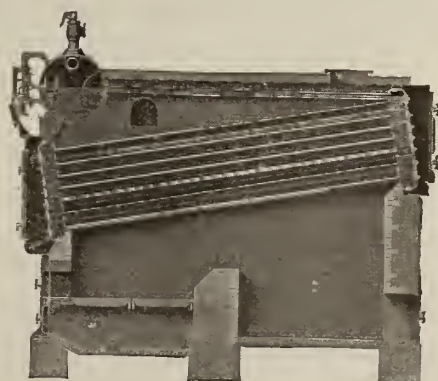
The treatises, "Boiler Logic," and "Marine Boiler Logic," describe Heine construction in detail, for land and sea installation respectively. Copies are available for those interested in modern boiler design or operation.



HEINE STANDARD LONGITUDINAL DRUM
BOILER



HEINE MARINE WATER TUBE
BOILER



HEINE CROSS DRUM WATER TUBE
BOILER

ERIE CITY IRON WORKS

Manufacturers of Steam Engines, Boilers and Grates

ERIE, PA.

BRANCH OFFICES

NEW YORK, N. Y., 1360-62 Woolworth Building
PHILADELPHIA, PA., 2124 Land Title Building
CHICAGO, ILL., 1368 Peoples Gas Building
PITTSBURGH, PA., 1228 Park Building

CLEVELAND, OHIO, Citizens Building
BOSTON, MASS., 141 Milk Street
NEW ORLEANS, LA., Godchaux Building
SAN FRANCISCO, CAL., 67 Second Street

Products.

ERIE CITY VERTICAL and HORIZONTAL WATER TUBE BOILERS, IMPROVED "ECONOMIC" RETURN TUBULAR BOILERS, HORIZONTAL RETURN TUBULAR STATIONARY BOILERS.

ERIE CITY "LENTZ" ENGINES.

ERIE CITY SHAKING GRATES.

Also, "Counter Current" Feed Water Heaters, Tanks and Steel Plate Construction.

Erie City Vertical Water Tube Boiler.

This boiler comprises two horizontal drums—one placed directly above the other—connected by a series of tubes, the combination being supported by heavy frame of steel beams. A wall of masonry surrounds boiler, and a frontal extension thereof, lined with fire brick and faced with metal front, forms the furnace.

DRUMS—Upper drum (the larger) carries body of water to the center of the drum, 10 and 12 ins. of water being above the top row of tubes, and has at each end a steam storage compartment (patented), unequaled for production of dry steam. Lower drum is supported by tubes connected to upper drum. Each drum has a man-hole, giving ready access for installation and inspection.

TUBES—Curved to facilitate expansion and contraction. Spaces between different banks of tubes permit a man to enter. Each tube enters drum radial with center. Tubes readily cleaned by either air or hydraulic tube cleaner.

MATERIAL—Drum-shell plates, of best open hearth homogeneous flange steel. Tubes, of mild steel, are hot rolled and seamless. Rivets, of mild steel, conform to standard specifications.

GENERAL CONSTRUCTION—Shell plates are rolled to true circle; longitudinal seams, double butt-strapped; edges of plates, bevel planed; end of lap strip, scarfed on special milling machine; seams, calked inside and outside of shell; tubes so spaced as to leave ample alignment of metal; heads of drums, of same material as shell; steam and water openings in drums are reinforced with pressed steel nozzles, and flanges are thoroughly riveted and calked.

FURNACE—Its location at front of boiler permits construction of arched roof of fire brick over fire—an anterior combustion chamber for the gradual liberation of gases and proper admixture of air through grate area, preliminary to the perfect utilization of products of combustion when in

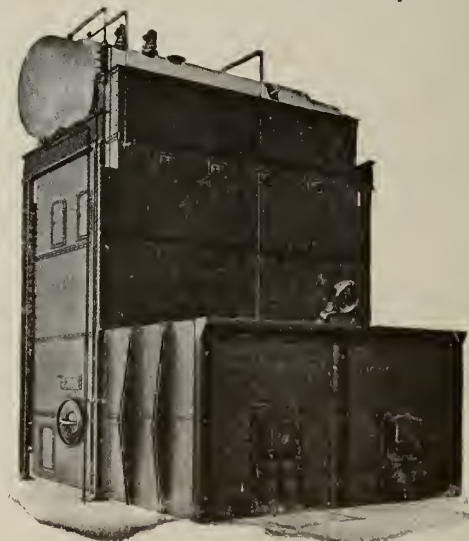
contact with tubes. Ample grate surface, for various forms and grades of fuel.

STEEL CASING—To prevent entrance of uncontrolled air to furnace. Built with lining of 9-in. fire brick, and a dead air space between brick wall and metal casing (patented).

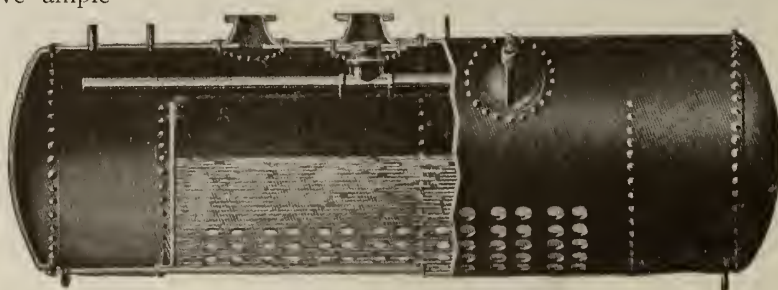
CIRCULATION—Each tube, individually, is an independent steam producer, in nearly vertical position between both drums, without cross-over connecting pipes or any other restriction whatsoever, insuring rapid circulation. Water level is at center of upper drum, affording largest disengaging surface; ample depth of water over ends of tubes; water level steady; "spouting" eliminated—all these being signs of a scientifically designed boiler.

BLOW-OFF—Two blow-off openings are provided on bottom of lower drum.

CLEANING—Two access doors located directly under horizontal supporting beams, and a third near floor line at side of setting, for cleaning and inspection purposes, removal of tubes when necessary, etc. A steam blower with pipe is furnished with each boiler.



ERIE CITY VERTICAL WATER TUBE BOILER



SECTIONAL VIEW OF UPPER DRUM
Showing steam compartments (patented)

FEED INLET—Feed water, entering lower drum, is distributed through a double discharge and taken up through front bank of tubes, then down through tubes in middle and rear bank to lower drum, thence upward again in similar manner.

DRY STEAM—Steam disengaging surface in upper drum is very large and steam outlet pipe (located near top of drum) permits *steam only* to enter the main, in a dry state.

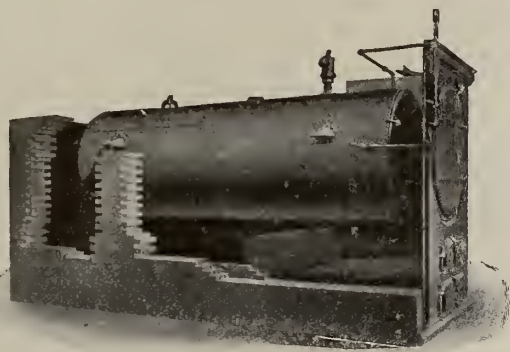
Erie City Horizontal Water Tube Boiler.

The ERIE CITY IRON WORKS has been building this type of boiler for many years, and recently placed on the market a new style horizontal water tube boiler in which is eliminated, as far as possible, the weak points incidental to this particular type of boiler.

A description of this boiler will be gladly furnished on application.

Erie City Horizontal Tubular Stationary Boiler.

Shell plates and heads made of open hearth homogeneous boiler steel. Shell up to 18 ft. long built in two courses; over 18 ft. long in two or three courses.



HORIZONTAL TUBULAR BOILER

Rivets driven by machinery. No steam dome. Boiler equipped with full arch front; and tested under water pressure 50% above proposed working pressure.

Erie City "Economic" Return Tubular Boiler.

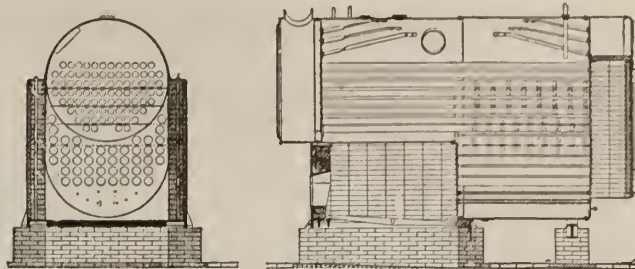
Shell and heads made of open hearth homogeneous steel; tubes and rivets, of mild steel. Boiler is self-contained, occupies small space and is a rapid steamer. No stay-bolted water sides to fill with mud and burn out, or flat crown sheets to be exposed by low water and cause explosions and loss of life.

Front and sides of furnace are lined with 9 ins. of fire brick, with air space on outside wall next to steel casing.



"ECONOMIC" RETURN TUBULAR BOILER

Regularly built for 100 lbs. working pressure, and for higher pressures on order

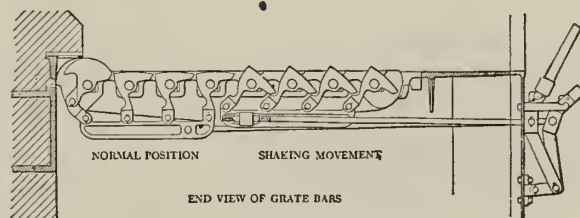
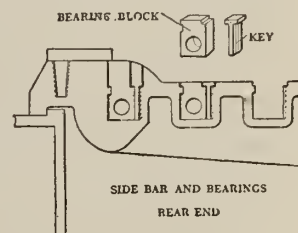


SECTIONAL VIEW OF "ECONOMIC" BOILER
Protected by patents

Erie City Shaking Grates.

Grates properly proportioned for majority of fuels used under steam boilers. Note bearing blocks in side bars and how held in place. Blocks and keys carefully fitted together.

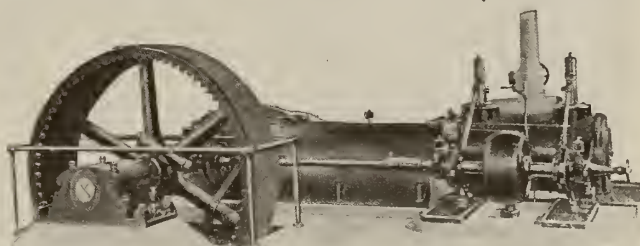
Worn bearing readily replaced, instead of renewing entire horizontal side bar. Individual bars designed to prevent loss of fuel through grates to ash pit while in shaking position. Note normal position and shaking movement.



SECTIONAL VIEWS OF GRATES

Erie City "Lentz" Engines.

Under the American rights secured, this company is now manufacturing the "Lentz" engine—a reciprocating engine designed for the use of superheated steam (at high pressures) and proved by experience, since 1899, to be the *most economical* prime mover that can be used. Now used in almost every line of manufacture.



"LENTZ" ENGINE

SPECIAL FEATURES—Steam regulation is accomplished by varying a cut-off through a shaft governor and straight-shot eccentric instead of by throttling. Cylinders and beds made simple and compound, condensing or non-condensing, to meet conditions. Valves are of double seated poppet type, and are each actuated by a cam working on a roller running at side of engine. No elastic packing throughout engine, special cast iron rings being used in stuffing boxes, etc.

Full particulars sent on application.

INTERNATIONAL ENGINEERING WORKS, INC.

Boilers, Grates, and Steel Plate Construction

GENERAL OFFICES AND WORKS
FRAMINGHAM, MASS,

BRANCH OFFICES

BOSTON, MASS. PHILADELPHIA, PA. NEW YORK, N. Y. SAN FRANCISCO, CAL.

Products.

SCOTCH BOILERS; VERTICAL TUBULAR BOILERS; HORIZONTAL RETURN TUBULAR BOILERS; SHAKING GRATES; STEEL PLATE CONSTRUCTION.

Engineering Services.

The engineering department of this organization offers its services to those having boiler, grate and steel plate construction problems to solve.

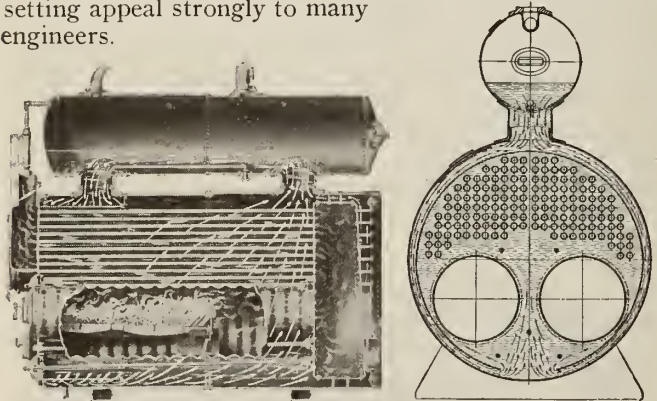
The experts in this department have at their disposal the knowledge and accumulation of valuable data of many years of successful boiler, grate and steel plate construction, and co-operation with these experts insures the most efficient and the most economical solution for any particular requirement, without obligation.

Designs, recommendations and estimates will be submitted promptly upon receipt of the necessary information regarding conditions.

Brady Scotch Boilers.

Of the many types of boilers which have been used in marine service, none has attained the degree of all around efficiency shown by a well designed standard Scotch marine boiler.

For stationary practice, the Scotch boiler is equally satisfactory. Its extremely small radiation loss due to the internal furnaces, its strength, economy, ability to stand hard service and the absence of troublesome brick setting appeal strongly to many engineers.



BRADY SCOTCH BOILER

GENERAL DESIGN—The Brady Scotch boiler combines the advantages of internal firing and self-contained construction, while overcoming all possible objections by providing positive, rapid circulation without a special pump or other device.

In the Brady Scotch boiler, positive rapid circulation is obtained by placing just below the front neck an annular ring or plate extending around the inside of the shell, with an opening in the bottom (see illustrations). This circulation overcomes the great difficulty in Scotch marine and dry back boilers, which ordinarily are not quick steamers because water remains cold at the bottom.

Unequal expansion is impossible in the Brady Scotch boiler, because the water circulates from the bottom of the shell along a definite path.

INTERNAL FURNACES—No brickwork is necessary with the Brady Scotch boiler, as furnaces are internally fired. Radiation losses are practically eliminated and there is the highest efficiency of transmission of heat to water.

The efficiency of transmission with the internally fired boiler is higher than with the brick furnace, because the furnace of the former and all products of combustion are entirely surrounded by water heating surfaces, and the efficiency of combustion is not reduced by air leakage.

Cost of installation is also reduced with the Brady Scotch boiler, as there is no brickwork. The boiler is self-contained and ready for use as soon as piping and smoke flue connections are made.

COMPLIANCE WITH OFFICIAL REQUIREMENTS—Brady Scotch boilers are built in compliance with the requirements of the A.S.M.E. Code, the Massachusetts Board of Boiler Rules, the laws of other states, British Board of Trade, Lloyds Registry and the various Canadian provinces.

Vertical Tubular Boilers.

MANNING TYPE—Perfectly adapted to all requirements of the highest pressures and the largest units, because no plate subject to tensile strain comes in contact with the fire.

It is the best boiler for turbines on account of its ability to furnish steam superheated 25° to 50°. Amount

DATA, BRADY SCOTCH BOILERS

Horsepower	Shell		Furnace		Combustion chamber		Tubes		Drum		11"x15" Man-hole		Nozzles		Uptake		Fire doors		Ash doors		Grates		Dimensions over all						
	Grate surface, sq. ft.	Heating surface, sq. ft.	Diam. in.	Length in.	Number	Diam. in.	Length in.	Diam. in.	Length in.	Diam. necks, in.	In drum	In head	Number	Diam. openings, in.	Diam. flanges, in.	Feed pipe, in.	Blow-off, in.	Combustion holes, in.	Width, in.	Depth, in.	Number	Width, in.	Number	Width, in.	Width, in.	Length, in.	ft. Length	ft. Width	Height foundation to steam outlet
50	13.75	450	66	10-4	1	33	8-0	59	18	76	21 1/2	8-0	27	9-0	14	1	1	1	42	8	1	18	1	22	33	66	10-6	5-11	9-5
75	18.0	643	72	11-4	1	36	9-0	65	18	100	22 1/2	9-0	30	10-0	14	1	1	1	48	9	1	18	1	24	36	72	11-6	6-5	10-2
100	21.66	812	78	14-0	1	40	11-0	71	24	84	24	11-0	30	12-6	14	1	1	1	36	16	1	20	1	24	40	78	14-2	6-11	10-9
125	26.25	1020	84	15-0	1	45	12-0	77	24	98	24	12-0	33	13-6	14	1	1	1	38	18	1	24	1	30	45	84	15-2	7-5	11-6
150	31.25	1214	90	15-0	1	50	12-0	83	24	118	24	12-0	36	13-6	14	1	1	1	40	20	1	24	1	30	50	90	15-2	7-11	12-6
200	42.0	1677	102	16-0	2	56	13-0	94	24	150	24	13-0	42	14-6	16	1	1	1	44	24	2	18	2	30	56	102	16-2	9-0	14-5
250	52.5	2082	114	16-0	2	62	13-0	106	24	188	24	13-0	45	14-6	18	1	1	1	48	24	2	20	2	30	62	114	16-2	10-0	15-8
300	60.0	2585	120	17-0	2	68	14-0	112	24	220	24	14-0	48	15-6	18	1	1	1	52	24	2	24	2	30	90	120	17-2	10-6	16-4

DATA, MANNING VERTICAL TUBULAR BOILERS

Number	Horsepower	Grate surface, sq. ft.	Heating surface sq. ft.			Diam. in. upper shell, in.	Outside diam. of outside furnace sheet			Furnace inside		Tubes			Steam and safety valve outlets, in.	Feed pipe, in.	Blow-off pipe, in.	Height of boiler only. Bottom of water leg to top of upper course	Height of base, in.	Height of boiler over all. Floor line to top of bonnet	Size of smoke outlet, in.	Distance on centers in battery	Weight with cast-iron base. 150 lbs. w. p.
			Water heating	Superheating	Total		150 lbs., in.	175 lbs., in.	200 lbs., in.	Diam., in.	Height, in.	Number, in.	Diam., in.	ft. Length									
1	95	19 6	860	287	1147	50	67 1/2	68	68 1/2	60	48	120	2 1/2	15-0	4	1 1/2	2	19- 7	22	23- 6	30x16	6-10	18800
2	117	23 7	1057	354	1411	56	73 1/2	74 1/2	74 1/2	66	51	148	2 1/2	15-0	4	1 1/2	2	19-10	22	23-11	33x18	7- 4	22200
3	148	28 2	1334	450	1784	62	80	80 1/2	80 1/2	72	54	188	2 1/2	15-0	5	1 1/2	2	20- 1	22	24- 4	36x20	7-10	25600
4	183	33 1	1640	555	2195	68	86 1/2	86 1/2	86 1/2	78	57	232	2 1/2	15-0	5	1 1/2	2	20- 4	22	24- 9	39x22	8- 4	30300
5	223	38 4	1998	680	2678	74	92 1/2	92 1/2	92 1/2	84	60	284	2 1/2	15-0	6	1 1/2	2	20- 7	24	25- 4	42x24	8-10	34400
6	260	44 1	2329	795	3124	80	98 1/2	98 1/2	98 1/2	90	63	332	2 1/2	15-0	6	2	2 1/2	20-10	24	25- 9	45x26	9- 4	39400
7	307	50 2	2744	938	3682	86	104 1/2	104 1/2	104 1/2	96	66	392	2 1/2	15-0	7	2	2 1/2	21- 1	24	26- 2	48x28	10- 0	47100
8	350	56 7	3131	1073	4204	92	110 3/4	110 3/4	110 3/4	102	69	448	2 1/2	15-0	7	2	2 1/2	21- 4	24	26- 7	51x30	10- 6	52200
9	408	63 6	3651	1255	4906	98	116 3/4	116 3/4	117	108	72	524	2 1/2	15-0	7	2	2 1/2	21- 7	24	26-10	54x30	11- 0	58900

of superheat may be increased by lowering the water line or by using longer tubes.

It is well suited for any locality regardless of water conditions when made with the multiple plan of cleaning handholes, which give access to every part of the crown sheet. Additional facilities are provided for cleaning and inspection.

The economical evaporative performance is remarkable. All radiant heat from fuel bed is absorbed directly by water heating surface, distribution of furnace gases over heating surface is practically uniform, there are no losses due to the infiltration of air in the setting and stand-by losses are comparatively small, occupying less ground space per h.p. than other types.

OTHER TYPES—Straight shell and tapered course types of vertical tubular boilers also built.

Detailed information on request.



MANNING VERTICAL TUBULAR BOILER

Horizontal Return Tubular Boilers.

Constructed in a most approved manner in full accordance with the rigid requirements of the A.S.M.E. code and the Massachusetts Board of Boiler Rules, the highest standard of efficiency being maintained.

Standard settings can be provided with stationary or shaking grates and where increased efficiency and compactness are desired, standard steel casings can be provided for these settings.

Designed with liberal proportions of heating surface, steam space and grate area. They are safe, most economical in fuel consumption, simple in design, cost less per horsepower than other types, require less repairs, and, when necessary, repairs are more easily made and less expensive.

Made in units up to 350 h.p.



HORIZONTAL RETURN TUBULAR BOILER

Special Boilers.

Special boilers of any size built for all conditions of service.

The engineering department offers its services for the most satisfactory solution of all boiler problems.

Macdonald Shaking Grates.

These grates perform all the proper functions of a shaking grate. Following are several of the reasons why they are the best shaking grates on the market:

They have unrestricted air passages and foolproof

locking device. Fuel can not be wasted by shaking. Powerful leverage provided for shaking and breaking up small clinkers.

They may be repaired or renewed at small expense by replacing top sections only.

Detachable top sections may be changed to give any desired air opening or spacing of grate.

Proper distribution of metal gives the greatest strength possible in proportion to the weight of the material.

When shaken, the maximum irregularity or depth of vibration is given without opening a wide space between sections. A flat grate locked in position so that the surface can not be left uneven or with points projecting into the fire.

Gives more perfect combustion, saves fuel and increases the capacity of the boiler.

Further information on request.



MACDONALD SHAKING GRATE

View with side supporting bar removed and operating lever thrown down

Steel Plate Construction.

Steel plate construction of every description for all industries, fabricated from this company's own designs or in accordance with purchaser's specifications.

The company's plant is the most efficient and best equipped steel plate construction plant in the East, and has exceptional shipping facilities.

The engineering department's services (see preceding page) are at the disposal of those having steel plate construction problems to solve.



RENDERING TANK



JACKETED MIXING TANK



VENTURI TUBE

E. KEELER COMPANY

Manufacturers of Water Tube and Return Tubular Boilers
WILLIAMSPORT, PA.

NEW YORK, N. Y.
PHILADELPHIA, PA.
BUFFALO, N. Y.

BRANCH OFFICES
PITTSBURGH, PA.
BOSTON, MASS.
CHICAGO, ILL.

NEW ORLEANS, LA.
PORTLAND, ORE.
RICHMOND, VA.

Products.

WATER TUBE BOILERS; RETURN TUBULAR BOILERS.
Built to A. S. M. E. Rules.

Standard Keeler Water Tube Boiler.

The arrangement of furnace, tubes, headers and drums is correct, accessible and compact. The superior efficiency of the Keeler boiler rests upon correct proportions of heating and grate surface for the character of fuel to be burned, ample height of furnace, superior arrangement of baffle walls and perfect circulation.

Every portion of the heating surface is accessible for both external and internal inspection, making it impossible for soot or scale to accumulate undetected.

Wrought steel is used for every part of the boiler under pressure. This is the first requirement of reliability.

All tubes are straight. Boilers with bent tubes are accepted only as a compromise. Bent tubes are harder to keep clean and the interior can not be inspected. In the standard type all tubes are 4 in. in diameter and 16 or 18 ft. long. This is a standard carried in stock by dealers everywhere. A 4-in. tube is stiffer than a 3½-in. tube in the ratio of 1.52 or 1.04 (their section moduli); 3½-in. tubes sag and leak at the headers, 4-in. tubes do not.

The Keeler boiler is provided with vertical baffles. These support the tubes instead of being a dead weight. Vertical baffles insure a more perfect distribution of gases, need no repairs and do not collect soot.

The wrapper sheet in the header is flanged, and the header sheet straight. A wrapper, being small, can be flanged at one operation; while to flange a header it is necessary to heat it several times. This has a tendency to crystallize the metal and cause internal strains.

The Keeler boiler has its steam outlet at the center of a horizontal drum. This is out of the way of the violent agitation at the front header and insures dry steam.

The distance between the center line of tubes and underside of drum in Keeler boilers is 10¾ in. in front and 26½ in. to 28½ in. in rear. This large space between the drum and tubes gives ample room for expansion and contraction, without throwing strains on the throat connection. It also affords space for superheaters and facility for inspection of all parts of the drum.

Keeler boiler has a substantial and workmanlike flush front. This means there is no projection for

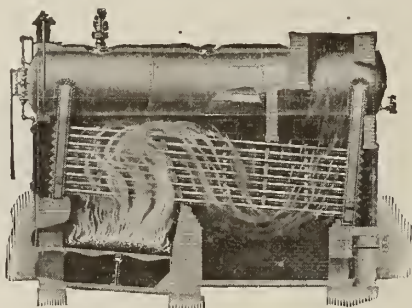
the fireman to come in contact with in coaling the boiler or cleaning the tubes.

The method of supporting the boiler meets the requirements of the most exacting specifications.

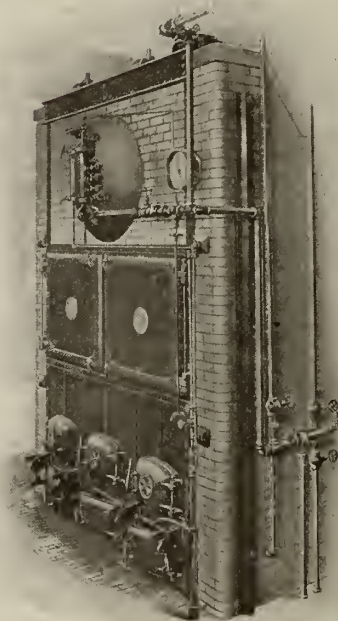
In the Keeler boiler the blow-off is in the bottom wrapper sheet of the rear header. The design is such that there are no obstructions of any kind; the dirt and sediment are drawn from boiler by gravity.

The rear header of the Keeler boiler is covered with a steel casing, supported by structural steel frame. This keeps the cold air away from the header.

Unless otherwise specified, solid staybolts are used, with test holes drilled in each end. Where hollow staybolts are used a certain amount of cold air is admitted into the boiler setting. Hollow staybolts must be plugged. These plugs are seldom kept in place and have to be frequently replaced, which is an expense.



STANDARD WATER TUBE BOILER
Built in units from 75 to 1,000 h.p.



WATER TUBE BOILER, UNITED STATES
BUREAU OF STANDARDS, WASHINGTON, D. C.



TWELVE 410 H. P. KEELER WATER TUBE BOILERS, ISTHMIUS
OF PANAMA
Built for the United States Government

The Keeler boiler is cleaned from the side of the setting with a steam blower, through a small opening over each row of tubes.

Keeler Cross Drum Boiler.

The Keeler cross drum boiler is a modification of the standard design only in the length and location of the drum and the method of connecting it to the headers.

This type was designed to meet the demand for a high pressure water tube boiler that could be installed in office buildings, school-houses, churches, apartment houses, hotels, and in boiler rooms generally where ceiling height is limited, or where boilers must be introduced through narrow passageways or restricted openings. This type is in use in many of the new public schools in Philadelphia, in the Sheffield Scientific School, New Haven, Conn., and is used by the United States Government. This boiler is shipped knocked down, and will appeal especially to architects and heating and ventilating engineers as a logical water tube boiler for their requirements.



CROSS DRUM BOILER
Built in units from 60 to 600 h. p. Especially adapted for schools, etc., where there is lack of headroom

Ask for new Water Tube Catalogue.

TESTS OF KEELER WATER TUBE BOILERS

Location	Gatun Handling Plant, Gatun Locks, C. Z.	United States Bureau of Standards, Washington, D. C.	Davis Coal & Coke Co., Thomas, W. Va.	Bureau of Engraving & Printing, Washington, D. C.
Engineer.....	Testing Dept. Mechan. Div.	S. Franklin Gardner	Mechanical Eng'eer of Co.	G. E. Reed & Printing, McRaeParker
Kind of fuel.....	Pocahontas coal run of mine	Anthracite, No. 1 buckwheat	Semi-Bituminous	Semi-Bituminous
Kind of furnace.....	Hand fired Ajax shaking grates	Hand fired Ajax shaking grates	Jones stoker	Crowe stoker
Grate surface, sq. ft. . .	68.5	63	80	80
Heating surface, sq. ft. .	4089	2526	5040	5018
Duration of trial, hrs. . .	10	18	8	18
Wt. coal as fired, lbs. . .	16,811	19,380	13,125	47,250
Per cent of moisture in coal. . .	4.17	6.6	5.8	6.1
Wt., dry coal, lbs. . .	16,110	18,101	13,059	44,368
Wt. ash and refuse, lbs. .	283.5	4904	3018	2434
Percentage ash in dry coal. . .	1.76	27.00		
Total water, lbs. . .	163,744	130,772	123,891	432,750
Water evaporated, corrected for moisture, lbs. . .	superheated	130,249	122,652	428,721
Factor evaporation. . .	1.1378	1.2168	1.0611	1.1867
Equivalent evaporation from and at 212° F., lbs. . .	186,308	158,487	130,146	509,950
Dry coal per sq. ft. grate per hour, lbs. . .	23.52	15.96	20.39	32.8
Equivalent evaporation per sq. ft. of heating surface per hour, lbs. .	4.55	3.48	3.22	5.65
Steam pressure, lbs. . .	193.24	121.05	147.4	123.16
Temperature of feed water, deg. F. . .	189.5	42.8	197	72.29
Temperature of escaping gases, deg. F. . .	488.62	461.57	481	528
Draft in uptake, in. . .	.836	.878	.79	.908
Per cent of moisture in steam entering superheater. . .	1.336	.004	1	.865
No. of deg. of superheat developed h. p. . .	106.81	0	0	822
Rated h. p. . .	540	255	472	500
Percentage of rated h. p. developed. . .	410	253	500	164
Equivalent evaporation from and at 212° F. per lb. dry coal. . .	11.56	8.755	9.34	11.58
Equivalent evaporation from and at 212° F. per lb. combustible. . .	11.77	12.01	12.20	12.29

Keeler Tubular Boiler.

The Keeler tubular boiler embodies all this organization has learned of boiler building in 55 years. Every boiler which leaves the shop is regarded as a pledge of good faith.

The Keeler full flush front is of heavy, substantial design. All doors have a deep flange or roll. This feature prevents warping or cracking of edges and gives the front a rich and handsome appearance. Fire doors are of an extra heavy deep pattern, with a liberal space between the door and the perforated liner which preserves both castings. Fire doors close against inclined seats, so that they never stand away from the front. There is provision for expansion above the fire doors, which absolutely prevents cracks in the front at the corners of the openings under all ordinary conditions of service. All doors and seats are carefully fitted to a close bearing, and all fronts are assembled complete before shipment. The top of the front is finished with a handsome cornice.



RETURN TUBULAR BOILER
Built in units from 40 to 300 h. p.

The chief difference in the same type of boiler is the time and attention given to details. That is why one boiler costs more than another, where specifications are practically the same. If a cheaply constructed tubular boiler is bought it may have to be removed in a short time. Do not run the risk of having to charge off as a total loss the money spent for freight, hauling, labor, brick setting and erecting the stack. A cheap, carelessly constructed boiler entails the same expense for freight, installation and other requirements as the most reliable boiler that can be built.

Material and Workmanship.

All Keeler boilers are guaranteed to pass the inspection of any established boiler insurance and inspection company for the pressure specified.

References.

Fifty-five years of boiler building without a shut down or an explosion is the reputation gained by this company. Following is a partial list of users of Keeler boilers :

WATER TUBE INSTALLATIONS		
NAME	LOCATION	NUMBER
Bureau of Engraving & Printing	Washington, D. C.	2-500 h.p.
Cook County Hospital	Chicago, Ill.	4-500 h.p.
Citizens Gas & Electric Company	Waterloo, Iowa	5-600 h.p.
Watertown Arsenal	Watertown, Mass.	8-150 h.p.
New York Shipbuilding Co.	Camden, N. J.	12-400 h.p.
Clifton Springs Distillery Co.	Cincinnati, Ohio	3-600 h.p.
P. Ballantine & Sons	Newark, N. J.	4-500 h.p.
Luzerne County Gas & Electric Co.	Plymouth, Pa.	9-500 h.p.
United States Government	Old Hickory, Tenn.	5-500 h.p.
Penn Public Service Co.	Johnstown, Pa.	8-500 h.p.
City of Fort Worth, Texas		3-500 h.p.
Keystone Steel & Wire Co.	Peoria, Ill.	3-500 h.p.
Quidnick-Windham Mfg. Co.	Quidnick, R. I.	2-300 h.p.
RETURN TUBULAR INSTALLATIONS		
Philadelphia & Reading Coal & Iron Co.	Shamokin, Pa.	10-150 h.p.
Bordens Condensed Milk Co.	New York, N. Y.	28-150 h.p.
Helvetia Milk Condensing Co.	Highland, Ill.	12-150 h.p.
Atlantic Pulp & Paper Co.	Port Wentworth, Ga.	4-250 h.p.
Great Southern Lumber Co.	Bogalusa, La.	24-175 h.p.
American Cotton Duck Co.	Baltimore, Md.	7-150 h.p.
Poole Engineering Co.	Baltimore, Md.	4-200 h.p.
Deemer Mfg. Co.	Philadelphia, Miss.	6-175 h.p.
E. Pritchard	Bridgeton, N. J.	6-150 h.p.
Newark Box Board Co.	Newark, N. J.	4-200 h.p.

PAGE BOILER COMPANY

815-819 Larrabee Street
CHICAGO, ILL.

Product.

PAGE TWIN WATER TUBE SECTIONAL BOILER.
(Patents pending.)

Elimination of Soot.

Soot $\frac{1}{4}$ in. thick will stop as much heat as 1 in. of asbestos. This is one of the most surprising facts ever discovered in connection with steam engineering. The importance of frequent cleaning can not be emphasized too strongly. A boiler frequently cleaned produces higher efficiency and a saving of coal. Soot and ash retard heat absorption, choke the tubes, a poor draft results, and coal bills continue to increase.

The Page boiler is equipped with an oscillating soot blower—all sections blown in one minute, not a door to open.

General Description.

The Page sectional water tube boilers are so designed that all heating surface is directly exposed to radiation. It is not a total area of heating surface that determines efficiency of boiler, but cross-sectional area with respect to flow of heat passages. These are split up vertically and horizontally; flues of small diameter are more efficient, due to more frequent contact from tube to tube. The section tubes are straight and short and so clustered over the gases that in a limited cubical space a large effective heating surface is accumulated, whereby great steaming capacity is condensed in a space remarkably contracted, yet perfect in utilizing fuel to best advantage. The alternate crossing of sections acts as a vertical and horizontal baffle in center

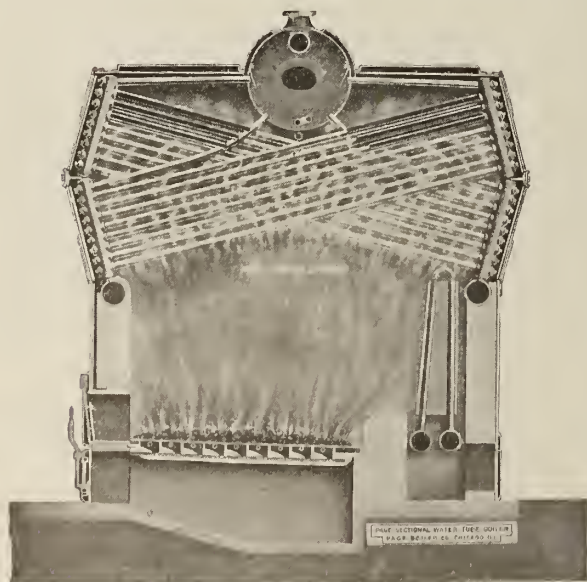
of boiler, which causes gases to expand to outer ends of the tubes' surface. On each side of boiler, at top, special baffles are provided for as gases pass in through main tubes; these baffles control gases and cause them to pass beneath steam and water drum. Accomplishes the same in a one-pass as other type boilers do in three-pass. By actual pyrometer readings, a most uniform baffling of gases is accomplished.

Expansion.

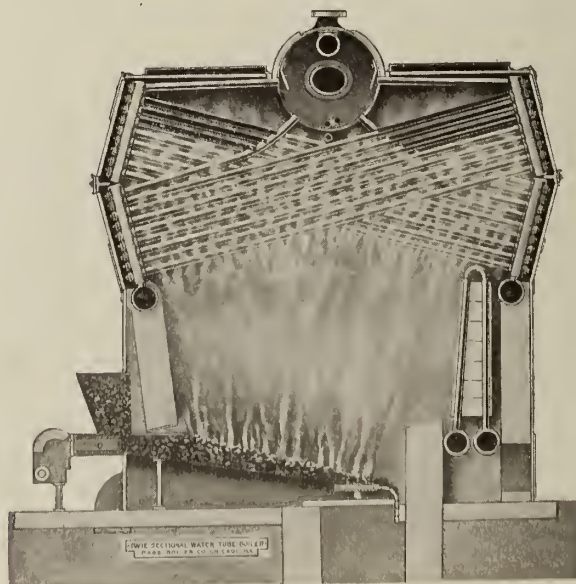
The advantages of the sectional tube boiler are considered of the highest type, due to each section being free to expand independent of other sections, each having a complete circuit of water circulation. Each section has a separate water feed from upper drum, and contains a separate intake to steam drum. Therefore, a boiler containing 30 sections has 30 water feeds coming into the sections and 30 deliveries coming into steam and water drum. These separated tubes coming in result in a most efficient and strong steaming boiler.

A positive and efficient circulation insures that all portions of pressure parts will be at approximately the same temperature, and in this way strains resulting from unequal temperatures are avoided. In a properly designed water tube boiler, steam may be raised from a cold boiler to 200 lbs. working pressure in less than $\frac{1}{2}$ hour.

The lack of accessibility in most boilers further leads to difficulties where repairs are required. In design and construction, the Page water tube boiler provides every convenience for inspection and cleaning.



Hand Fired



Stoker Fired

PAGE TWIN WATER TUBE SECTIONAL BOILERS

Quick Cleaning.

A feature is the water circulation passing above mud drums. Sediment formation may be blown out as desired. It is not necessary to remove header plates when washing out. After a constant service on high pressure for a number of years, these boilers have been found to be almost free from sediment and scale.

Enclosure.

Entirely enclosed in an airtight steel casing. An arrangement of doors makes every part of the interior construction readily accessible for cleaning and repairs.

The steel casing being lined with asbestos non-conducting material and fire brick of a tough and durable texture, so effectively prevents radiation that when a boiler is running at its rated capacity the hand may be put on any part of the casing without discomfort.

Efficiency.

The efficiency and airtightness of this type of enclosure is a marked improvement over cumbersome, leaky and weighty brick settings. Brick settings also encroach on valuable space and are a continual source of annoyance through deterioration. Efficiency on these boilers frequently runs from 72% to 75%.

Compactness.

Compactness, a feature of this boiler, is due not alone to elimination of brick walls as an enclosure, but to the peculiar cross tube system which distinguishes it from all others of sectional type. Capacity in horse-

power per cubic foot of space is greater than is afforded by any other boiler on the market.

Gases extend under entire heating surface. Combustion chamber is of proper height to permit use of any kind of fuel. Proportion of grate surface to heating surface is liberal. Rated horsepower is easily developed with 13 lbs. of good coal per square foot of grate per hour. Baffling of gases is arranged to suit conditions.

Cost.

The cost varies with size of boiler, the pressure carried, location of boiler, and special requirements.

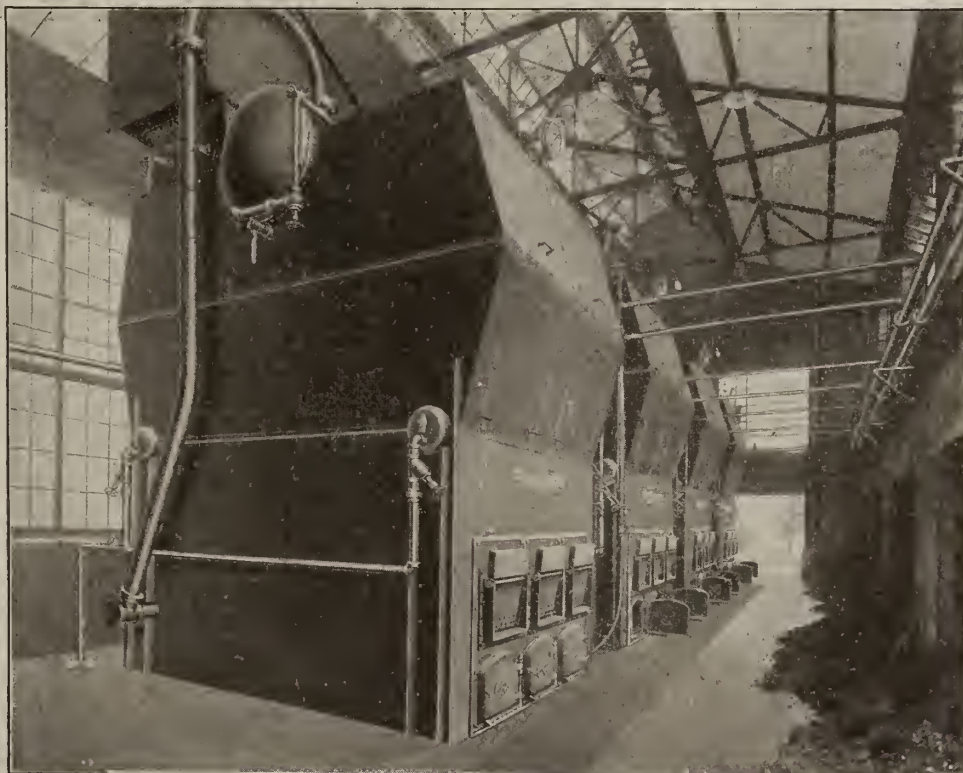
Marine Boilers.

The Page sectional water tube boiler is equally efficient and adapted to marine service. Design and construction are such that the weight per horsepower is less than in any other type of boiler; larger capacity can be placed per cubic or square foot; and the large combustion area beneath boiler is greater.

Utilization of Waste Heat.

Page boilers in actual service as waste heat boilers have shown an evaporation of from 15% to 20% more than other types of boilers. Manipulation of baffles can be so arranged as to control velocity of gases to suit conditions. The oscillating soot cleaners are most reliable and are a part of the equipment.

Refer to Kroupp Forge Works, Chicago, in regard to the efficiency and easy manner in which they can run double the capacity out of each unit.



PAGE WATER TUBE BOILERS WITH SUPERHEATERS

1000 h.p. plant; one of five plants for Illinois Central R. R. Co.

SAMUEL SMITH & SON COMPANY

Boilers and Steel Plate Construction

TELEPHONE:
PATERSON 4200

PATERSON, N. J.

CABLE:
"SAMSMITH"

Products.

BOILERS: Horizontal Tubular, Locomotive and Vertical; STEEL PLATE CONSTRUCTION.

Horizontal Tubular Boilers.

For over 75 years we have built boilers of this type to the complete satisfaction of our customers. Until the Rogers Locomotive Works were absorbed by the American Locomotive Co. and closed down on account of their disadvantageous location away from railroad facilities, this shop was chiefly occupied in building locomotive boilers for the famous Rogers locomotive. Their characteristics are too well known to require mention here.

H. R. T. Boilers are so simple and prove so satisfactory, the fact is often lost sight of that only the very best materials to be had and intelligently directed skill must enter into their manufacture.

An indifferent job of boiler making is probably the most undesirable thing on earth. This fact is vividly recalled and too late to be remedied when a catastrophe occurs through its being blown up. The success of the Smith boilers is due largely to the fact that the makers have never been guilty of an indifferent job. All boilers are built to A. S. M. E. standard specifications

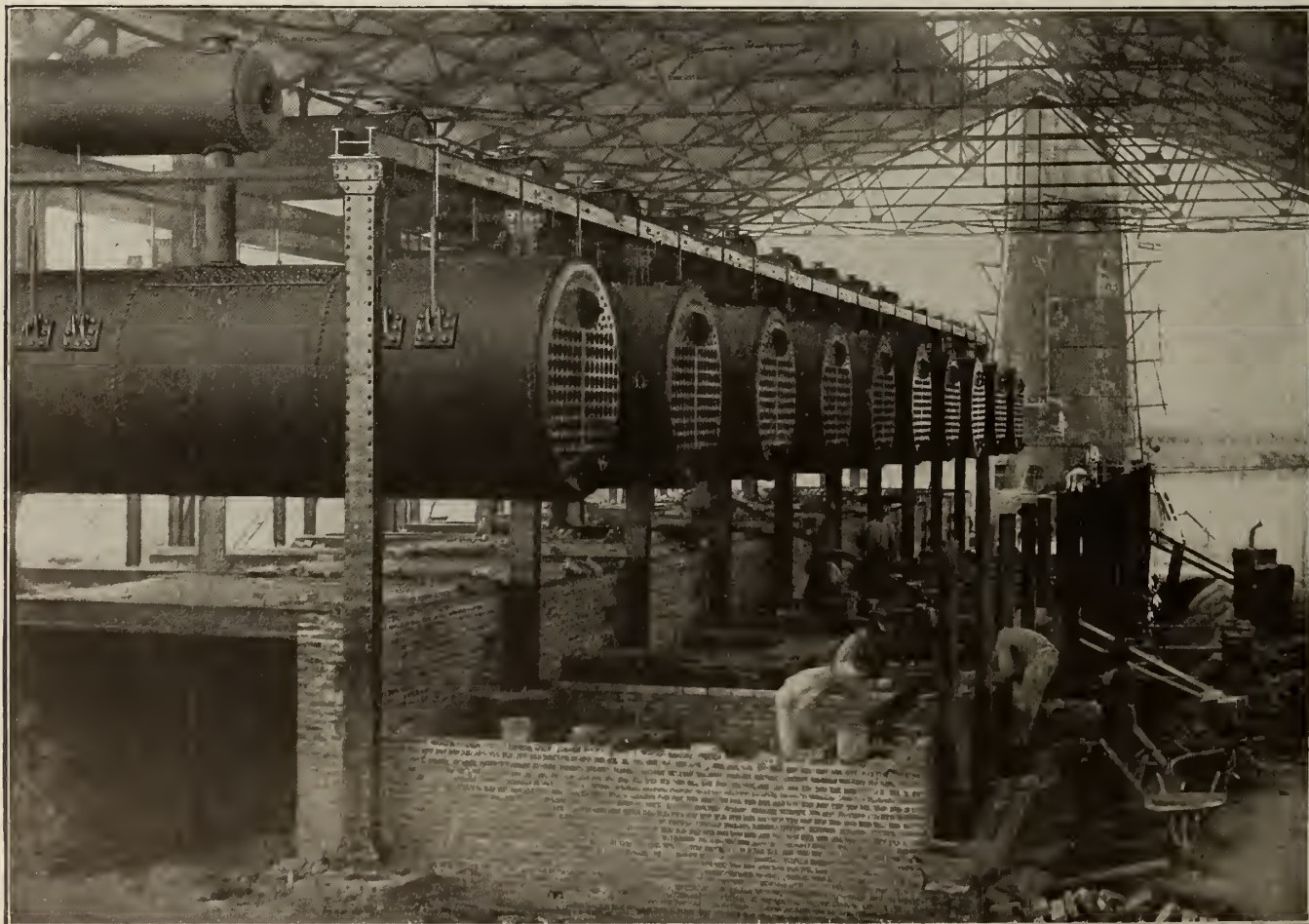
strictly; and are easily adapted to the use of any fuel, including bagasse.

Vertical Boilers.

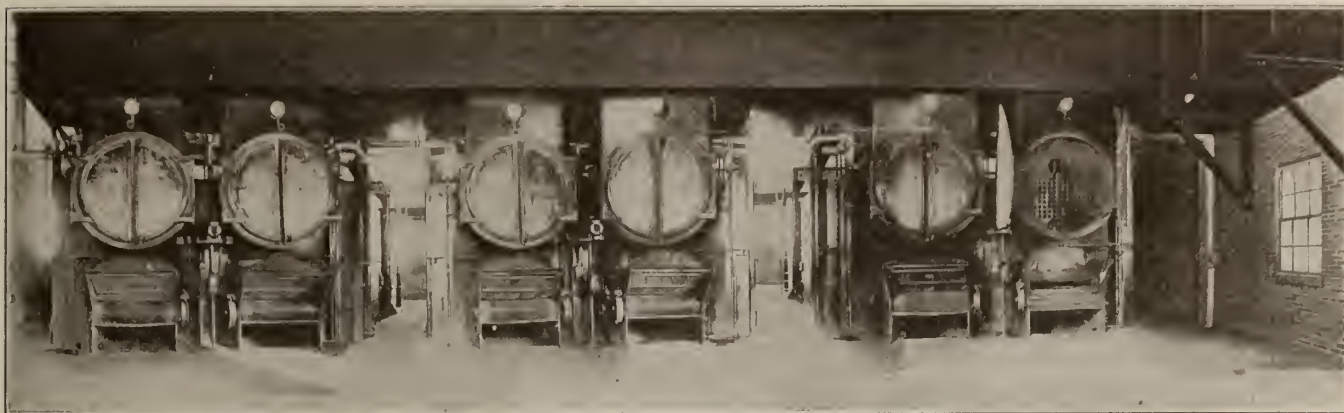
Though not so generally used as the horizontal tubular type, there are conditions which often make the vertical boiler preferable. The Smith vertical boiler may be described as a Super-Manning. The illustration on the opposite page shows how accessible this boiler is for cleaning and inspection. This feature of accessibility eliminates the one big disadvantage from which vertical boilers have suffered. The conical firebox permits large grate area, with stronger yet lighter superstructure of boiler. Distribution of air is equalized by having from 4 to 8 large sliding doors. Actual tests show from 50° to 100° superheat. The boilers are made in units from 100 to 500 h.p.; and for pressures from 125 to 200 lbs.

Steel Plate Construction.

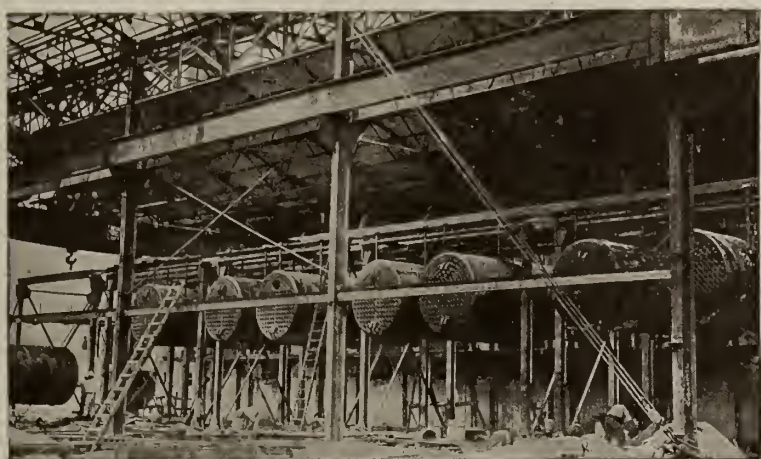
This organization is equipped to handle steel plate construction in all its forms. Steam boxes of all descriptions, vulcanizers, kiers, tanks, stacks, digesters, riveted pipe, are made as part of the regular line or to specifications. The shop is well equipped to handle this class of work rapidly and economically. Its location is most favorable, being within 15 miles of the



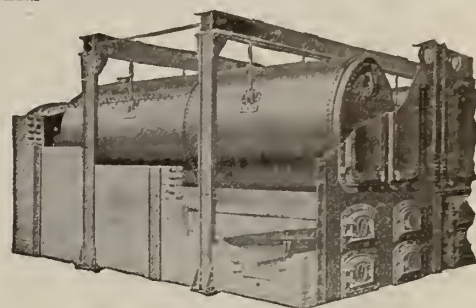
ONE-QUARTER OF LATE INSTALLATION OF SMITH BOILERS, ARRANGED FOR BURNING BAGASSE



TYPICAL INSTALLATION OF SMITH BOILERS



INSTALLATION OF SMITH BOILERS IN CUBA



HORIZONTAL BOILER IN SUSPENSION SETTING



VULCANIZER

Made any size, diameter and length, and in all pressures up to 250 lbs.



STANDARD HORIZONTAL TUBULAR BOILER.



VERTICAL BOILER, 100 TO 500 H. P.
Up to 200 lbs. working pressure

world's greatest port (New York City) and lying between the yards of the Erie and the Delaware, Lackawanna & Western Railroads, with switching service from the former.

Consultation.

The Engineering Department is always at the service of patrons to give advice and assistance. Correspondence is solicited.

UNIFLOW BOILER COMPANY, INC.

GENERAL OFFICES
PHILADELPHIA, PA:

SALES OFFICES

CLEVELAND, OHIO MERIDEN, CONN. GRAND RAPIDS, MICH. BOSTON, MASS. ROCHESTER, N. Y.
OMAHA, NEBR. NEW ORLEANS, LA. PITTSBURGH, PA. KANSAS CITY, MO.

Product.

UNIFLOW BOILERS of the Improved Return Tubular Type.

Service.

It is the policy of the UNIFLOW BOILER COMPANY, INC., to assume the entire responsibility of steam boiler plant installation in all parts of the country.

Boiler plants of any size can be quickly erected, and without affecting the operation of the plant.

The Uniflow organization consists of a group of steam boiler specialists who endeavor to give the customer the boiler best adapted to conditions.

Construction.

The Uniflow boiler is constructed in accordance with the Uniflow design, fully patented in the United States, Canada and foreign countries.

The material used in the construction of the Uniflow boiler is carefully selected, and guaranteed to be reliable and durable for the work for which it is designed.

The Uniflow boiler is also constructed in accordance with the requirements of the A. S. M. E. Boiler Code, or the Massachusetts Code, and can be made conforming to other established state or municipal boiler laws.

TUBES—Arranged on a hexagonal plan, in vertical rows, which provides a film of water $1\frac{1}{4}$ in. in thickness to pass up between tubes in the three tube banks. The downward circulation occurs in the circulation spaces between the tube banks.

STEAM OUTLET—The improved Uniflow dry pipe projects through rear head of boiler. This dry pipe is placed high in steam space of boiler. With the improved dry pipe, steam is taken from steam space throughout length of boiler, with the result that there is no surging or priming.

FEED INLETS—Are so placed on front head of boiler that feed water is distributed equally to both sides of boiler and discharges downward into circulation paths provided in tube layout.

Incoming feed water does not interfere with discharge of steam into steam space.

SMOKE BOX EXTENSION—Made of a separate steel plate ring, fastened to front head of boiler instead of shell being extended forward, permitting the breeching connection to stack to be taken out vertically or at any angle that suits conditions.

The Uniflow Setting.

The Uniflow furnace setting fulfills all the requirements of correct furnace construction. By the introduction of air through bridge wall that is not preheated, smokeless combustion and complete secondary ignition of gases from the fuel result. By the use of inverted arch extended from bridge wall toward rear of boiler, the gases impinge against shell with a scouring action, making that portion of the shell, which has previously been insulated with a film of dust, a part of the most effective heating surface of the boiler.

The whole of the brickwork is so assembled as to prevent the internal expansion disturbing it. The red brick is retained as the structural element of the setting, leaving the fire brick to function as the heat insulation alone.

The Uniflow boiler is suspended from I-beams, supported on the red brickwork of setting.

Special Features.

The patented Uniflow tube layout divides the water currents and produces a rapid and positive circulation resulting in: high efficiency—economy of operation; rapid steaming—ability to absorb heat; delivery of dry steam—no priming; large steam disengaging area; great overload capacity without overheating; minimum travel of entrained steam; reduction of the amount of incrustation; even temperatures, overcoming expansion strains.

Compactness: 50% more heating surface than in ordinary boiler, economy in floor space and height, less cost of settings.

Uniflow furnace: complete and smokeless combustion and minimum radiation losses and upkeep cost.

Durability: simplicity of construction.

Accessibility for cleaning, internally and externally.

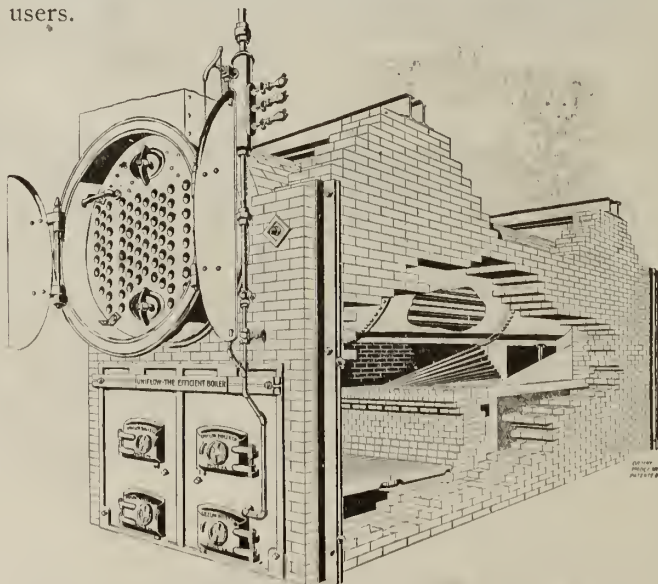
Ease of installation and operation. Low maintenance cost and long life.

Guarantee.

Every installation of the Uniflow boiler is made under the guarantee of 71% to 74% efficiency, 50% overload capacity, delivery of commercially dry steam at all times, and smokeless combustion of bituminous coal.

Catalogue, etc.

Send for descriptive matter and list of prominent users.



DETAILS AND METHOD OF INSTALLING THE UNIFLOW BOILER
Capacities of 100 to 600 h. p. Stock sizes rated at 134, 155, 216, 259 and 313 h. p. 100 to 160 lbs. working pressure

UNION IRON WORKS

Manufacturers of Steam Boilers and Steel Plate Construction

ERIE, PA.

BRANCH OFFICES AND AGENCIES

BOSTON, STARKWEATHER & BROADHURST, 53 State Street
 NEW YORK, EDWIN H. LUDEMAN, 165 Broadway
 SYRACUSE, CHAS. F. WAYTE, 918 University Building
 INDIANAPOLIS, DRAGO-DOYLE Co., Merchants Bank Building
 PHILADELPHIA, DRAGO-DOYLE Co., Commercial Trust Building
 ST. LOUIS, LOUIS F. MAHLER, Syndicate Trust Building

SCRANTON, SCRANTON SUPPLY & MACHINERY Co.
 PITTSBURGH, DRAGO-DOYLE Co., Diamond Bank Building
 CLEVELAND, 550 Rockefeller Building
 TOLEDO-DETROIT, W. HAWLEY & Co., 950 Nicholas Building, Toledo, Ohio
 CHICAGO, 330 Old Colony Building
 SAN FRANCISCO, PAUL COOP, Hobart Building

Products.

UNION WATER TUBE BOILERS; UNION HORIZONTAL RETURN TUBULAR BOILERS.

Also, all types of Fire Tube Boilers, Vertical, Internally Fired, Scotch, and Locomotive, as well as Portable Boilers, Stacks, Tanks, Breechings, etc.



PLANT OF THE UNION IRON WORKS

Water Tube Boilers.

Over thirty years' experience in high pressure steam boiler building has produced the Union water tube boiler. There are more distinctive features in its design which make for continued efficiency, high overload capacity, safety, and minimum cost of operation and maintenance than any other water tube boiler. Among these advantages may be mentioned the following:

The patented corrugated flange connection from drums to headers eliminates distortion of tubes and leaky headers. There are no restricted areas, thus free circulation is assured, and internal strains are relieved in the boilers.

The patented purifier in the drums takes out practically all of the impurities in the feed water before it comes in contact with the heating surfaces. Settling chamber is out of range of the fire and path of circulating steam making element. Fitted with separate reinforced blow-off connection.

The horizontal drums provide ample steam and water space and steam liberating surface. Large area of connection from drums to header allows unrestricted circulation. This insures dry steam and large water storage capacity, permitting high overload.

The shape of the handhole permits each steel plate to be withdrawn through the hole it covers. No ground joints are used, and plates are easily kept tight. The yoke is of novel design, readily and quickly removed.

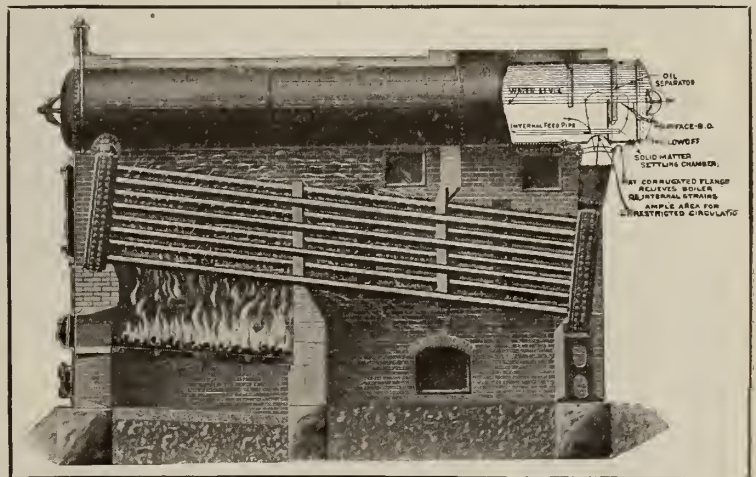
The tube spacing and purifier permit keeping the boiler clean while in operation. These features reduce the labor for cleaning, and the time lost while boiler is out of service. There is both higher operating efficiency and greater overload capacity than in any other boiler on the market.

The headers are made in integral halves in one heat and operation. The water space is of unusual depth and the headers have at no point two thicknesses of plate or rivets in the fire.

We have never had a broken staybolt in the Union water tube boiler. The water contents of these boilers is exceptionally large and practically the same as for return tubular boilers of the same horsepower rating. Regular pitch of staybolts, and additional blow-off at bottom of the headers.

The greater inclination of the tubes promotes more rapid circulation. They are vertically staggered to expose the maximum area to the heat. The horizontal spacing in rows is to permit inspection and proper cleaning of the fire side of the boiler. It also furnishes ample room for the passage of gases. All tubes are straight, of the same length and standard diameter.

The standard vertical baffles permit the installation of any regular superheater, as well as mechanical soot blowers. Horizontal baffles, however, may be fitted, as tube spacing is arranged for them. Products of com-



UNION WATER TUBE BOILER

bustion pass through ample spaces between tubes and baffles, making at least three passes and then are discharged through the uptake areas of large capacity.

The workmanship is guaranteed to be the very best that can be done by a well trained organization, with modern facilities.

All boilers are inspected and put to hydrostatic and steam tests, and passed only when found to be absolutely tight under the highest allowable working pressures, in compliance with boiler laws and insurance company requirements.

Horizontal Return Tubular Boilers.

The Union horizontal return tubular boilers are of standard designs and have the highest reputation for quality of material and workmanship. This line is complete in various types and sizes. A large stock is usually kept on hand for prompt shipment.

THE WALSH & WEIDNER BOILER CO.

CHATTANOOGA, TENN.

Products.

STEEL BOILER CASINGS; HORIZONTAL RETURN TUBULAR BOILERS; HORIZONTAL WATER TUBE BOILERS; SUGAR CRYSTALLIZER; STORAGE TANKS, STRUCTURAL STEEL and all classes of STEEL PLATE CONSTRUCTION.

Also, Vertical Water Tube Boilers, Pressure Tanks, Steel Riveted Piping, Acid Tanks, Oil Tanks, and Packing House Tanks.

Facilities.

The plant is located in the heart of the Southern iron and steel territory where material can be purchased to advantage, where the best of skilled mechanics are available and where favorable freight rates prevail.

This company has one of the largest shops in the country for doing all classes of boiler and plate iron work, and is in a position to handle jobs of almost any size.

The shop is well equipped with the most modern machinery, and an efficient corps of engineers capable of designing and preparing plans for all classes of work in this line is employed.

The company is especially well prepared to build special plate ironwork, tanks and structural work required in industrial plants.

A large, experienced erection force is prepared to erect material in any part of the country.

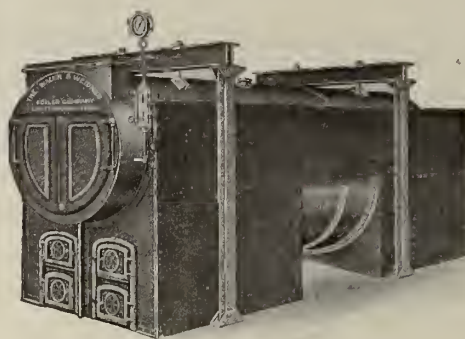
A large stock of materials is always carried on hand, and prices will be quoted for prompt shipment from stock.

Catalogues covering the line will be gladly furnished on application.

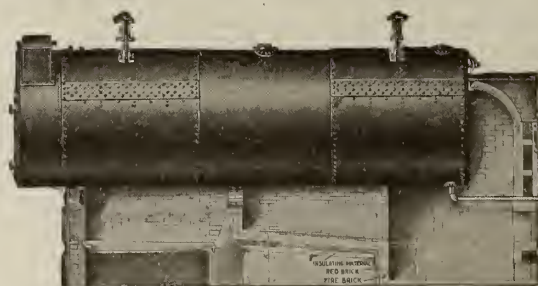
Special Horizontal Return Tubular Boilers with Steel Casing Setting.

This company makes a specialty of high grade horizontal return tubular boilers and usually furnishes the improved drop combustion chamber steel casing setting with them.

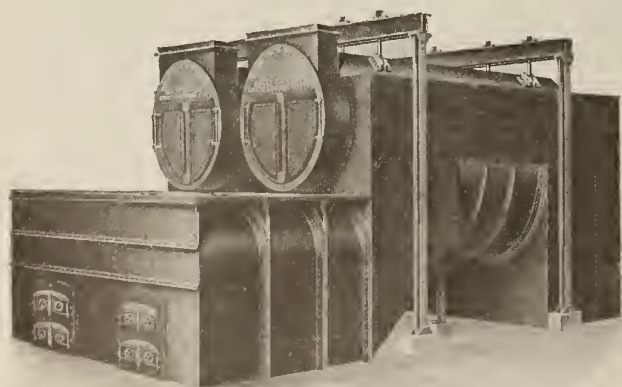
This setting costs about the same as a brick setting and decreases the coal consumption from 10% to 25%. They are built for any number of boilers in a battery and arranged for any special type of furnace.



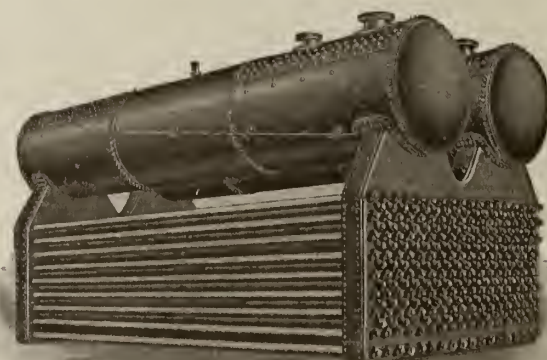
STEEL CASING SETTING



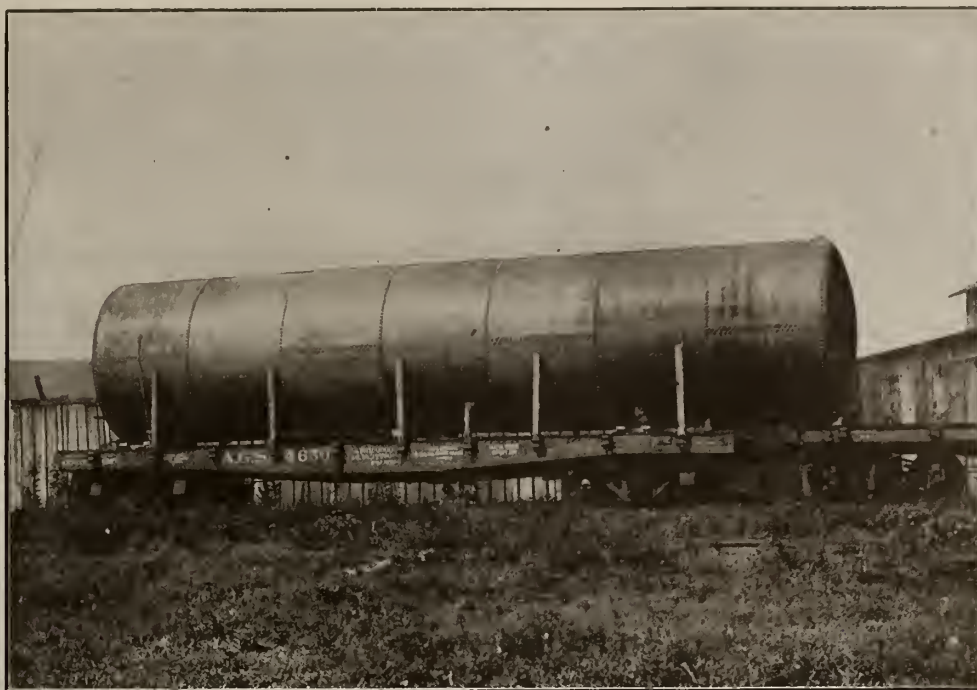
SECTIONAL VIEW STEEL CASING SETTING



DOUBLE DUTCH OVEN SETTING WITH STEEL CASING
Designed for burning sawdust, bagasse or any other refuse material



HORIZONTAL WATER TUBE BOILER
Built in sizes for all practical pressures.
Furnished with mechanical stokers or stationary grates



ONE OF THE SEVENTEEN 25,000-GALLON BENZOL TANKS BUILT FOR THE T. C., I. & R. R. CO., BIRMINGHAM, ALA.

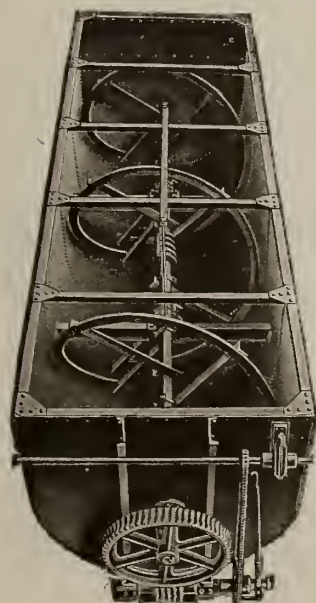


TWO 1,000,000-GALLON TANKS ERECTED FOR THE BARRETT CO., FAIRFIELD, ALA.

Co-operative Service.

THE WALSH & WEIDNER BOILER CO. is prepared to furnish and erect tanks, plate steel and structural work of any description.

The estimating and engineering departments will gladly furnish prices and designs of whatever is required in this line and give to the inquirer the benefit of long experience.



SUGAR CRYSTALLIZER
Both open and closed types of crystallizers in all sizes are built



STRUCTURAL STEEL BUILDING ERECTED FOR THE MARION EXTRACT CO.



TANKS WITH TOWERS

ESTABLISHED 1880

HENRY VOGT MACHINE CO.

Manufacturers of Boilers

LOUISVILLE, KY.

Products.

WATER TUBE and HORIZONTAL RETURN TUBULAR BOILERS; SECTIONAL STEEL BOILER CASINGS.

Plain and Smokeless Firebox Heating Boilers; Down-draft Furnaces; Sectional Shaking and Dumping Grates; Steel Stacks and Tanks.

For Ice and Refrigerating Machinery, see page 1017.

Vogt Water Tube Boilers.

The exacting requirements of the modern power plant are satisfied by Vogt water tube boilers.

Continuous high economy is obtained, due to the design of the boilers and the arrangement of the furnaces for the proper combustion of the fuel.

Low cost of maintenance is secured by the elimination of numerous handholes at ends of tubes and by the accessibility for cleaning and inspection; also by the flexibility of construction, effected by the method of suspension which allows for the freedom of expansion and contraction.

High grade workmanship and material are embodied with the most advanced boiler practice, which complies with the new A. S. M. E. Boiler Code.

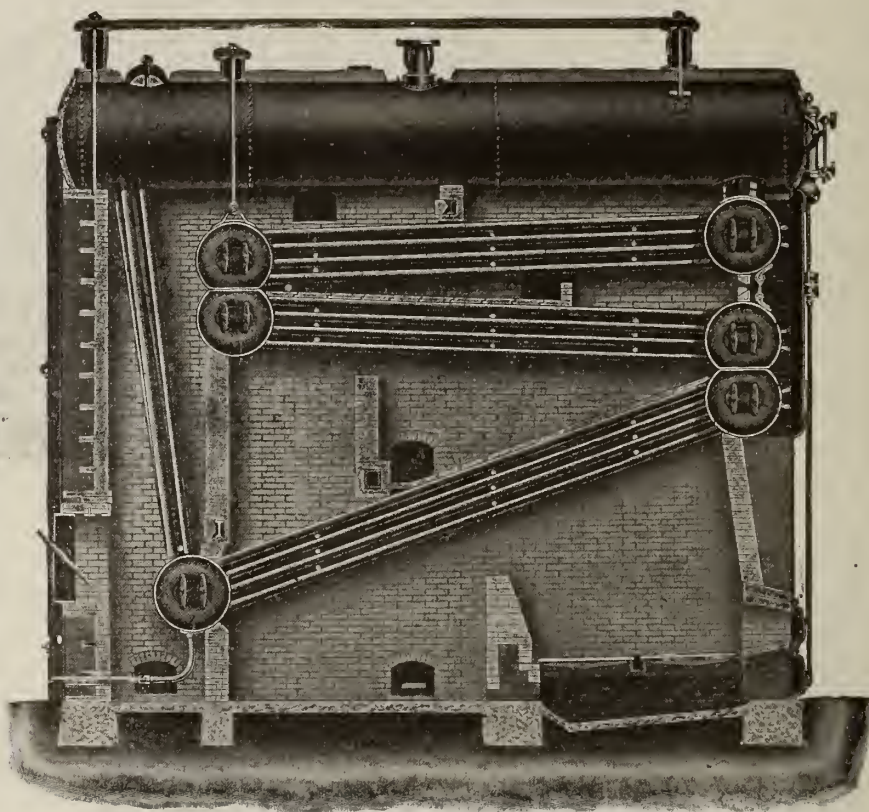
Vogt Sectional Steel Boiler Casings.

The necessity that more perfect combustion be obtained has made the elimination of the excess air, which leaks through brick boiler settings, one of the most important features of boiler setting design.

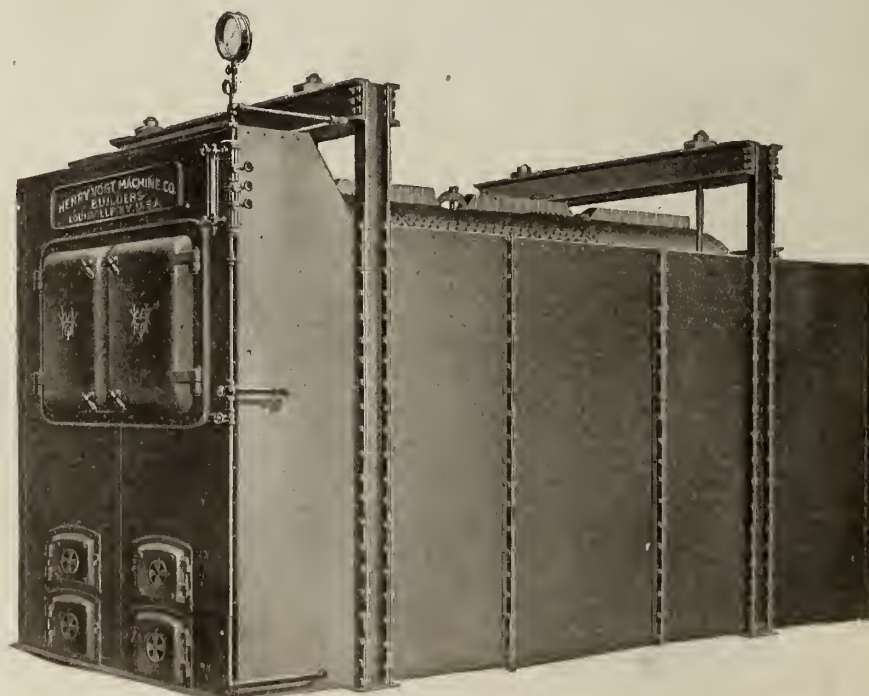
The Vogt steel casing for return tubular and water tube boilers constitutes a decided step towards securing this more perfect combustion, as it avoids all leaks common to brick settings.

A considerable saving in the cost of maintenance and in the elimination of expensive delays is effected, since the brick lining of the steel casing (being tightly sealed) is not subject to the usual expansion and contraction.

Excess air means wasted fuel. Stopping the leaks reduces the coal consumption. Coal saved is dollars saved, which is a direct return upon the investment.



VOGT STANDARD HORIZONTAL WATER TUBE BOILER



SECTIONAL STEEL INCASED HORIZONTAL RETURN TUBULAR BOILER

C. J. WALTON & SON

Boilers, Tank and Plate Work

1221 West Main Street
LOUISVILLE, KY.

Products.

RETURN TUBULAR and WATER TUBE BOILERS;
STEEL CASINGS.

Also, Scotch Marine Boilers, Stacks, Tanks, Shaking Grates, General Plate Work, etc.

Experience.

During the 80 years that the firm of C. J. WALTON & SON has manufactured steam boilers, the highest standards of construction, material and workmanship have been constantly maintained. Throughout the entire manufacturing career of this company, the most modern methods and the newest mechanical equipment have always been sought and utilized for the improvement of its products.

Scope of Work.

While specializing in return tubular boilers, C. J. WALTON & SON also build boilers with riveted flues, internally fired Scotch marine boilers, vertical boilers with full length and submerged tubes and vertical water tube boilers.

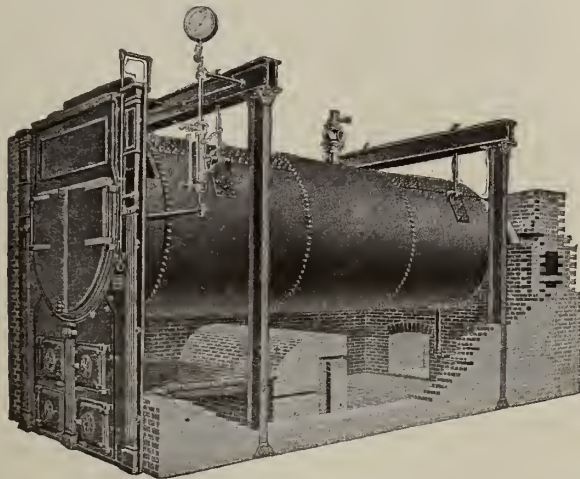
The scope of work also includes plate and sheet iron work and the manufacture of shaking and standard flat grates.

Return Tubular Boilers.

These boilers, with ranges from 30 to 250 h.p., may be supported by wall brackets, or I-beam and column supports. The latter is recommended for larger sizes.

Boilers can be furnished with full flush, three-quarters or half fronts, and fronts arranged to receive any type of stoker.

Grates of the flat type or shaking grates can be furnished.



BOILER SHOWING INDEPENDENT SUPPORTS

TRIMMINGS—The trimmings consist of pop safety, blow-off check and globe valves, water gage with gage cocks, steam gage and siphon, in addition to the regular setting fixtures.

Water Tube Boilers.

The Walton water tube boiler is of the vertical type with straight tubes, large steam space and built in sizes of 200 to 400 h.p.

SPECIFICATIONS, STANDARD RETURN TUBULAR BOILERS
Longitudinal Seams. All Butt Jointed

H. p. of boiler as rated	Diam. of boiler, in.	Length of tubes, ft.	No. of 3-in. tubes	No. of 3½-in. tubes	No. of 4-in. tubes	Width of grates, in.	Length of grates, in.	Area of grates, sq. ft.
30	42	10	38	28	—	42	36	10.5
35	42	12	38	28	—	42	42	12.25
40	42	14	38	28	—	42	48	14.0
45	48	12	46	34	28	48	42	14.0
50	48	14	46	34	28	48	48	16.0
60	54	14		44	36	54	48	18.0
70	54	16		44	36	54	54	20.25
80	60	16		54	44	60	54	22.5
90	60	18		54	44	60	60	25.0
100	66	16		66	54	66	54	24.75
110	66	18		66	54	66	60	27.5
125	72	16		86	70	72	54	27.0
150	72	18		86	70	72	60	30.0
165	72	20		110	70	72	66	33.0
180	78	18		110	88	78	60	32.5
200	78	20			88	78	66	35.75
225	84	18			106	84	66	38.5
250	84	20			106	84	72	42.0

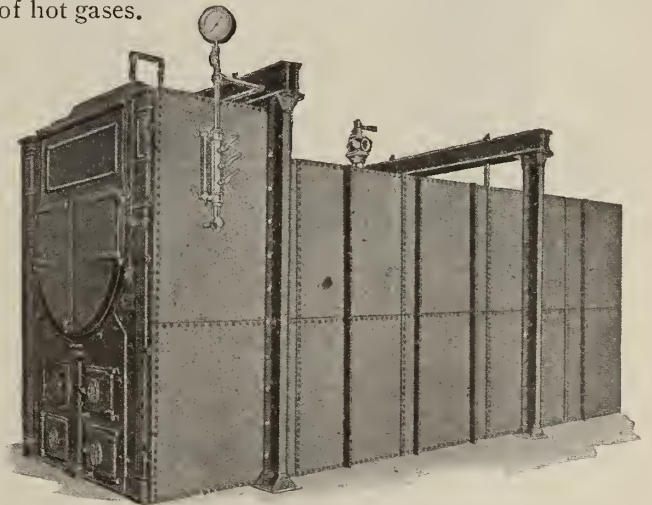
TABLE CONTINUED—SIZE OF TRIMMINGS

Size of steam opening, in.	Size of pop safety valve, in.	Size of water gage glass, in.	Size of water column connections, in.	Size of gage cocks, in.	Size of blow-off, in.	Size of feed and check valve, in.	Size of steam gage in dial, in.
2½	1½	5⁄8	1	¾	1½	1¼	5
3	1½	5⁄8	1	¾	1½	1¼	5
3	2	5⁄8	1	¾	1½	1¼	5
3	2	5⁄8	1	¾	1½	1¼	5
3½	2½	5⁄8	1¼	¾	2	1¼	6¾
3½	2½	5⁄8	1¼	¾	2	1¼	6¾
4	2½	5⁄8	1¼	¾	2	1¼	6¾
5	3	5⁄8	1¼	¾	2	1½	6¾
5	3	5⁄8	1¼	¾	2½	1½	6¾
5	3	5⁄8	1¼	¾	2½	1½	6¾
5	4	5⁄8	1¼	¾	2½	1½	6¾
6	4	5⁄8	1¼	¾	2½	1½	6¾
6	4	5⁄8	1¼	¾	2½	1½	6¾
6	4	5⁄8	1¼	¾	2½	2	6¾
6	4	5⁄8	1¼	¾	2½	2	6¾
8	4½	5⁄8	1¼	¾	2½	2	8½
8	4½	5⁄8	1¼	¾	2½	2	8½

Steel Casing.

Steel casing for enclosing the boiler is furnished instead of standard brick casing which often cracks, admitting cold air.

Riveted steel plates made with straight sides or rounded bottom, insure airtight construction. The casing is lined with fire brick to protect it against the action of hot gases.



BOILER SHOWING STEEL CASING

Plate Work.

Estimates gladly furnished for stacks, tanks and general plate work.

THE WICKES BOILER CO.

Manufacturers of Water Tube and Return Tubular Boilers

SAGINAW, MICH.

SALES OFFICES

NEW YORK, N. Y., 1716 West Street Building
BOSTON, MASS., 201 Devonshire Street
SEATTLE, WASH., 736 Henry Building

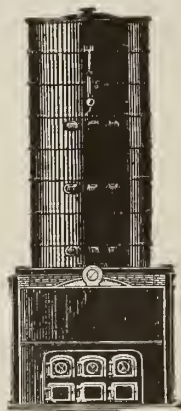
PITTSBURGH, PA., 1218 Empire Building
DETROIT, MICH., 1116 Penobscot Building
CHICAGO, ILL., 76 West Monroe Street

Products.

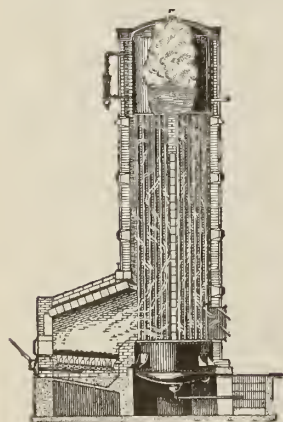
WICKES VERTICAL WATER TUBE BOILERS and
HORIZONTAL RETURN TUBULAR BOILERS.

Wickes Vertical Water Tube Boilers.

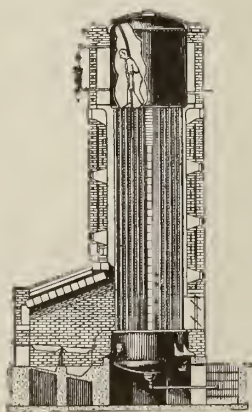
Designed and built in accordance with the A. S. M.
E. Boiler Code.



Steel Cased Setting Increases Efficiency



Great Height of Steam Room
Insures Dry Steam



Man Stands Erect Cleaning

DISTINCTIVE FEATURES WICKES VERTICAL WATER TUBE
BOILER

Built of homogeneous metal. No cast metal of any
kind used.

All tubes perfectly straight.

Very highest class workmanship known to the art
put upon these boilers.

No special parts used. Material can be furnished
and boiler repaired by local boiler maker.

SWEET'S CATALOGUE

Baffle tile is heavy, rabbetted, tongued and grooved
and can not be misplaced.

Easiest boiler to open, wash or turbine and close
on the market. Hence, can be operating the maximum
number of hours per year.

Accessible mud drum located at the lowest point
of the boiler.

Gases have a very long travel; entirely surround
and scrub heating surface from entrance to release.

There are no passages in setting not filled with
heating surface. No opportunity exists for gases to
short-circuit heating surface.

Precipitation of soot and impurities in water are
taken advantage of by gravity to the fullest possible
extent.

Steel cased settings stop air leaks and so increase
efficiency.

Great height of steam outlet from water level,
coupled with liberal steam storage capacity, results in
absolutely dry steam being delivered by this boiler.

BULLETINS—Ask for educational, technical bul-
letins, illustrated with Wickes vertical water tube
boilers. The titles of these bulletins, for free distribu-
tion while they last, are:

Reducing Costs in the Boiler Room.

The Magnitude and Prevention of Air Infiltration Losses.
Saving Coal in Steam Power Plants.

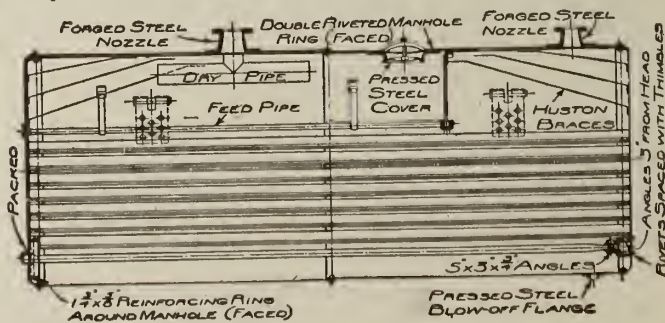
Aids in the Selection of a Steam Boiler with a Peep at the
Wickes Vertical Water Tube Boiler.

In writing please mention SWEET'S CATALOGUE.

Horizontal Return Tubular Boilers.

Designed and built in accordance with the A. S. M.
E. Boiler Code.

Ask for catalogue covering design and workman-
ship.



A.S.M.E. CODE RETURN TUBULAR BOILER

JAMES BEGGS & CO.

Manufacturer of Steam Blowers and Shaking and Dumping Grate Bars

OFFICE AND SALESROOM

42 Warren Street

NEW YORK, N. Y.

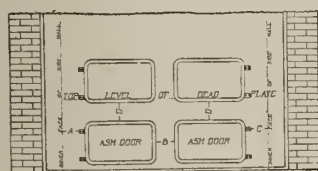
Products.

BEGGS MCCLAVE IMPROVED DUMPING, SHAKING and CUT-OFF GRATE; STEAM BLOWERS.

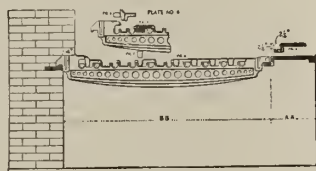
For Boilers, see page 642.

Beggs McClave Improved Dumping, Shaking and Cut-off Grates.

This improved grate combines in one grate the ability to burn all kinds of coal from bituminous run-of-mine to the smallest size of anthracite. The grate has three distinct motions: first, the cut-off, where a slice of ash is removed from the bottom of the fuel bed; second, the dumping where the entire contents of one or more sections is dumped in the ash pit; third, the shaking where the fuel bed is agitated, permitting the fine ash only to fall into the ash pit. The grate surface is divided into sections and any one of these motions may be imparted to any section without disturbing the other sections.



SECTION OF FIREBOX



BOILER FRONT



GRATE SHOWING FRONT SECTION DUMPING, REAR SECTION FIRING POSITION



GRATE SHOWING SHAKING POSITION

ANTHRACITE FUEL—Anthracite coals require that fuel bed shall be disturbed as little as possible. With the Beggs McClave improved grate, the combustion is maintained with the minimum amount of agitation. As the layer of ash under the hot coal accumulates, a slice approximately 3 in. thick is removed by means of the cut-off motion of the grate, leaving a thin bed of hot coals, the ideal condition for the fire.

BITUMINOUS FUEL—Bituminous coal tends to slag and cake, thereby cutting off the draft through the fuel bed. Continuous agitation is required to keep the fire broken up. Beggs McClave improved grate is admirably adapted for this, as the shaking motion agitates the fuel bed permitting only the fine ash to drop into the ash pit.

DIRECTIONS FOR ORDERING—(1) Give the exact width between side walls of furnace at the level of grate.

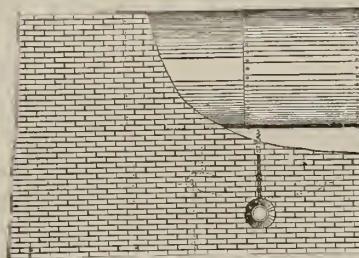
(2) Give length of lines AA and BB.

(3) State whether the dead plate has a lip (or rabbet) on its inner edge to carry front end of grate frame. The lip (or rabbet) for the Beggs McClave improved grate should be $2\frac{1}{4}$ -in. projection, $2\frac{1}{8}$ -in. depth.

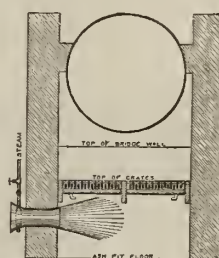
(4) Give measurements, A, B, C and D.

Ring Blowers.

For furnishing forced draft to burn the smallest grades of coal or to help over the peak, a ring blower installed in the ash pit is most economical and efficient. It is easily installed and requires no adjustments or repairs. It does not depreciate when not in use. A large volume of air is obtained by the use of a small amount of steam. Clinkering is prevented as a result of the softening effect of the steam.



RING BLOWER INSTALLED IN ASH PIT WALL



BLOWER CAPACITIES

H. p.	Number of blowers	Outside diam. of blowers at inlet, in.	Length of blower, in.	Diam. of hole in wall, in.	Length of blower, in.	Diam. of hole in door, in.
Up to 35	1	8 $\frac{1}{4}$	24	6 $\frac{1}{2}$	..	5 $\frac{3}{8}$
Up to 35	1	8 $\frac{3}{4}$	24	9 $\frac{1}{2}$	17	7 $\frac{7}{8}$
40 to 80	1	11 $\frac{3}{8}$	24	10 $\frac{1}{2}$	17	9 $\frac{1}{4}$
40 to 80	1	11 $\frac{3}{8}$	24	12 $\frac{1}{2}$	..	..
90 to 150	1	13 $\frac{1}{2}$	24	10 $\frac{1}{2}$	17	9 $\frac{1}{4}$
90 to 150	1	13 $\frac{1}{2}$	24	12 $\frac{1}{2}$	..	..
160 to 210	1	16 $\frac{1}{4}$	24	10 $\frac{1}{2}$	..	..
210 to 275	2	13 $\frac{1}{2}$	24	10 $\frac{1}{2}$	..	..
300 to 400	2	16 $\frac{1}{4}$	24	12 $\frac{1}{2}$	..	..

THE AUTOMATIC FURNACE CO.

DAYTON, OHIO

Products.

MODEL AUTOMATIC SMOKELESS FURNACE; MODEL CHICAGO CHAIN GRATE; MODEL ACME STEAM ENGINE.

Co-operative Service.

This company will gladly co-operate with consulting engineers, architects, owners, managers, operatives, and all who have to do with steam power, heat or light plants and will gladly furnish such detailed information as may be desired to determine the practicability of any proposed installation.

Model Automatic Smokeless Furnace.

The Model Automatic smokeless furnace is so designated because it is an improved form of the side-feed type and embodies greater utility than any other make or type.

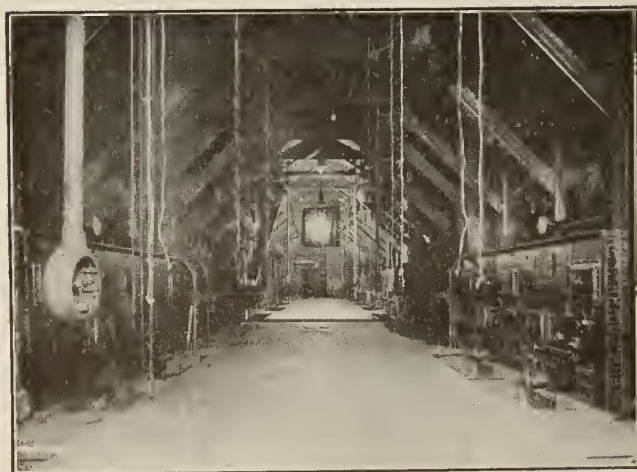
The devices for getting rid of the ash have been so designed and perfected that the furnace keeps the fire clean all the time.

There is therefore no "defect," as the clinker and other coarse refuse, as well as fine ash, are constantly and automatically discharged in the ash pit underneath the grate, and a clean, live fire is maintained at all times, even when low grade slack is used.

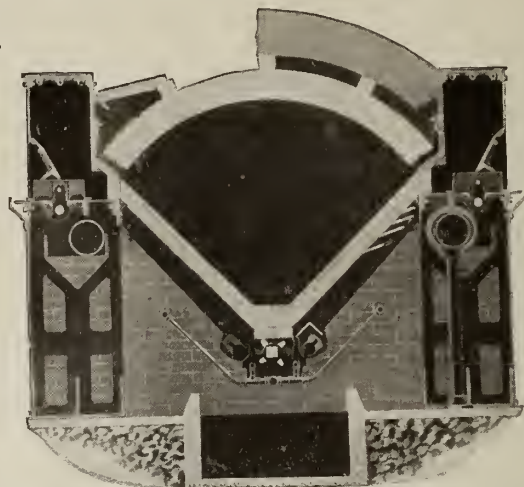
The Model Automatic is operated on natural draft and is not only superior in constant, efficient self-cleaning and smoke prevention, but is also designed to, and does, give effective protection. When repairs are necessary, renewal of any part can be made readily without disturbing other parts.

The principal parts of the furnace are not exposed to damage and will last a lifetime. The grates are in pairs, one piece of each being stationary and the other movable. They are set in, but not fastened, the upper end resting against the bed plate of the coal magazine and the lower end resting on the grate bearer, which, with the sectional clinker grinder, forms the longitudinal center of the grate surface.

Illustrations show the narrow surface of each grate that is exposed to the heat and the broad surface on which the air acts and cools as the air is drawn from the ash pit up between the grates into the fire bed.



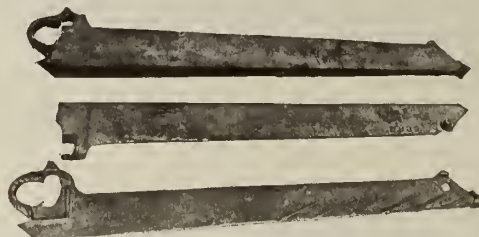
10,000 H.P. PLANT, WITH COAL AND ASH HANDLING MACHINERY



CROSS SECTION THROUGH MODEL AUTOMATIC FURNACE SHOWING SINGLE AND DOUBLE ARCH CONSTRUCTION

The coaling process is made the more effective by reason of the automatic cleaning keeping the air spaces always free of ash, clinker, and other choking refuse, thus avoiding sticking or sliding and maintaining an even fire bed. Each pair of grates can be renewed separately and each section of the bar that grinds up and discharges the clinker and coarse refuse can be renewed separately and, if necessary, without putting the furnace out of commission or seriously interfering with its operation.

That part of the magazine bed plate, against which the upper end of the grate bars rest and over which the coal is fed onto the grates, is covered with feed plate angles made in short sections held to place by a single bolt, so that renewal, if necessary, can be made quickly and only the section damaged need be disturbed. Air for combustion of the volatile gas is heated before it enters the fire chamber and so admitted as to avoid overheating of the fire arch, arch plates and other parts, and insures instantaneous, complete combustion.

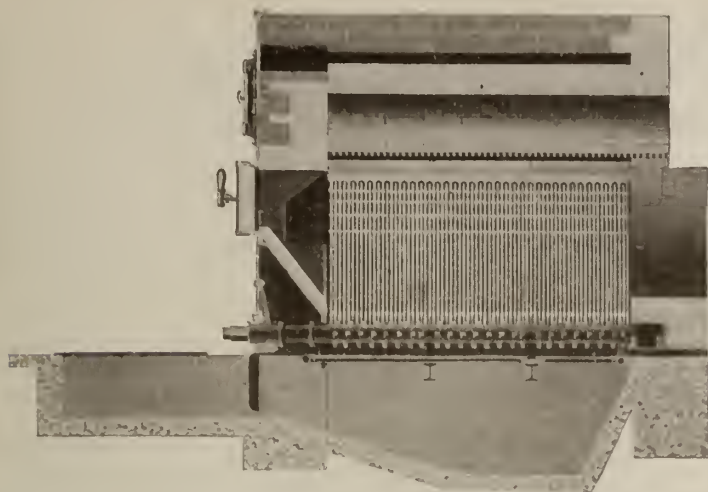


MOVABLE AND STATIONARY GRATE BARS
Separately and in pairs as they are set in the furnace

DRAFT—The Model Automatic furnace operates with either natural or induced draft.

The stronger the draft, the more coal can be burned per square foot of grate and the harder the boiler can be crowded. There are Model Automatic furnaces under stacks 175 ft. high with ample area where 500 h. p. boilers have been repeatedly crowded to 1500 h. p. for days at a time and maintained a clear stack, and there are no cinders to trouble the neighbors, as is ex-

Continued on next page



LONGITUDINAL SECTION THROUGH CENTER OF FURNACE

perienced with furnaces that are operated with forced draft.

AUTOMATIC REGULATION—A combination draft and fuel feed regulator can be applied, so that the rate of fuel feed, air supply and combustion correspond to the steam requirements.

ADAPTABILITY—The Model Automatic can successfully handle and burn with superior economy any known bituminous coal mined in this country or in any foreign fields, can be adapted to any make or form of boiler, and to almost any conditions of boiler room or fuel or duty requirements.

The stronger the Model Automatic furnace is crowded, the higher the temperature and the greater the volume of white heat, but no smoke, and this holds true whatever district coal is used.

No other mechanically operated furnace lends itself more advantageously to economic use of mechanical coal or ash handling. The clinker and other coarse refuse is broken up, so the ash is in suitable condition for any desirable method or system for ash handling.

REPAIRS—The construction and arrangement of the Model Automatic furnace provides for a maximum self-protection to all parts subject to damage by heat or wear, and there is therefore a minimum cost for maintenance. The fuel saving is sufficient to pay for the necessary repairs and also to give a large return on the cost of furnace.

This company does not sell furnaces to secure repair orders, but will furnish repair parts that are right, at a slight advance over cost of material and labor involved.

OPERATOR—A small steam engine or electric motor is furnished with each furnace, battery, or row of furnaces and fitted to a set of double worm gears, thus



GRATE BEARER AND CLINKER BAR WITH ONE SECTION REMOVED

giving ample power with use of little steam, and the exhaust is utilized in connection with our steam shower beneath the clinker bar and grates.

Mechanisms for operating both the stoking and cleaning arrangements are on the outside of the front, not exposed to the heat of the fire. Each part can be disconnected and connected up again without stopping engine or motor. Motion of clinker grinder can be varied to suit amount of refuse in the coal by simply pulling out a single pin and replacing it in desired position, to keep the fire clear of refuse and not waste combustible in the ash.

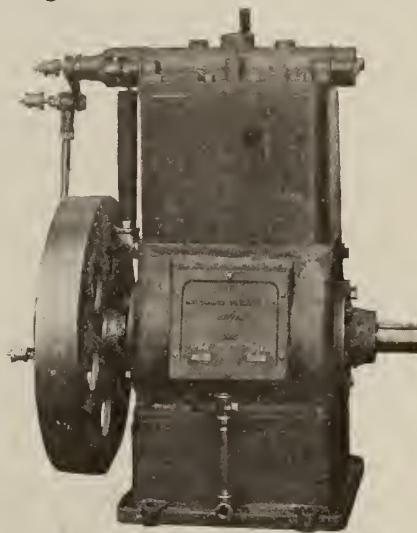
Coal can be supplied to coal magazines by hand with shovel or by gravity from above the magazines or through chutes from an overhead bin.

Chain Grate.

This company also manufactures the Model Chicago chain grate. It is of rugged, heavy construction and is designed to stand the trying service of boiler room equipment. Detailed description will be gladly sent on request.

Model Acme Steam Engine.

USES—There are now thousands of Acme engines in operation, driving mechanical stokers, generators, core drills, air compressors and similar units, and owing to their rugged construction, simple and durable design, they have no equal for such service, operating as they do with the minimum amount of attention.



MODEL ACME STEAM ENGINE

DESCRIPTION—Engine is of the single acting, two-cylinder type. Designed to operate under a steam pressure from 80 to 200 lbs. and a speed of 150 to 600 r. p. m. A pair of vertical cylinders are placed above an enclosed crank case which serves as a rigid foundation for the engine as well as a reservoir for the oil used in the automatic splash system of lubrication.

It is provided with generous sized ports for quick inlet and exhaust of steam. Valve is a one-piece casting ground to fit an accurately bored chamber, the latter piece also serving as a cylinder head. Automatic relief valves are provided in the top of the cylinder head to insure quick release of any water which may collect in the cylinders, thereby eliminating any chance of damage from this source.

Engines are equipped with either a flyball governor with speed ranger attachment, or with an automatic governor located in the flywheel. For some classes of work, one type of governor is more satisfactory than the other, but both are of the best design, workmanship and material.

All bearings of this engine are of ample size and are continuously lubricated by a positive splash system contained in the crank case.

ESTABLISHED 1900

THE JAMES A. BRADY FOUNDRY CO.

Stokers, Ash Conveyors, Flat Arches, Coal Scales and Heavy Castings
45th Street and Western Boulevard
CHICAGO, ILL.

Products.

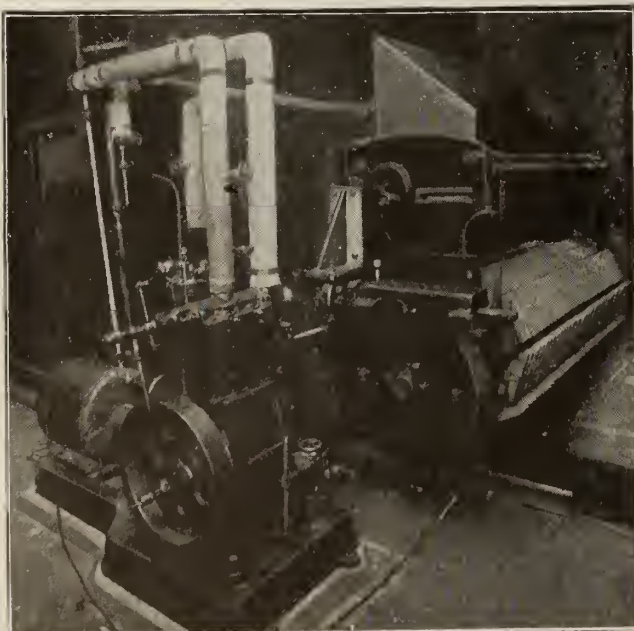
Manufacturers of TRAVELING GRATE STOKERS, STEAM JET ASH CONVEYORS, FLAT ARCHES, AUTOMATIC COAL SCALES, and HEAVY CASTINGS.

Traveling Grate Stoker.

The Harrington stoker constitutes an automatic mechanism designed for firing bituminous coal and lignite and more particularly coals containing high ash. It embodies an endless chain grate which carries coal into furnace in an even bed whose depth is regulated by height of the fuel gate at rear of the coal hopper. The coal bed is undisturbed during its entire consumption.

A series of small self-cleaning grate clips, placed over cast iron bars, make up the grate surface. Clips are arranged with an air space between them and are free from any strains whatsoever, thereby insuring their long life. If for any reason it is found necessary to replace a clip, the operation can be performed from the front of the stoker, in less than two minutes time. The fuel bed is carried on heavy semisteel driving links with rollers supported on tracks; therefore little power is consumed in its operation and all unevenness of grate surface is entirely eliminated.

For low grade fuels or high rates of combustion, forced draft is employed. The big feature in the Brady stoker is the special zone draft regulation which consists of an arrangement of four draft chambers located underneath the grate and transversely to it. Into these chambers forced or natural draft, in any relative proportions, or any pressure, is admitted by manually controlled means, from front of stoker. Complete regulation of drafts in one chamber is entirely independent of that in any other, giving the operator extreme flexibility of control of combustion on any portion of grate surface. Through this efficient method of operation, one man can



HARRINGTON TRAVELING GRATE STOKER INSTALLATION
With dual driving system—motor and engine

take care of as many as 10 stokers where the gravity overhead coal feed system is employed.

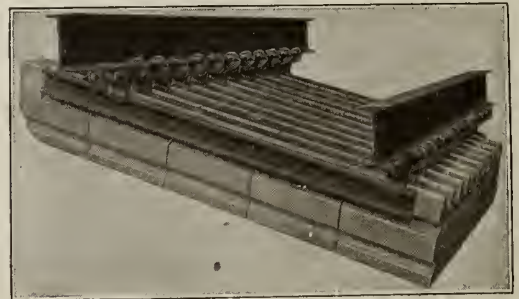
Steam Jet Ash Conveyor.

The Brady conveyor consists of a pipe line of extremely hard wear resisting pipe and specially designed fittings, cast from Brady metal—a special mixture of iron. Through this pipe line ashes are conveyed by suction of air at high velocity, created by steam jets located between ash intakes and point of discharge. Usually pipe line is carried out of doors to an elevated ash tank under which a car or wagon can haul off ashes expelled from swinging spout. Manufactured in the 8-in. diameter size only; capacities of from 1 to 8 tons per hour.

Flat Arches.

The Brady flat arch is used not only for ignition purposes in stoker settings but for furnace roofs of all kinds.

It is so constructed in any size that all side thrust is eliminated and therefore tighter settings are insured without the use of heavy buckstays.



BRADY FLAT ARCH, ASSEMBLED
Showing rows of tile, racks, etc.

Coal Scale.

The Reliance scale operates on a new principle which makes it possible, with a careful adjustment, to weigh coal continuously to within 1% of the actual weight, as long as the coal is delivered to it. Each scale is furnished with an automatic counter.

Heavy Castings.

THE JAMES A. BRADY FOUNDRY Co. also do a job casting business, with plant facilities capable of turning out 100 tons of iron or semisteel castings per day and single castings weighing up to 35 tons.

Co-operative Service.

THE JAMES A. BRADY FOUNDRY Co. maintain an engineering department which will furnish any information required, and submit drawings and proposals covering costs and guarantee of capacity. They will gladly call at any plant and suggest a layout.



RELiance AUTOMATIC COAL SCALE
Front view showing driving gears and operating shaft in dustproof case, and hopper bottom

CYCLONE GRATE-BAR COMPANY

BUFFALO, N. Y.

NEW ENGLAND AGENT: WALTER H. SULLIVAN, 707 Stevens Street, LOWELL, MASS.

WESTERN AGENT: M. H. DETRICK COMPANY, 549 West Washington Boulevard, CHICAGO, ILL.

Products.

GRATE BARS, SHAKING and DUMPING GRATES.

Description.

The bars are constructed on the clip and truss plan, having two trusses lengthwise; and the clips are bridged across these trusses, each clip forming a double brace with the trusses. No other design can give such a uniform strength to the entire bar. It has no weak spots to warp or buckle. The illustrations will explain clearly the general construction of the grates.

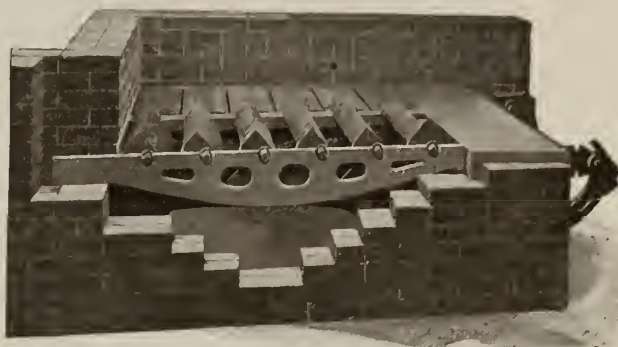
The trusses and clips are beveled from the top side to the underside as follows: The trusses on top side are $\frac{7}{8}$ in. tapering to $\frac{3}{8}$ in. at underside. The clips are $\frac{3}{8}$ in. at face (top) of the bar and beveled to $\frac{3}{16}$ in. at underside. The distance between the clips on the face of the bar is $\frac{3}{8}$ in. and on underside is $\frac{9}{16}$ in.

The bevel has three special advantages: First, all ash that passes through the face of the bar must drop directly through to the ash pit. Second, the openings being nearly twice as large at the underside as on the face side, it admits nearly double the volume of air than if the lines between the clips were parallel. Third, there is no friction on the air (draft) until it has reached the extreme top edge of the openings, or face of the bar, thus unbroken currents pass up through unobstructed air spaces, the result of which is too obvious to need explaining. This design is practically equal to a forced draft, as the large volume of air gathered through the larger air spaces at the underside of the grate can not escape except through the top side, at which point it is evenly distributed through the fuel. The bars rest in the frame on chilled axles, which are proof against wear.

The shaking device is strong, simple, and effective. The equalizing bar slides onto the trunnions of the arms, which run down from the ends of the bars, and are secured by cotter pins; while a wrought iron rod 1 in. in diameter connects the equalizing bar with the shaking and dumping arm on the front of the boiler. This arm locks into a lug which is secured to the front of the boiler by cap screws, and is fitted with a cast steel link which drops into a slot and locks the bars level.

The bars can be shaken as vigorously or gently as may be desired, according to the condition of the fire, having a motion of 4 ins. up and down without opening the spaces between the bars any farther than when the grate is locked level. No unburnt fuel can drop through it. The "filing movement" of the bars (owing to the fact that they set in the frame eccentrically) cuts the ash entirely off the bottom of the fire, making it possible to maintain the free circulation of air through the fire.

When it is desired to dump the residue of the fire, the shaking lever is pressed downward until the bars are thrown to such an angle that the entire contents of the firebox drop through between the openings, which are then about 4 ins. wide, into the ash pit. There are, of course, clinkers which, under certain conditions, no shaking grate can dump; but if the conditions of the firebox, bridge wall, combustion chamber, and grates are such as they should be, heavy clinkers may be avoided, for there is no other grate that will handle clinkers as effectively as the Cyclone.



CYCLONE GRATE BAR IN FIREBOX

Material.

It is a common fallacy that any kind of iron is good enough for grate bars, but the very opposite is the case. These grates are made from a mixture of iron which has been found from years of tests and experiments to be best suited for the purpose. We use this grade only. Grates are therefore of uniform quality, and many sets have shown no evidence of burning after 4 years of continual firing 24 hours a day.

It admits 68% of the available air.

It can not waste fuel when shaken, as the openings between the bars are no greater when shaken than when locked level.

When the bars are thrown to dumping position the residue of the fire drops directly into the ash pit, clear of all working parts of the grate.

Points of Superiority.

It locks level; can not get out of adjustment. Damage by accident or careless handling has been fully provided against.

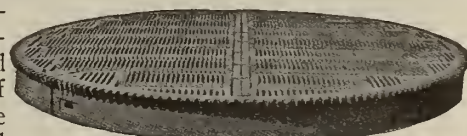
It will burn any kind of fuel; the bar furnished is best suited to the fuel which is cheapest, or most desirable, in any locality.

The bars are so braced and trussed that warping is a practical impossibility. There are no points or fingers to burn off.

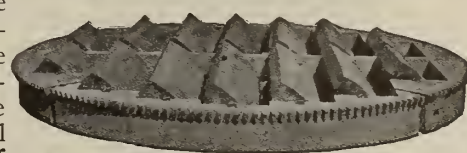
The filing movement, when shaken, cuts the ash off without disturbing the fire. Cleans ashes from unburnt fuel without waste.

Evaporation—more water per pound of coal. The heavy smoke is consumed, therefore more perfect combustion is obtained.

Every detail in the construction and equipment of the Cyclone shaking and dumping grate has been studied with the view of conserving the three essential features of simplicity, durability and economy of fuel.



CYCLONE ROUND GRATE



CYCLONE ROUND GRATE BAR IN A DUMPING POSITION

KELLY FOUNDRY & MACHINE CO.

Manufacturers of Furnace Grates, Boiler Fronts and Power Plant Equipment
GOSHEN, IND.

Products.

ROCKING, DUMPING and STATIONARY FURNACE GRATES; BOILER FRONTS and ACCESSORIES.

Also, Cast Iron Power Plant Equipment.



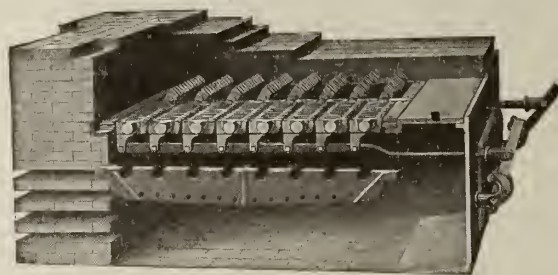
TRADE-MARK

SUPERIOR FEATURES—The Kelly idea is to make the grates fit the conditions under which they are to work, and the utmost in fuel economy is attained by making the grates with air opening best suited to the fuel used.

The ventilated center bearing bar is a feature not possessed by other grates. The air enters from either side below the grate surface, and passes through the openings on the surface. These openings are shown in plate No. 18.

A steady, even fire can be maintained by rocking the grates and keeping the air space open. Grates have a flat surface, and therefore operate with greater effect in disturbing and breaking up the fuel bed. Grates can be cleaned by shifting the fire and dumping one section at a time.

No fingers to burn off; will burn any kind of fuel, and burn it up clean; need no alterations in a regular furnace to install. Actual tests have proved that they will save from 5% to 25% in fuel.

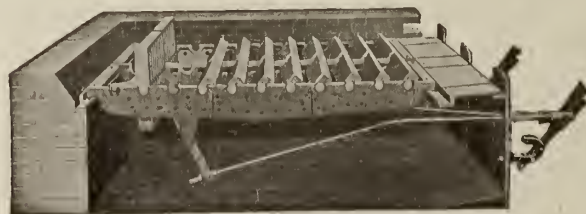


STYLE A. PLATE NO. 16

Side bearing bar removed, giving a clear view of simple mechanical arrangement for rocking and dumping. Each section operated independently.

Rocking and Dumping Grates (Style B).

In this style the large dumping grate, at the rear of the furnace, operates independently in disposing of the residue of combustion at the rear of the furnace, where it accumulates next to the bridge wall.



STYLE B. PLATE NO. 22

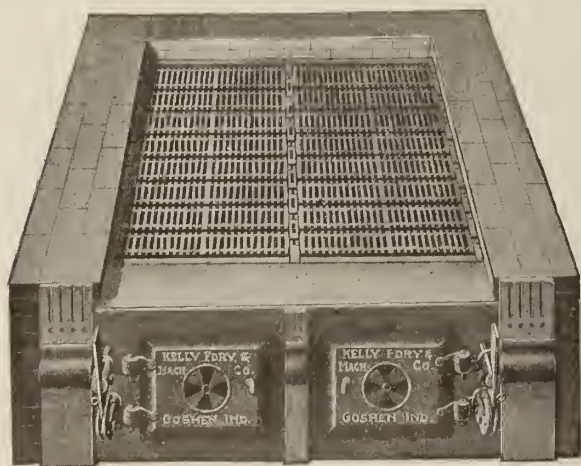
Full dumping position with 18-in. rear dump

Rocking and Dumping Grates (Style A).

CONSTRUCTION—The Kelly grates offer least resistance to the passage of air, and at the same time support the fuel; movable, for the sifting of ashes and dumping of clinkers, and operated easily and effectively; free from cumbersome or complicated parts and attachments, and adaptable to the various fuels and furnace conditions.

Material used has the greatest heat resisting qualities. Grates are made in uniform pattern, will expand and contract evenly, and are not liable to warp. Entire framework is held together by pins, connecting the ends of the side and center bearing bars with the ends of the tie bars.

INSTALLATION—The Kelly grates may be installed where any ordinary stationary grate has been used, without changing supports; sets on regular standard front and rear angle grate rests. Drilling required in boiler front for shaking attachment is 1-in. holes.



STYLE A. PLATE NO. 18

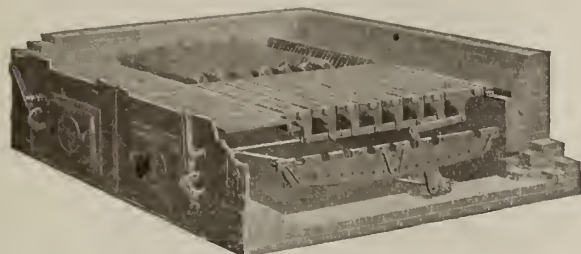
Standard installation

OPERATION—The rocking motion is confined to a certain limit, by a simple locking device, eliminating the possibility of wasting fuel or dumping the grates in the rocking operation; by releasing the lock pin, the grates may be dumped and thoroughly cleaned without opening the fire doors.



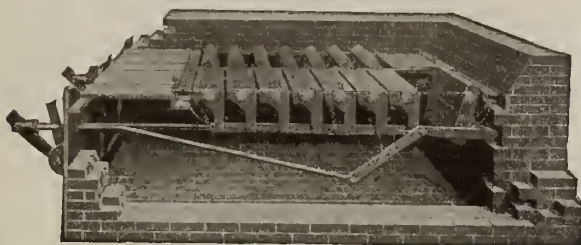
STYLE B. PLATE NO. 23

Rocking motion with rear dump grates locked in level position. With use of lock pin in shaker stand each section of grate can be locked in level position. 18-in. rear dump



STYLE B. PLATE NO. 15

Grate surface 5 ft. long by 5 ft. wide. One side bearing bar removed from normal position to give view of mechanical arrangement of rocking and dumping operation. The shaking attachment is made at right- and left-hand sides. Each section requires two levers to operate



STYLE B. PLATE NO. 13

Front sections of grate surface are operated independently from double capacity rear dumping grates, giving fireman every advantage for perfect control of fires. The dumping operation is accomplished by removing lock pin from shaker stand. 12-in. rear dump

Sizes, Styles A and B.

Standard sizes run in even feet and half feet in both width and depth, and are carried in stock. Grates are furnished for any size area and any number of sections wide on receipt of order, at no extra price per square foot.

"Kelly Improved" Grates, Stationary.

The air opening is continuous from one side of the furnace to the other, admitting 10% more air than any other grate. No dead surface. An equal volume of air to every square inch of the surface.



THE "KELLY IMPROVED" GRATE

Standard width 6 ins., any length. Air openings $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$ in.

SWEET'S CATALOGUE

The side, or support bar, does not come to the fire surface, but is 1 in. below it. This allows a draft circulation above the side bar, which keeps it cool and protects the strength of grate from the direct action of the heat, therefore it can not sag nor warp.



SECTION "KELLY IMPROVED" GRATE

Boiler Fronts and Trimmings.

Design, style and sizes of the Kelly boiler fronts and trimmings have been established for years and conform to the average power plant equipment. Many patterns have accumulated and special work can be furnished on short notice. Pattern and machine shops are well equipped to handle work from blue print or sketch.

Complete setting consists of front proper, fitted with flue, fire and ash doors, baffle plates fitted to fire doors, dead plate and liners, rear grate rest and grates, rear arch rest and arch bars, buckstays and diamond washers, soot door and frame, breeching frame and damper. Front accurately fitted and lettered.

STYLES AND SIZES—Ten different regular styles: Full arch and half arch fronts; Dutch oven fronts; smoke extension fronts; full and half creamery fronts.

Sizes: 30-in. to 84-in.



STANDARD NO. 1 BOILER FRONT

Catalogues.

Foundry catalogue is "G."

Grate catalogue is "C."

MARION FOUNDRY CORPORATION

Manufacturers of Shaking Grates

Marion National Bank Building
MARION, IND.

Product.

The CLEAR-CUT SHAKING GRATE.

Description.

The Clear-cut grate has four positions :

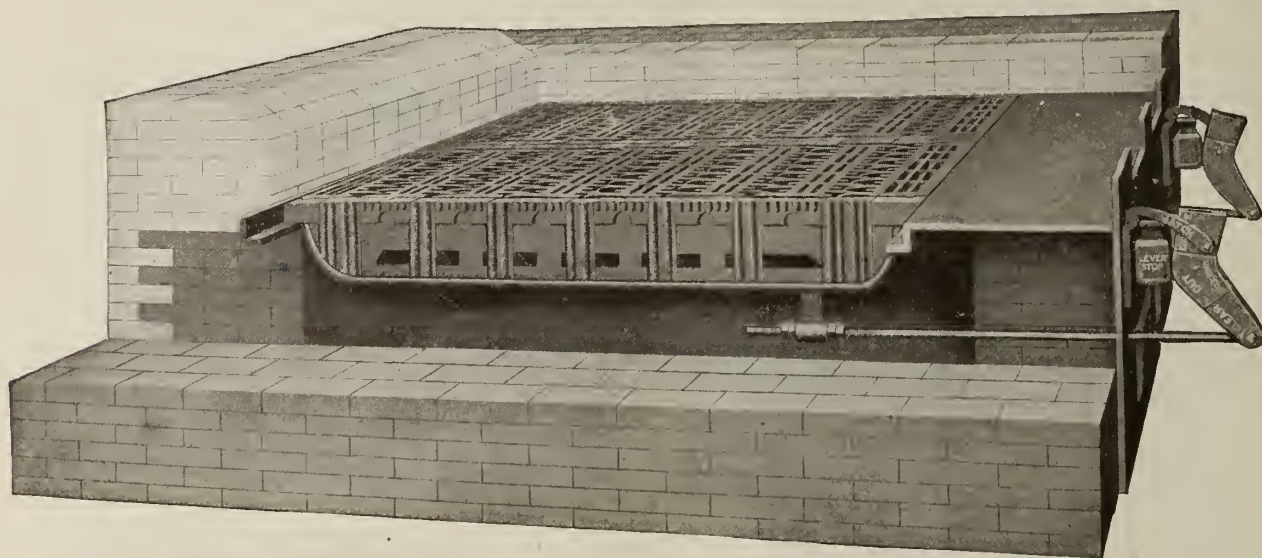
Level.

Ash sifting.

Semi-dumping or medium dumping.

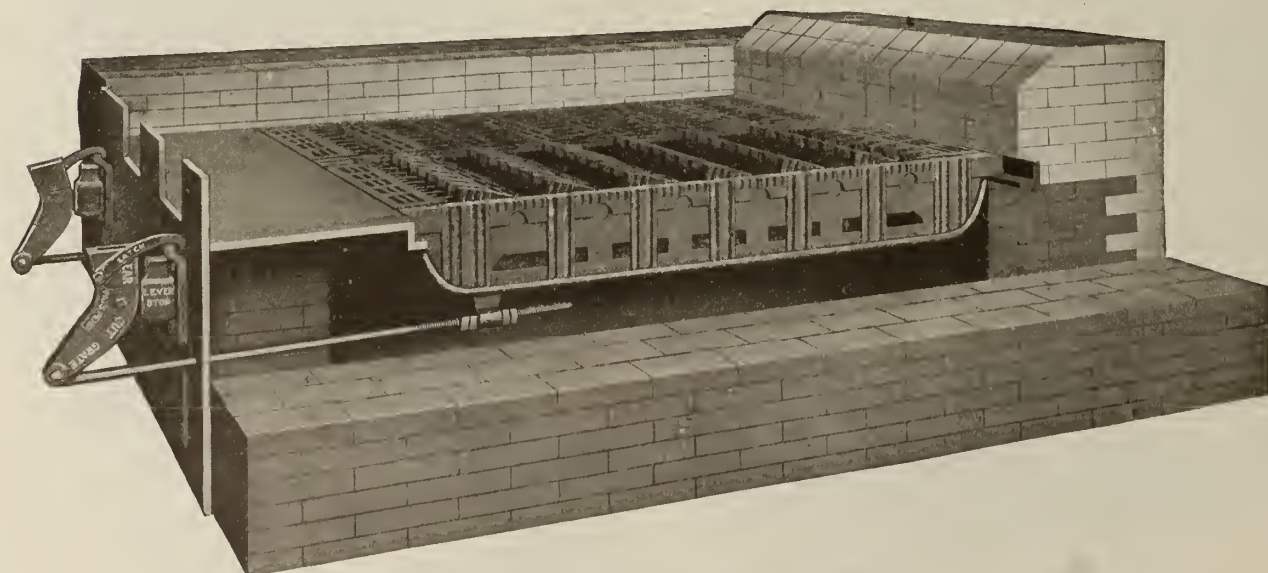
Full dumping.

The illustrations herewith show these four positions.



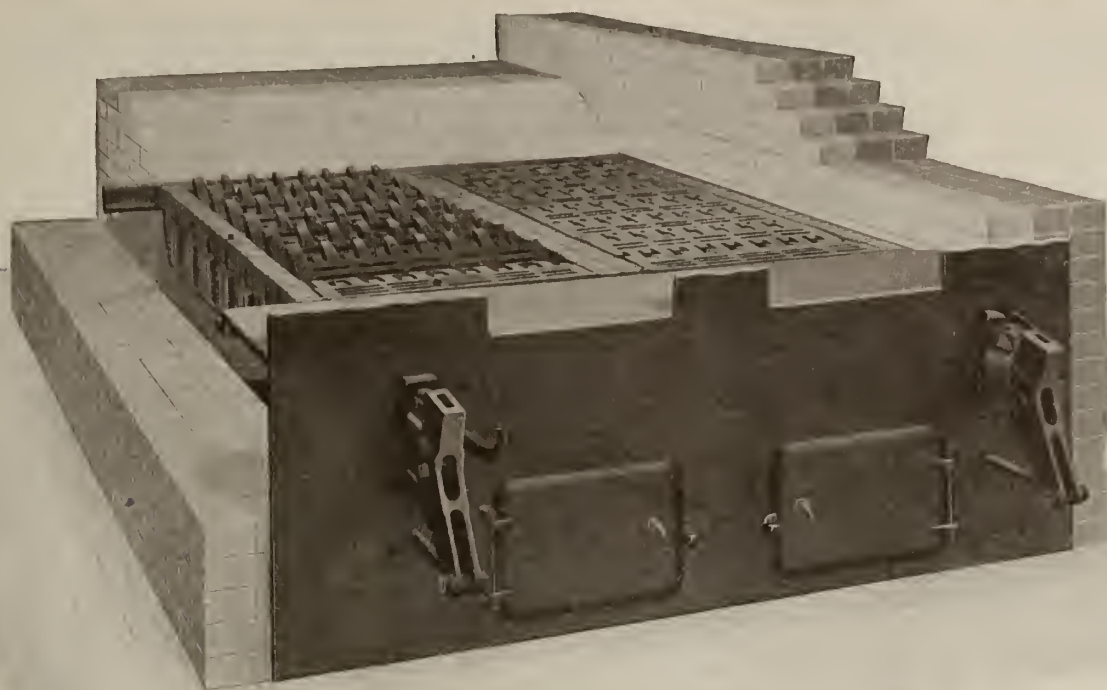
TWO-SECTION GRATE IN LEVEL POSITION

Grates are held level by the latch



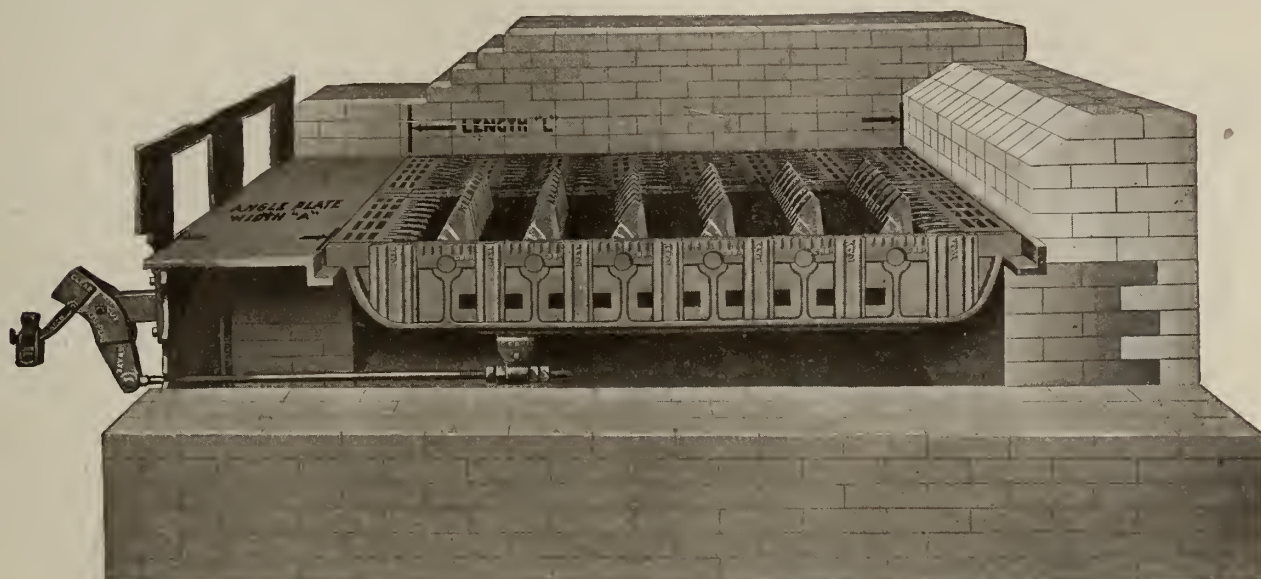
TWO-SECTION GRATE IN ASH SIFTING POSITION

Without throwing the latch the grates can rock forward and back to level without appreciable widening of the air openings



TWO-SECTION GRATE IN SEMI-DUMPING OR MEDIUM DUMPING POSITION

Latch is thrown back when this action is used. There is a 2-in. dumping clearance along the full length of the rocking bars. Clinkers too large to fall through this 2-in. opening may slide into the valleys between bars and are then cut up and pushed through by the knife edge fingers of the rocking grates. Locked shafts help to make this crushing action possible



TWO-SECTION GRATE IN FULL DUMPING POSITION

Lever stop is removed from fulcrum post to obtain this full dumping action, which gives a 5-in. dumping clearance along the full length of the rocking bars

MARION MACHINE, FOUNDRY & SUPPLY CO.

Manufacturers of Boiler Room Specialties

P. O. Box 995
MARION, IND.

BRANCHES

TULSA, OKLA.
DRUMRIGHT, OKLA.
NOWATA, OKLA.

WIRT, OKLA.
ELDORADO, KANS.
WILSON, OKLA.

BURKBURNETT, TEX.
FORT WORTH, TEX.
GORMAN, TEX.

SCOTTTDALE, PA.
RANGER, TEX.
PAOLA, KANS.

Products.

MARION HAND FIRED STOKERS; MARION INTERLOCKING GRATES; MARION SCOTTTDALE GRATES; KEYSTONE NON-INTERLOCKING ROCKING GRATES; MARION NON-INTERLOCKING ROCKER GRATES; MARION SOOT BLOWERS; SCOTTTDALE CRUSHERS.

Marion Bagasse Grates, Power Plant Specialties, Coal and Coke Handling Machinery, and Oil Well Machinery.

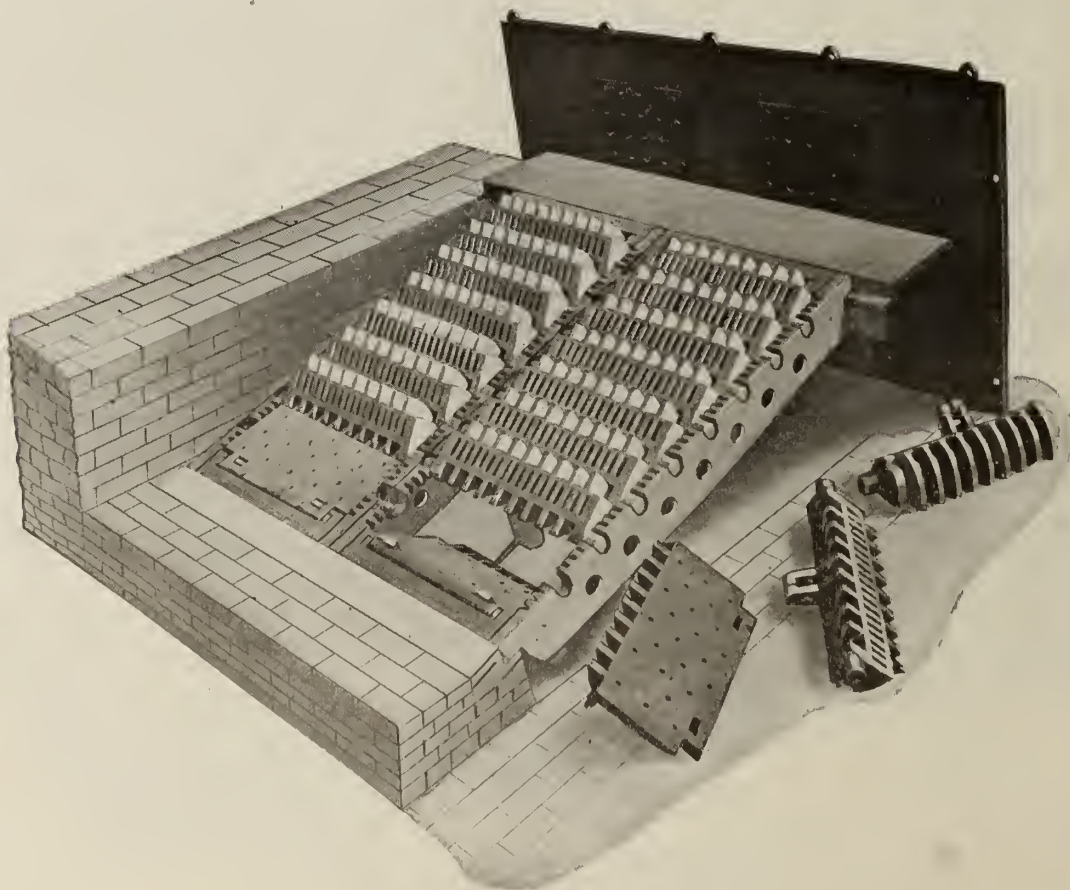
Introduction.

Inefficiency in a steam plant is very often attributed to the kind and grade of coal used, when upon investigation and tests it is found that improper method of firing is the direct cause. Frequently but little attention is paid to what actually takes place within the fire

box. In burning bituminous coal, great care is necessary if good results are to be obtained.

Composition of Coal.

ANALYSIS—The principal components are fixed carbon, volatile matter, sulphur, ash and moisture. The volatile matter is the gases and vapors that are liberated from the fresh coal, consisting of hydrogen and hydrocarbons and is the part which causes the most difficulty in securing perfect combustion. The hydrogen and lighter hydrocarbons burn off almost immediately if given sufficient oxygen. The tars and heavy gases are slow burning and require a longer time; therefore a longer combustion chamber must be provided so that combustion will be complete by the time the tubes are reached. After the volatile matter has been driven off,



MARION HAND FIRED STOKER

the fixed carbon remains which burns without flame and will vary from a red color at about 800° Fahr. to a white heat, depending upon the rate of combustion.

The principal elements of combustion are hydrogen and carbon from the fuel and oxygen from the air. If burned with sufficient air the carbon forms carbon dioxide (CO_2), and if insufficient air is furnished, carbon monoxide (CO) is formed, which is a combustible gas. As the hydrogen burns, it combines with the combustion agent oxygen and forms water.

When combustion is thorough, the CO_2 formed should be about 14% of the flue gas, and this indicates that there is little CO , or combustible gas, escaping up the stack.

ENERGY OF COAL—There is enough energy in 1 lb. of coal if it could be utilized, to lift a 200-ton locomotive 54 ft. high, or 1 ton over a mile high. A lump of coal as large as an average apple, if all converted into useful energy, will drive a 3000-ton ship 1 mile through the water.

The average modern power plant of 1,000 to 2,000 h. p. loses 26% of all of the heat of the coal in the hot chimney gases; only 3% is being actually used in manufacturing.

Marion Hand Fired Stokers.

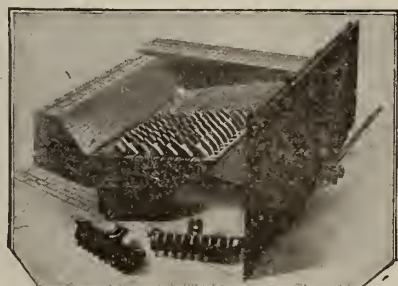
No one type of grate and no one method of firing will successfully burn all kinds of coal under all conditions, and consequently the grates used and the method of firing must be adapted to the kind of coal, the type of furnace and the load condition.

There are three methods of hand firing, viz.—coking, spreading and alternate and of all these the coking method is the most economical for bituminous coal. In this method the coal is placed at the front of the grates, where the volatile gases are distilled off gradually and the fuel then worked backward until the fixed carbon is finally burned by the time the fuel has reached the back end of the grates.

It may be seen that as the volatile gases are burned off, the remaining fuel as it approaches the back part of the grate is practically coke, and thus the name coking. By this method the heat units ordinarily obtained from the use of coke would be utilized, plus all the heat obtained from the burning volatile gases not found in coke due to their being burned off in the coke ovens.

All ash and clinker remaining are removed at intervals by dropping into the ash pit. This method requires a special grate or stoker.

The Marion hand stoker is designed to burn bituminous coal containing a high percentage of heavy, slow burning, volatile matter, which distills rapidly at low furnace temperature. The peculiar method of stoking will keep a clean, uniform, practically smokeless fire.



MARION HAND FIRED STOKER

OPERATION—The grates are stoked until the first coal introduced has worked clear back on the grates.

Then fresh coal is thrown on the coking plate at the front of the grate. The volatile matter is distilled off and passes over the fire where it mixes with the hot air and burns completely before reaching the tubes.

The firing door should be opened slightly for a brief period after firing, to furnish more oxygen for the burning gases. The long interlocking teeth of each grate bar extend back of the axis of rotation of the preceding bar so that the forward movement causes each rocking unit to take fuel from the preceding unit and carry the fuel forward to the following bar, giving a positive continuous forward movement to the fuel. The shape of the teeth is such that in all positions of stoking there is a uniform opening between the teeth, thus conserving fuel, and the design of the grate bars is such that they will not warp or get out of shape.

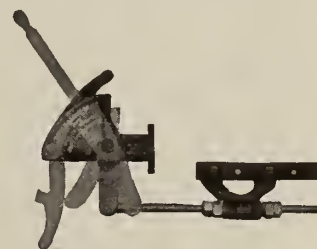
Marion Interlocking Grates.

A smooth, even surface is obtained when the Marion interlocking grate is at rest. When in operation, the bed of clinker and ash is effectually broken up by the rocking, fore and aft, of the projecting interlocking fingers, which serve to keep air spaces open, so no large clinkers can form or stick fast to grate bars.

With each successive upward tilt of the rockers, clinker and ash is thus stirred up and slides down into openings and is crushed through with the return movement of the grate.

The centering and locking device makes it impossible to unlock operating handle from socket until grates are brought to a dead level, when handle can be removed with ease. This device removes all objections to an interlocking grate, for there is no danger of burning the projecting fingers if handle is always removed.

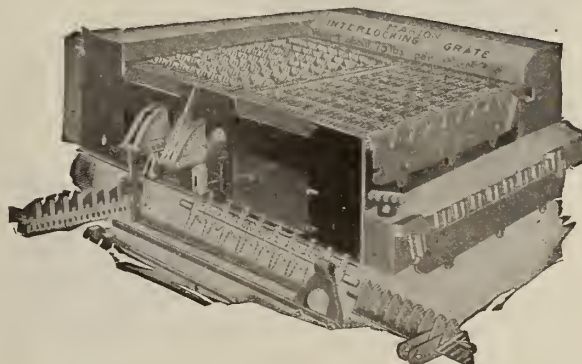
Practically all the power applied to the operating lever is exercised in breaking the clinker. The leverage is about 30 to 1.



LEVELING DEVICE AND SAFETY LOCK



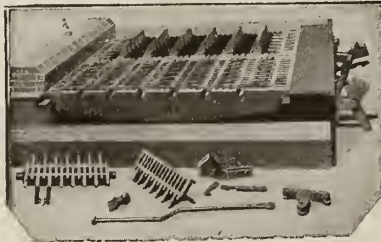
GRATE BAR



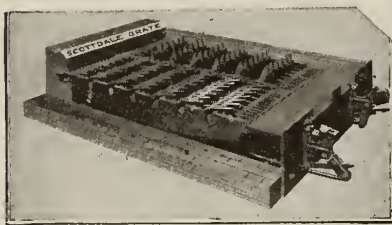
MARION INTERLOCKING GRATE
Weight, about 75 lbs. per sq. ft.

Marion Scottdale Grates.

With the Marion Scottdale grate, the fireman can brighten up the fire and sift out the ash, by lifting the top latch of fulcrum bracket and rocking the grates through a limited arc without increasing any opening of grate. He can remove the clinker by lifting the latch attached to bottom of fulcrum bracket and allowing grates to open up as necessary.



Two-section, Showing Various Parts



One Section in Ash Shifting Position, and the Other Section in Clinker Dumping Position

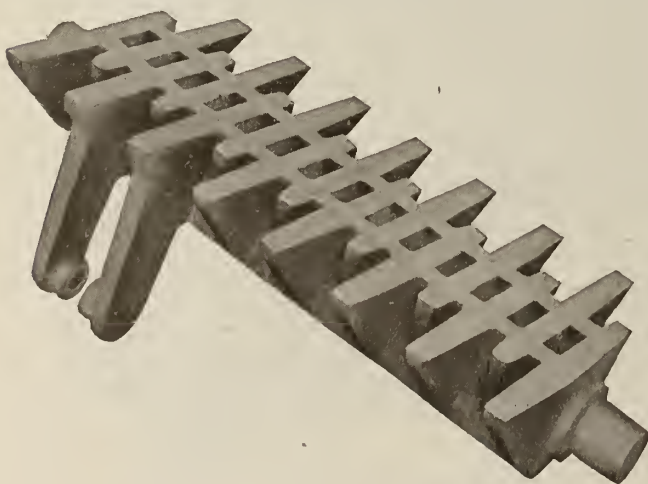
MARION SCOTSDALE GRATE

SPREADING METHOD OF FIRING—With the use of this method, the whole fuel bed has to be covered with fresh fuel at each firing, and made perfectly level.

The key to successful firing by this method is to fire thin and often, avoiding piling fresh coal on high places. In this way the flame soon cuts through the fresh fuel, and there is no coking.

If all fine ash is removed by shaking the grates slightly, large lumps of coal broken up, the ash pit kept clean, and care exercised in firing thin and often, there will be less smoke and a cleaner fire maintained. A little water in ash pit will make the clinker porous. No hooks or slice bars should be used.

MARION SCOTSDALE BAR—The design is such as to give the highest percentage of air space without sacrificing strength of individual fingers. The double rib



UNDERSIDE OF MARION SCOTSDALE BAR
Furnished in $\frac{3}{8}$ -, $\frac{1}{2}$ -, $\frac{5}{8}$ - and $\frac{3}{4}$ -in. meshes

construction is very strong, and can not warp. This design makes possible the use of deep fingers in proportion to their short length.

Keystone Non-interlocking Rocking Grates.

The efficiency of furnace and capacity of boiler will be increased greatly by the proper use and care of rocking grates. A much greater load can thus be carried, and a much easier job afforded for the fireman.

The Keystone grates are made in two styles—the Rocking, and the Rocking and Dumping. Both are of the non-interlocking type. It is not necessary to operate the grates very vigorously or very often to remove the ash and keep a clean fire. The fire should not be stirred with a slice bar or hook, as this makes a clinker.

Marion Non-interlocking Rocker Grates.

Coals that form a large, soft clinker need a dumping grate. Grates that must give an extremely high rate of combustion need to have a large percentage of air opening and be able to keep an absolutely clean surface free from ash and clinker and to remove same easily.

The Marion rocker grate is both serviceable and substantial, built with much more attention to detail than is ordinarily found in grates of this type. Latch locking device insures a level grate when not in operation. Can be fitted to any boiler setting without disturbing furnace brickwork. Steel trunnions are used.

The same arrangement for preventing dislocation of any rocking bar is used in this grate as in the Marion Scottdale grate. Each pair of frames consists of one with removable bearings and the other having bearings cast solid with frame.

Marion Soot Blowers for Water Tube Boilers.

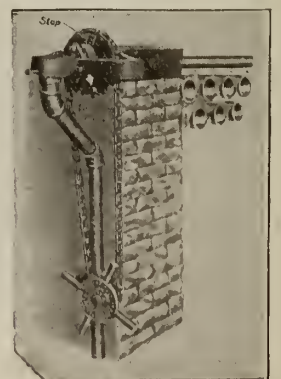
MARION ROTARY SOOT BLOWERS—The Marion rotary soot blower is a single jet type blower and delivers a small volume of steam at high velocity through the flues, driving out all loose ash and soot.

The steam nozzle contains a number of steam ports having different angles. These ports are opened one at a time. The whole nozzle is rotated upon its axis, which allows each port to successively direct a steam jet against a fixed section of the flue area. The nozzle is made of a special mixture of cast iron which stands the high temperature.



MARION ROTARY SOOT BLOWER

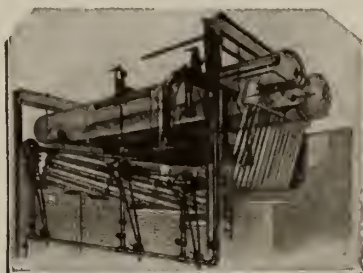
MARION PLANET SOOT BLOWERS—They are designed for all types of water tube boilers, including vertical, horizontal and marine. These blowers have the internally welded nozzle, which forms an integral part of the blowing element. The nozzles are so spaced as to clean the entire tube surface. The blowers are operated by a special hand wheel control, which gives the blowers a steady rotating movement.



PLANET BLOWER

They can be used at all times, regardless of load conditions.

No piece of equipment will save so much coal as a good system for keeping the boiler tubes clean. An efficient soot blower will often save as much coal as the feed water heater. One is as indispensable as the other in the up-to-date plant. To obtain the maximum efficiency from any boiler, the flues should be blown free of



MARION PLANET SYSTEM WITH
WATER TUBE BOILER AND
SUPERHEATER

soot every few hours. When the soot and ash first collect on the tubes, it is loose and fluffy and very easily removed by a blast of steam. However, if allowed to remain for a comparatively long time, the heat will fuse it into a hard clinker which is stuck to the tubes and can be removed only by means of a tool. It is possible to save from 5% to 10% by keeping the soot removed from the tubes, which will pay for the equipment in a very short time. Soot and fine ashes are practically equal to asbestos, as far as heat insulation is concerned.

The body of the Marion Planet steam soot blower is a large, substantial casting through which the distributor passes. This body is placed in the brick wall and thoroughly anchored.

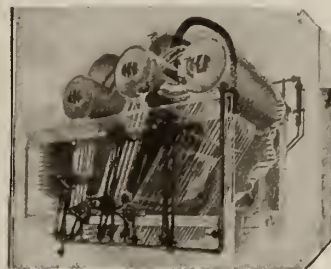
The yoke, which is fastened to the body, holds the steam connections in position and keeps them in alignment with the distributor.

The large sprocket contains the stuffing box and is screwed to the outside end of the distributor, making a rigid unit.

The turned nipple is well packed in the stuffing box, making the whole thoroughly steamtight.

OPERATION—The mechanical soot blower is a permanent installation and each unit cleans a certain section of the tubes. These blowers are so placed that the tubes are thoroughly cleaned in each pass; enough units are used on the boiler to thoroughly clean all the tubes and headers. If the boiler has a superheater, a unit will be so placed as to clean this also.

The jets of steam blow the soot off the tubes, part



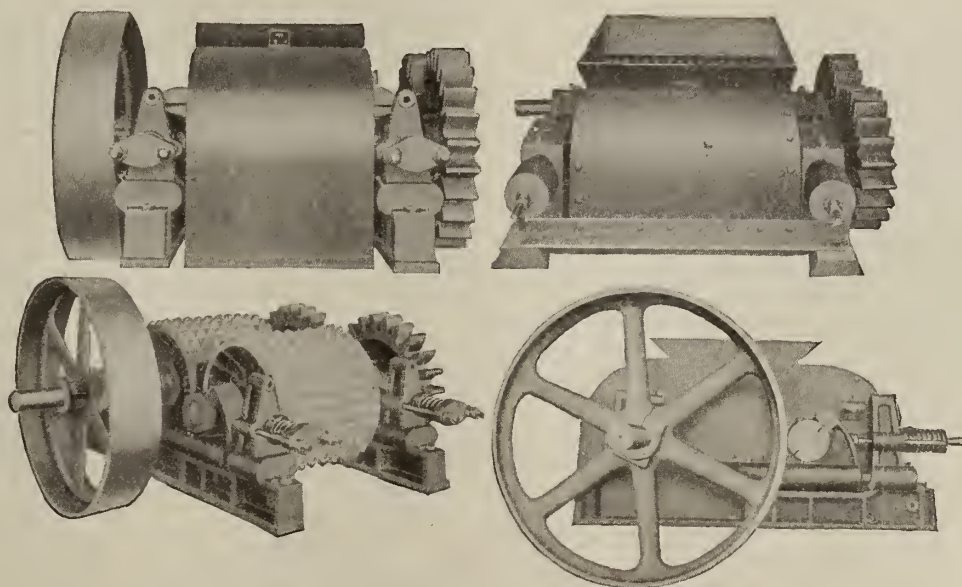
MARION PLANET SOOT
BLOWER APPLIED TO
STIRLING BOILER

of it passing out with the flue gases and the heavier matter settling in the combustion chamber, from which it can be removed from time to time.

Scottdale Crushers.

Scottdale crushers are made in sizes to crush bituminous, semi-anthracite and bone coals and give a product from $\frac{3}{4}$ to $4\frac{1}{2}$ in. To accomplish this, adjustment for various sizes of product, one roll is made floating or adjustable and is driven by special long-tooth gears, to insure proper meshing of teeth when roll is set for fine or coarse crushing.

The rolls are made of white iron with deep, chilled face and teeth, and are mounted on large steel shafts, key seated to fit closely over feather key in shaft. The hubs of the outside sections of the rolls bear against the end bearings and hold the sections in place on the shaft. All rolls are carefully designed with a high factor of safety and are fully guaranteed for material and workmanship.



VARIOUS VIEWS OF CLASS 6 SCOTSDALE CRUSHER

FILES ENGINEERING COMPANY, INC.

Manufacturers of Files Stokers

PROVIDENCE, R. I.

SALES OFFICES AT ALL IMPORTANT CENTERS

Product.

FILES HAND STOKER (Patented April 29, 1919).

Structure.

The Files hand stoker is a device constructed strictly upon the principle of correct metal distribution. The side and center bearing bars that support the stoker are perforated and channelled, which insures perfect circulation of air around them, even when against side walls. Rapid radiation keeps the bars from warping. The heavy head of the cleaning plate swings up in toward the bridge wall, crushing, as between two jaws, every particle of clinker thereon and dumping all refuse into the ash pit.

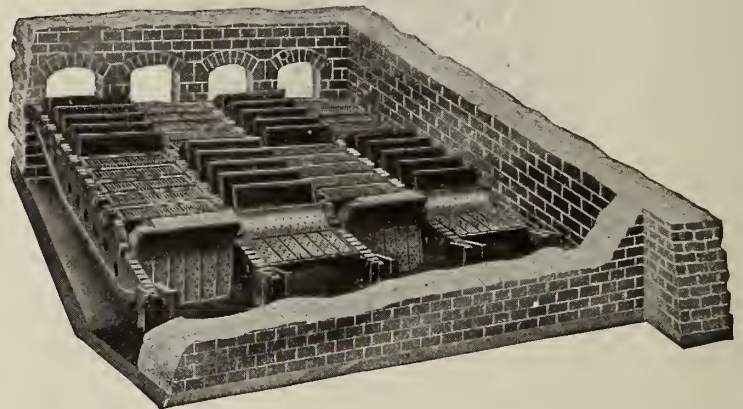
When the plant conditions warrant it a mechanical coal feed may be installed, making a saving of labor equivalent to mechanical stokers.

Function.

Fresh coal fed periodically to the front of furnace just inside doors is subjected to a coking action; the volatile gases distilled by this action are consumed in their passage over the incandescent fuel bed. The fuel, freed of these gases, is then carried gradually forward toward dump plates by action of hand operated stoking bars, giving up in its passage down the inclined grate all of its heat value. The last remaining heat value is extracted on the dump plates. The result is perfect combustion; no carbon in ashes; no loss in chimney, in furnace or in ash pit.

Adaptability.

Most furnaces are equipped to burn only a good, high grade coal, that may be either of the anthracite or of the bituminous variety; but they can not burn both. On the other hand, poor grades of coal can not be burned at all unless the fuel bed gets constant stoking attention such as can not be given with ordinary hand



FURNACE VIEW OF A FILES HAND STOKER

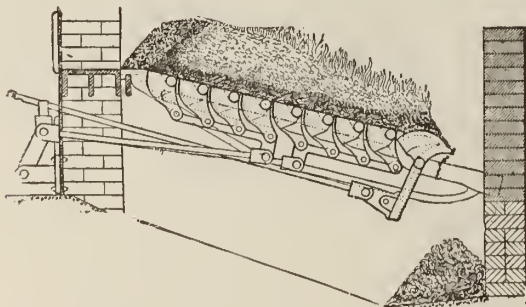
firing methods. The Files hand stoker, however, by virtue of its construction, provides an equipment for the furnace that will successfully and efficiently burn all grades of anthracite, slack and bituminous. In a comparatively short time the proper removable grate sections can be substituted, and thus be independent of zone restrictions.

Advantages.

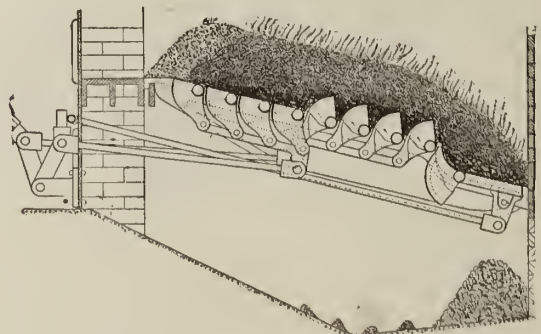
When a Files hand stoker is used, there is no need for opening the furnace door every few minutes to poke, slice, or rake the fires to keep them clean. This is done by pulling a hand lever in front of the furnace, which causes a section of stoker bars to cut up into the fuel bed 6 in. at a stroke, grind out the ash, pull over fresh fuel and carry any clinker down to the cleaning plate. Air is uniformly distributed. A maximum amount of water is thus evaporated for every pound of fuel used.

Co-operative Service.

This company will be pleased to furnish, to those interested, complete and detailed information as to how Files hand stoker can be installed to the best advantage.



CLEANING OPERATION SHOWING DUMP GRATE OPEN



FIRST STOKING OPERATION, COVERING DUMP GRATE

ESTABLISHED 1878

MURPHY IRON WORKS

Manufacturers of Automatic Stokers

DETROIT, MICH.

Product.

MURPHY AUTOMATIC STOKER.

Description.

Forty-two years of fuel and power conserving service in hundreds of power plants have demonstrated the correctness of the principles upon which the construction of the Murphy automatic stoker is based.

Improvements have been made, which have increased its efficiency and durability; and today it stands, we believe, as the one automatic stoker which most completely fulfills the requirements of the modern boiler room.

At either side of stoker extending from front to rear is the coal magazine, into which coal may be introduced either by hand or mechanically. At bottom of this magazine is the coking plate, against which the inclined grates rest at their upper ends. Stoker boxes, operated by segment gear shafts and racks, push coal over coking plate and onto grates. Grates are made in pairs, one fixed and the other movable. Stationary grates at their lower ends rest on grate bearer, which also acts as a support for clinker grinder. Clinker grinder consists of a steel shaft, on which is slipped cast iron toothed segments, which are readily replaced in case of breakage.

Over the coking plate is the arch plate, from which a fire brick arch is sprung over entire stoker. On this arch plate are cast numerous ribs to form a series of air ducts immediately over the coking plate, conveying heated air from chamber above arch into combustion chamber. This arch plate also forms wall of magazine.

Stoker, or battery of stokers, can be operated by a small automatic engine, motor or by overhead shaft and ratchet drive. Arrangement is made for exhaust steam connections at lower end of grates for protection of this portion of grates and clinker grinders and for softening of clinker.

In connection with horizontal tubular boilers or water tube boilers horizontally baffled, the Murphy stoker can be installed with a flush front setting.

Adaptability.

Stoker is adaptable to any type of boiler, and to units of any size—50 h. p. and up.

Automatic.

It is automatic in all its functions. Handles economically all grades of bituminous coal, feeds and distributes it, and removes all ash and refuse.

Combustion.

The stoker feeds the coal, without opening fire doors, thus preventing admission of cold air with consequent lowering of stoker temperatures.

Efficiently handles variable loads and overloads up to 200% rating with minimum attention and without forced draft.

Practically Smokeless.

The large coking area of the Murphy stoker drives off all volatile gases and insures perfect coking of coal before the ordinary processes of combustion begin. A proper mixture of these gases with air (both at high

temperature) in the highly heated combustion chamber completely consumes them and practically eliminates smoke.

Wide Usefulness.

Its usefulness is not limited to the economical generation of steam; for it gives excellent results in all operations requiring high temperatures, such as brick drying, cement burning, salt evaporation, calcining of soda ash, heating furnaces, etc.

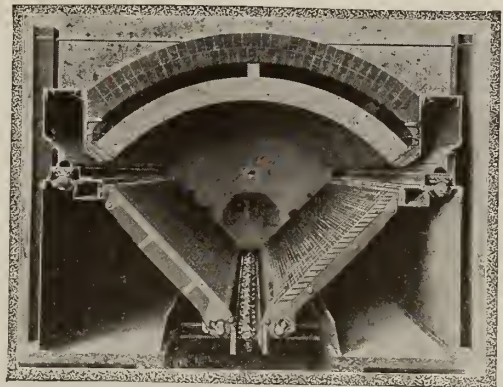
Maintenance and Operation.

Maintenance cost is low, averaging about 10¢ per horsepower per year.



MURPHY AUTOMATIC STOKER
Dutch oven setting

Operates with natural draft. Cost of actuation is less than 1% of total steam generated. Also effects greatest possible saving in labor.



MURPHY AUTOMATIC STOKER
Rear view

Designed to Meet Requirements.

Before making installation, this company thoroughly familiarizes itself with exact conditions under which the Murphy stoker is to be operated, and designs the stoker to meet the requirements.

An engineer will be sent to make an examination of any plant before submitting proposition.

Write for illustrated catalogue.

SANFORD RILEY STOKER CO.

WORCESTER, MASS.

BRANCH OFFICES

BOSTON

NEW YORK
CINCINNATI

PHILADELPHIA
DETROIT

PITTSBURGH
CHICAGO

BUFFALO
ST. PAUL

CLEVELAND
DENVER

Product.

The RILEY SELF-DUMPING UNDERFEED STOKER.

Adaptability.

Applied to any boiler, either water tube or fire tube; the Riley stoker is also adapted for heating and smelting furnaces.

Construction.

Stoker is of the inclined underfeed type; that is, the coal is forced up from beneath the point where air is admitted, and then is worked along toward bridge wall.

Instead of stationary dead plates, it has moving air supplying grates carried by reciprocating sides of retorts. These retort sides also move the overfeed grates which extend across the entire width of the stoker below the retorts. Beyond these are the rocker dump plates which continuously agitate, crush and discharge the ash. Motion of these reciprocating parts is adjustable, so as to control movement of fuel bed and dumping of refuse. This reciprocation of alternate retort sides, in opposite directions, is the distinctive feature of the Riley stoker.

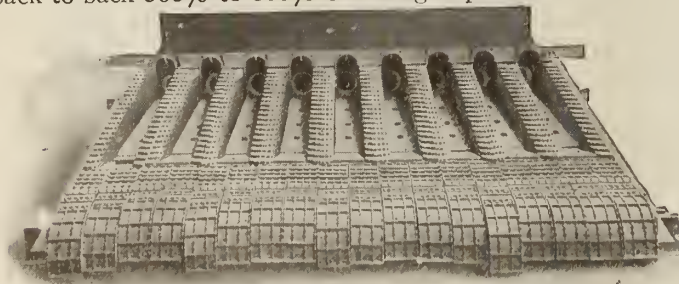
Smokelessness.

The stoker and its forced draft fan are so connected as to give the correct amount of air for fuel burned. Complete combustion, without smoke, results at all times. The Riley stoker is guaranteed to meet smoke laws of any city in the United States.

Capacity.

Constant movement of fuel and shearing action on fuel bed, caused by reciprocation of retort sides, tends to prevent formation of clinker and does not allow flow of gases to become choked. This insures brisk combustion over every square inch of fuel bearing surface, and causes the Riley stoker to excel all others in capacity.

The boiler capacity which can be obtained with the Riley stoker depends upon the number of retorts that can be installed. With boilers fired from one end 300% to 350% of rating is easily obtained during peaks. In other cases where the boiler is fired by two stokers set back to back 500% to 600% of rating is possible.



FURNACE VIEW OF A NINE-RETORT RILEY STOKER SHOWING RELATIVE MOVEMENT OF FURNACE PARTS

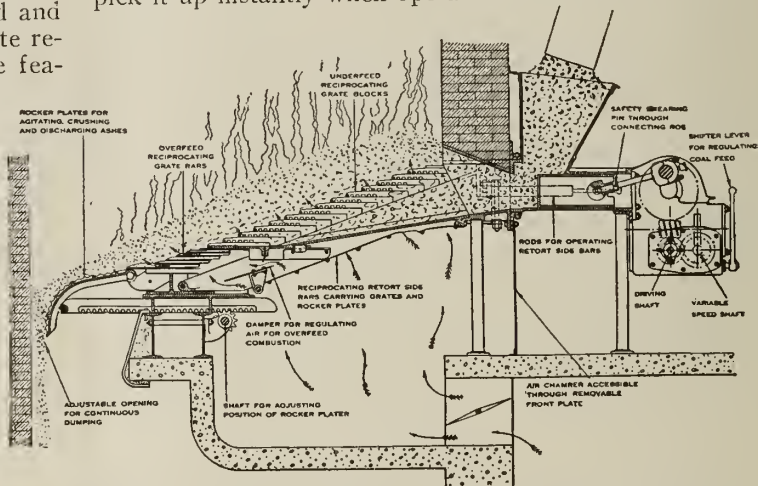


Safety.

Each plunger connecting rod is provided with a shearing pin, which absolutely prevents damage to stoker in case plunger is blocked. This device is equally effective at all points in plunger stroke. Excessive pressure shears the pin, which allows rod to move freely without moving plunger. After obstruction has been removed, pin is easily replaced while crank passes its outer center.

Quick Response.

Moving grates in the Riley stoker give an ideal means of slicing and starting up quickly from a banked fire, fuel bed being instantly broken up and active combustion begun as soon as air is admitted. This feature makes the Riley stoker especially adapted for so-called "stand-by" plants. In case of factory loads, it enables stoker to drop load within two or three minutes and pick it up instantly when operation is resumed.



SECTIONAL VIEW OF RILEY STOKER SHOWING OPERATION

Installations.

A few notable installations of Riley Stokers:

Worcester Electric Light Co., Worcester, Mass.
Norton Company, Worcester, Mass.
Hood Rubber Co., Watertown, Mass.
Massachusetts Institute of Technology, Cambridge, Mass.
American Printing Co., Fall River, Mass.
Hartford Electric Light Co., Hartford, Conn.
Remington Arms & Ammunition Co., Bridgeport, Conn.
Chase Metal Works, Waterville, Conn.
Yale University, New Haven, Conn.
Wanskuck Mills, Providence, R. I.
New York Central Railroad Co., Port Morris, N. Y.
International Railway Co., Buffalo, N. Y.
Buffalo General Electric Co., Buffalo, N. Y.
U. S. Aluminum Co., Edgewater, N. J.
Public Service Electric Company, Newark, N. J.
Vacuum Oil Co., Paulsboro, N. J.
Aircraft Factory, Philadelphia, Pa.
Goodyear Tire & Rubber Co., Akron, Ohio
American Steel & Wire Co., Cleveland, Ohio
Youngstown Sheet & Tube Co., Youngstown, Ohio
Milwaukee Electric Railway & Light Co., Milwaukee, Wis.
Tennessee Power Co., Parksville, Tenn.

THE UNDER-FEED STOKER COMPANY OF AMERICA

Book Building
DETROIT, MICH.

BRANCH OFFICES

NEW YORK	PITTSBURGH	PHILADELPHIA	BOSTON	BUFFALO	KANSAS CITY
CINCINNATI	TORONTO	DENVER	CHICAGO	SEATTLE	MINNEAPOLIS
SALT LAKE CITY	CHARLOTTE	NEW ORLEANS	CLEVELAND	ST. LOUIS	

Product.

Manufacturers of the JONES UNDER-FEED STOKER.

Adaptability.

The Jones stoker is made in "Standard" (direct cleaning) and "A-C" (automatic cleaning) types, and is adaptable to any size of boiler and to any grade of bituminous coal. In addition to the generation of steam, its usefulness in any field where constant and easily controlled high temperatures are required has been demonstrated, and it is being successfully used in heating, annealing, melting, welding and forging furnaces, drying kilns, etc.

Description.

Great simplicity characterizes the Jones stoker. Few moving parts, absolutely none in contact with the fire, explain the extremely low repair costs.

The retort or fuel magazine is installed inside the furnace. It consists of a heavy casting, along the top edge of which are arranged tuyere blocks through which air is supplied. An auxiliary ram and pusher rod in bottom of retort moves in conjunction with main ram and insures equal distribution of fuel in the furnace. Note that, being at the bottom, it is entirely covered by fresh coal when stoker is in use. A lost motion connection permits adjustment in the movement of the pusher rod to suit any fuel.

The operation is shown in the sectional views. The volatile matter or hydro-carbons driven off during the coking process are thoroughly mixed with air coming through the tuyere openings before reaching the incandescent zone. This insures complete and therefore smokeless combustion. Supply of air and fuel being automatically proportioned to each other, there are no unconsumed gases, neither is there any unconsumed fuel due to sifting through grates, the fuel and fire being carried on dead plates.

In the automatic cleaning type, the ashes are carried to the rear of the furnace onto the dump plates, which, when dumped, drop the ashes into the ash pit below, as shown in the lower illustration.

Advantages.

The automatic features make possible remarkable results in fuel economy, smoke abatement, regularity of steam pressure and increased boiler capacity. For uncertainty of manual control is substituted mechanical regulation, automatic and positive.

The independent control of each stoker simplifies the care of the furnaces, particularly when two or more stokers are installed in one furnace, and enables the operator to hold his fires ready to respond quickly to unexpected calls for steam.

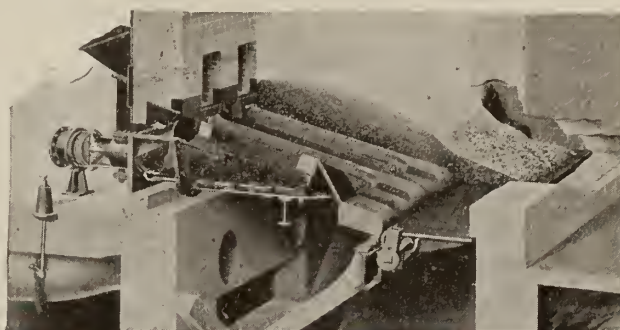
The installation of a Jones stoker under a boiler already in use involves no disarrangement of the plant. No special brickwork is required.

Where stokers are installed at the time of setting the boilers, a direct saving is made in the omission of grates, grate bearing bars, door arches, and dead plates.

The blowing equipment can be located at any convenient point.



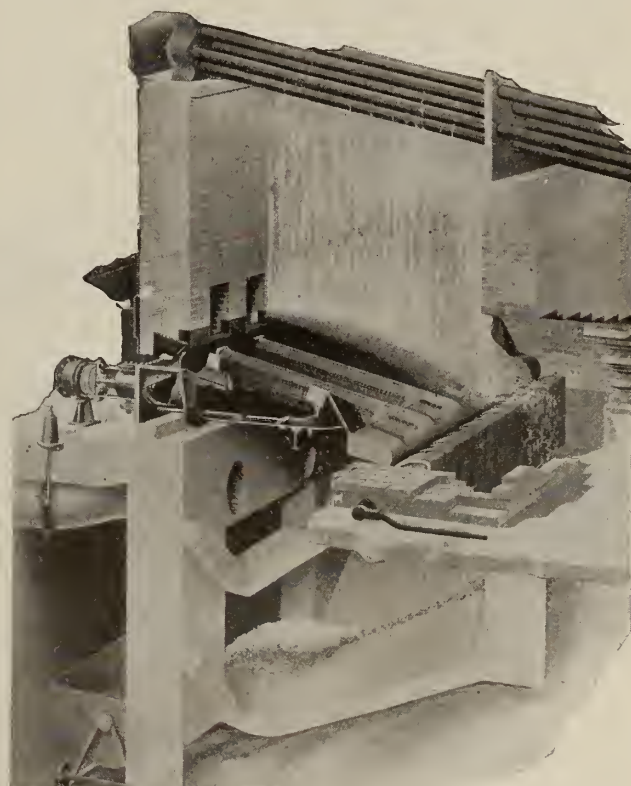
THE JONES "STANDARD" STOKER COMPLETE



LONGITUDINAL SECTION THROUGH FURNACE AND JONES "A-C" STOKER

Steam admitted behind piston forces piston and ram forward, carrying portion of coal in hopper to retort. Pusher rod moves with ram to carry coal forward in retort, and thus secures even distribution of fuel.

Note that no moving part is in contact with fire; also that each stoker is a unit and regardless of number of units installed in a given furnace can be individually controlled, if desired, and fuel and air may be regulated to produce an even fire



DETAILS OF JONES "A-C" STOKER (AUTOMATIC CLEANING TYPE)

VALLEY IRON WORKS

Manufacturers of Grates

WILLIAMSPORT, PA.

NEW YORK, N. Y., 30 Church Street

Products.

ROCKING and DUMPING GRATES.

Stationary Grates.

For Power Transmission Equipment, see pages 838-39.

Ajax Rocking Grate for Bituminous Coal.

The simplest and most effective rocking grate on the market. Provides an air space of about 65% of entire grate area, insuring an air supply adequate to effect complete combustion. Removes ash and breaks up clinker in the most effective manner, at the same time perfectly retaining on surface of grate all unburned or half-burned coal.

Sections are divided into narrow elements, each consisting of a cross bar topped with independently removable saddles (Fig. 2) and having trunnions fitting into bearings on side frames. Trunnions at sides of furnace are held in place by a locking bar that fits down over the top of frame, and those at the center of a 2-section grate are covered with special saddles. Cross bars are of heavy rectangular section and have rocking levers and cast pins for connecting bars and links. Method of fastening and connecting various cross bars with shaker handles is shown in Fig. 3.

Cross bars are provided with universal V-channels over which fit the saddles forming the grate surface. Contacts between saddles and bars are deep and accurate, giving ample support to the saddles and holding them rigid an equal distance apart and in perfect alignment. Saddle tops are all of the same size rounded into a quadrant, undercut beneath to give a sharp cutting edge and are equally surrounded by air space when in normal position.

1. Grate in normal position. Unburned and half-burned coal on top, but ash and clinker at bottom ready for removal

2. Grate rocked forward. Fire broken up and ashes falling from the steep slopes on edges of saddle into ash pit. Open spaces back of alternate saddles formed to entrap clinkers, preparatory to their being cut off

3. Return to normal grate position. Clinkers caught between edges of saddles and sheared down into ash pit. Fire clean over forward half of each saddle

4. Grate rocked backward. Fire further broken up and resting on back halves of saddles. Remaining loose ash slides to ash pit and remaining clinkers fall into position for shearing

5. Grate returned to normal position. Ash and clinker all dropped and sheared from fire. Only live fuel left on grate and provided with ample air channels

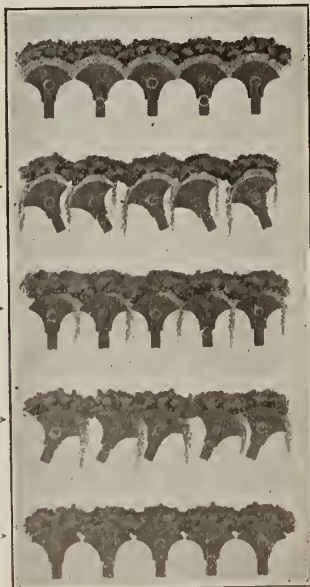


FIG. 1. ACTION OF THE AJAX BITUMINOUS GRATE

Fig. 1 shows that the fire rests normally on tops of saddles and of its own weight drops down over them uniformly. The slightest agitation of the grate permits fine ash to fall between saddles, but to get rid of the larger clinkers, openings in grate surface must be made temporarily larger and moving edges of saddles must travel in a manner to dig the bottom away from fire bed. This is accomplished by combining a differential motion of the saddle bars and cutting action at the saddle edges which makes the Ajax grate entirely and absolutely self-cleaning, a feature provided for imperfectly or not at all in other makes.

Fig. 1 shows that every other cross bar is journaled on a higher plane than its neighbors, and in rocking, alternate rows of saddles must pass through different arcs, resulting in wider spaces between every second row of cutting edges at the end of each stroke. The wider opening goes from one edge to the other of each row of saddles with opposite lever strokes, effectually opening and redistributing the fire bed. The relative motion of adjoining bars causes spaces which are open on forward movement to be closed on backward movement and vice versa. Unburned coal is thus prevented from falling through on both sides of each saddle by this closing of the pockets as the grate rocks back to normal position.

The motion given the entire fuel bed by the rocking of the grate breaks up any caked masses of fuel, and with the air channels thus formed through the fire, together with the removal of ash and clinker, combustion is enabled to proceed with a rapidity limited only by capacity of chimney draft to draw air through the fire.

REPLACEMENT FEATURES—Saddles are small and interchangeable and straddle on universal corrugations on the cross bar.

Any saddle can be easily and quickly lifted out and a new one installed independently.

It is impossible to incorrectly replace a saddle, for the V-shaped edges on the shank compel correct alignment. Saddles can be removed and replaced while fire is on the



FIG. 2. SADDLE BAR FOR BITUMINOUS GRATE
Illustrating method of attaching saddles

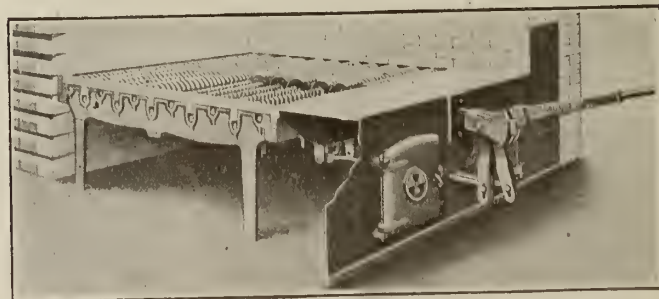


FIG. 3. TWO-SECTION AJAX ROCKING GRATE FOR BITUMINOUS COAL

grate, as it is only necessary to temporarily brush away the fire over the bad spot.

The economy of replacing one or a few saddles instead of the entire cross bar is too evident to admit of any discussion.

Ajax Rocking Grate for Anthracite Coal.

This grate cleans the fire with minimum disturbance of the fuel bed, a desirable feature for burning anthracite.

Especially adapted to boilers under continuous or periodic heavy load which require forcing.

Divided into narrow elements similar to those in the bituminous type, but saddles are of a different shape, to form, when in normal position, a perfectly flat grate surface with air space reduced by close interlock to better meet anthracite requirements (Fig. 4).

Saddles are all similarly placed on the small unit plan to permit removal of one without disturbing the others, but journals of all cross bars are at equal height to make the movement of each saddle exactly the same.

Saddles are cast with groups of 7 alternating long and short fingers on each side of the saddle bar, each finger to interlock with the similar finger of the other length on adjoining bar. Each saddle is provided with 3 projections underneath which locate it rigidly to the universal V-channels on the saddle bar.

As the grate lever is rocked from limit to limit, the saddles take uniform opposite slopes from the horizontal, alternately in each direction, the opposite edges of each saddle going an equal distance above and below the normal surface. This slope is just a little greater than the angle of repose of the material, so that the light ash can slide off into the ash pit. Further the long fingers on each edge of each row are thus alternately thrust up into the fire, giving light blows which break up clinkers and break the fire of its own weight. Hard clinkers are caught between the upper surface of one set of fingers and the lower of the next as they pass each other and thus sheared down and discharged into the ash pit.

The total movement of the grate fingers is not sufficient to disturb the fuel bed to any great extent, but the agitation is ample to shake out all loose ash, cut up clinker and free the air channels through the fire.

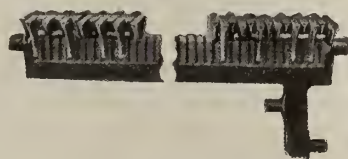


FIG. 4. SADDLE BAR FOR ANTHRACITE GRATE
Illustrating method of attaching saddles

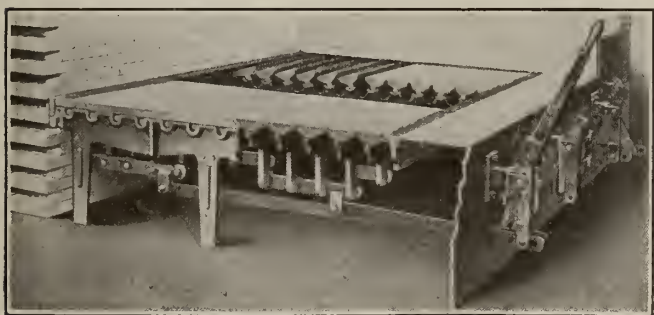


FIG. 5. SIX-SECTION AJAX ROCKING GRATE FOR ANTHRACITE COAL

Ajax Dumping Grate.

Adapted for various kinds of small anthracite coal which burns best without slicing or other agitation, and which often need not be disturbed only by a thorough sifting at rather long intervals to keep the fire in good condition. Such cleaning can be accomplished quickest, best and with least drop in boiler pressure by complete dumping of a large area of the grate at a time.

The Ajax dumping grate is designed to meet these conditions and is especially suitable for boilers under moderate load. Live coals rest perfectly flat on this grate, can be temporarily pushed away from front or back half of the section to be dumped, after which that entire portion may be tilted (Fig. 7) to permit all ash to fall forward into the ash pit. After cleaned portion is returned to normal position, live coals are redistributed thereon and other portions of the grate cleaned similarly.

The Ajax grate is strong and extremely simple. Parts subject to deterioration are few in number and easily replaced. Front and back halves of each section operate independently as with Ajax rocking grates. The advantage of 2 bars with correspondingly smaller surface units attached, in contrast to one as in some constructions, lies in the fact that only a small depth of ash pit is required.

Grate sections have beveled openings in side ribs (Fig. 6) which interlock with similarly shaped projections on the cross bars to form a rigid fire surface. The bar in the grate surface proper has ribs so strong that the heaviest fire can not warp it. Openings may be of any type. For the finest sizes of anthracite such as buckwheat, rice or culm, the Ajax is made in the pinhole type with holes from $\frac{1}{8}$ to $\frac{1}{4}$ in. diameter and placed so as to give an advantageously distributed air space ranging from 10% to 20% of the total grate area, ample to burn all fire that can be piled on.

Fine particles of unburned fuel with this construction can not fall through to the ash pit and thus reduce the economy that can be secured by using the cheaper sizes. Pin holes are conical, being larger at the bottom, thus they are self-cleaning and can not clog with ash. For the larger sizes of anthracite, herringbone grate surfaces, but on specially constructed bars, may be fitted to this type of Ajax grate. For bituminous coal, a rocking grate is recommended, although if a dumping grate is installed, it should be fitted with plain straight bar surface.



FIG. 6. PINHOLE TYPE OF SADDLE FOR AJAX DUMPING GRATE

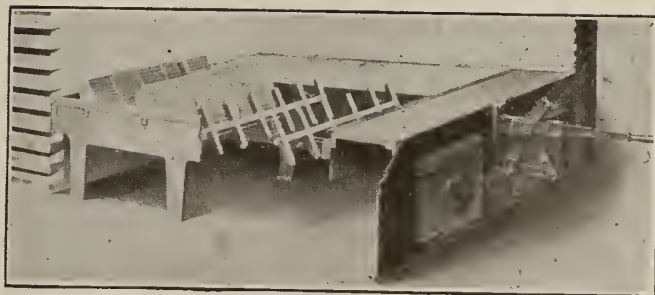


FIG. 7. TWO-SECTION AJAX DUMPING GRATE

WASHBURN & GRANGER, INC.

Manufacturers of Grate Bars, Incinerators and Furnace Castings

50 Church Street
NEW YORK, N. Y.

BRANCH OFFICE: BOSTON, MASS., 141 Milk Street
WORKS: MYERSTOWN, PA

Products.

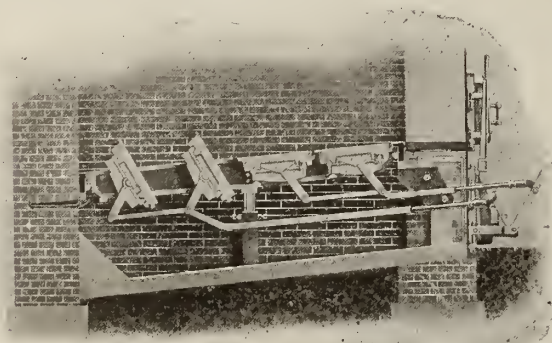
"DEAN" DUMPING and SHAKING GRATES; GARBAGE and REFUSE INCINERATORS and DESTRUCTORS; FIRE BRICK LININGS for Boiler Furnaces; ASH GATES.

Boiler Castings and Fronts, Boiler Room Floor Plates, Grates, Cast Iron Industrial Track, Turntables, Charging Cars, Trench Covers.

"Dean" Dumping Grates.

Built for burning small sizes of anthracite coal, with natural or forced draft. Bars tip in tandem (angle, 65°), and are supported at both ends by rectangular frame, eliminating tendency of bars to hang downward on the ends. Air spaces $\frac{1}{8}$ to $\frac{3}{8}$ -in. slot; also built in pinhole form, with $\frac{1}{4}$ or $\frac{5}{16}$ -in. diameter openings. Fires cleaned in one-half the time required with stationary bars.

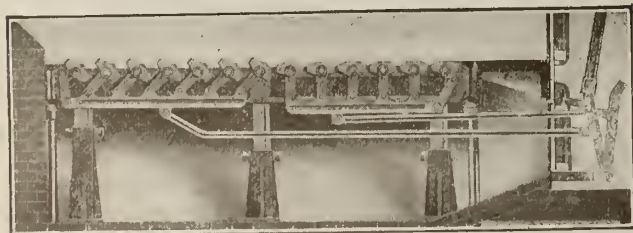
Catalogue No. 7 sent on request.



"DEAN" DUMPING GRATES

"Dean" Shaking Grates.

For bituminous and the larger sizes of anthracite coal. Grates supported by a frame resting on ash pit floor, independent of brickwork; bars placed on 8-in. centers, allowing ample opening for largest clinkers; journals, self-locking; and sides of bars are made solid, to resist wear and tear.



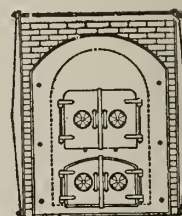
"DEAN" SHAKING GRATES

Incinerators and Destructors.

This company have patterns and designs for incinerators for burning rubbish and waste material, suitable for institutions, hotels, schools, apartment houses, museums, factories, etc.

They also build garbage destructors of the brick set type suitable for large hospitals and hotels and a portable type for use in large residences, clubs, restaurants; etc., designed with a steel casing and lined with fire brick to be operated with coal, gas or oil as fuel.

Send for catalogue No. 8, "Dean Incinerators."



INCINERATOR



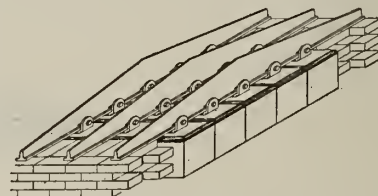
DESTRUCTOR

"Dean" Flat Suspended Arches.

For incinerators, furnaces, boilers, etc.

Fire brick blocks are 9 in. wide by 12 in. long by 10 in. high, suspended by cast iron clips bolted to heavy cast iron T's.

Each block can be removed and replaced independent of all others.



"DEAN" FLAT SUSPENDED ARCH

"Dean" Fire Brick Linings.

Made to withstand 3200° Fahr. of furnace temperature.

Standard side and bridge wall blocks are 24 by 18 by 8 in., with tongue and groove ends, thus minimizing number of joints and burning of furnace walls.



"DEAN" FIRE BRICK LINING

"Dean" Gates.

For ash hoppers. Made in two sizes, 24 by 24 in. and 24 by 36 in.

They open full size and are heavily constructed for hard service.



"DEAN" ASH HOPPER GATE

SLEICHER & DRAKE

Power Plant Equipment

5 Beekman Street
NEW YORK, N. Y.

Products.

DRAKE NON-CLINKERING FURNACE BLOCKS; FURNACE ENGINEERING CO. GRATE BAR for Underfeed Stokers; ELLISON DRAFT GAUGES; DWIGHT CO₂ INDICATORS.

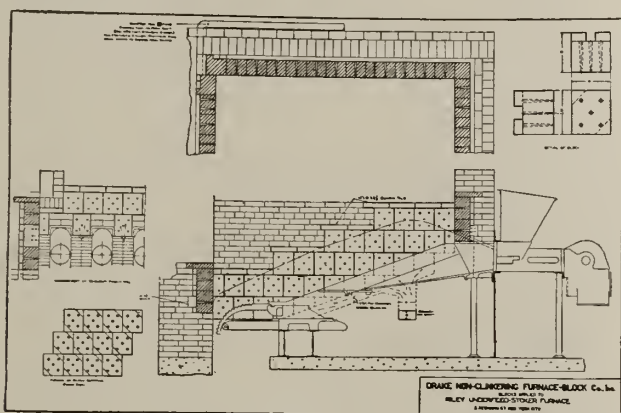
Weber Coniform Chimneys and Detrick Flat Suspended Arches.

Drake Non-clinkering Furnace Blocks.

Specially designed blocks having tapered perforations and lugs on back which form an air duct within the 9-in. furnace lining. Air admitted through perforations keeps the temperature of surface exposed to the fire below fusing point and enables the blocks to resist the corrosive action of combustion gases, effectively preventing clinker formation and burning of furnace walls.

Blocks are manufactured from a specially ground refractory material and properly burned to take care of expansion and contraction and to insure a smooth, hard surface on furnace face.

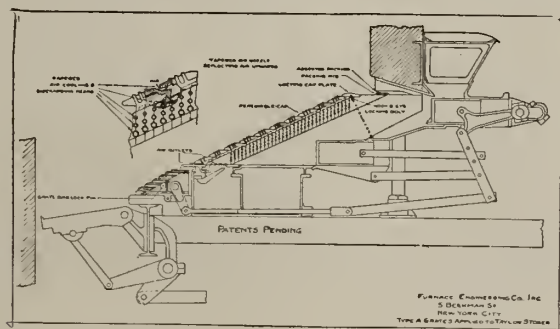
A special cover tile is supplied to prevent air from penetrating above clinker block line and acts as a bond to the blocks, thereby forming a rigid construction throughout.



DETAILS OF APPLICATION OF DRAKE NON-CLINKERING FURNACE BLOCKS

Furnace Engineering Co. Grate Bar for Underfeed Stokers.

This grate bar consists of a series of self-locking, upstanding units with uniform spacing of air passages in line with retort, the air passageways in vertical direction being graduated so as to give a uniform air supply.



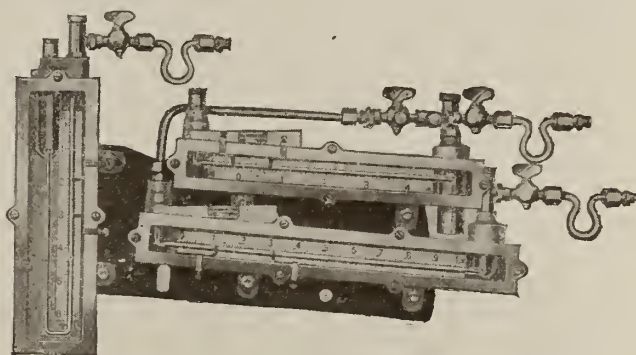
DETAILS OF INSTALLATION OF TYPE "A" GRATE

Upstanding grate bars are set between a top and bottom terminal piece, the whole protected by interchangeable caps which have numerous graduated air passageways. Thus, air is distributed over the entire retort area, keeping all parts of the grate thoroughly cooled.

Ellison Draft Gauges.

The simple design and construction of these highly perfected gauges insure absolute scientific precision. An incline tube with oil of constant capillary attraction, which lubricates the surfaces and travels without friction over a single reading scale, self-correcting for capillary attraction and specific gravity, indicates equivalent water pressures direct, without factor.

The levels are long and very sensitive and are made of high pressure glass to withstand high temperatures. Scales are of white metal in black graduations. Gauges are furnished with vent plug, oil dropper, extra cover glass for cover type gauge and wood or machine mounting screws.



ELLISON U-TWIN DIFFERENTIAL DRAFT GAUGE
Upper gauge for furnace, lower gauge for flue

Detrick Flat Suspended Arches.

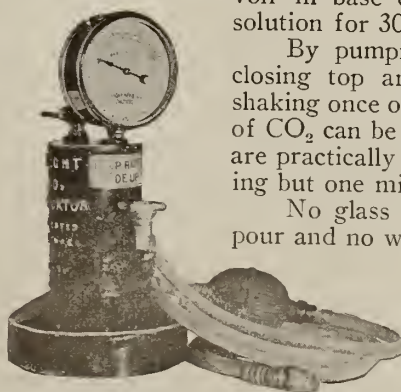
A full description of these arches will be found on page 686.

Dwight Co₂ Indicator.

Consists simply of a cast metal tank of special design and accurately calibrated indicating gauge. Reservoir in base of tank holds enough solution for 300 tests.

By pumping sample into tank, closing top and bottom cocks and shaking once or twice, the percentage of CO₂ can be read on gauge. Tests are practically instantaneous, requiring but one minute.

No glass parts, no solutions to pour and no water leveling. No experience is required to use Dwight CO₂ indicator, because its correct design and substantial construction assure absolute accuracy.



DWIGHT CO₂ INDICATOR
Type A—one-fifth actual size

THE ENGINEER COMPANY

Manufacturers of Boiler Draft and Baffle Systems

17 Battery Place
NEW YORK, N. Y.

BRANCH OFFICES

ATLANTA, GA., Trust Company of Georgia Building
BOSTON, MASS., 10 High Street
CHICAGO, ILL., State-Lake Building
CLEVELAND, OHIO, National City Building
HAZELTON, PA.

MINNEAPOLIS, MINN., Builders' Exchange Building
MONTREAL, CAN., Coristine Building
NEW ORLEANS, LA., 847 Baronne Street
PITTSBURGH, PA., Jenkins Arcade Building
PHILADELPHIA, PA., Harrison Building

ST. LOUIS, MO., Railway Exchange Building

Products.

BALANCED DRAFT REGULATION DEVICE
and TURNER BAFFLE WALLS.

Balanced Draft.

Balanced draft is a power plant essential. It is a system of better combustion obtained by the automatic regulation of both the supply of air to the furnace and the escape of gases from the furnace in such a manner as to maintain at all times a constant predetermined draft in the furnace for all rates of combustion.

Its principle is to supply all the air needed for perfect combustion but no more, and at the same time to maintain as little suction in the furnace as possible and still have sufficient draft to remove the gases from the furnace chamber as rapidly as they are formed.

These requirements are independent functions. They must be controlled separately and independently if best results are to be obtained.

DESCRIPTION AND OPERATION—The essential apparatus used for balanced draft consists of a furnace pressure regulator, with its pilot valve, and one or more hydraulic cylinders. An air pressure regulator and some form of mechanical draft, a fan driven by an engine or motor, and air ducts connecting the fan with the closed ash pits are necessary. Frequently they are already in use, in which case only the regulating apparatus is necessary.

The furnace pressure regulator may control the movement of the flue damper or the air gate or both, by hydraulic, pneumatic, electric, or any other means if so desired. The furnace pressure regulator is unique and of special design. A cast iron pipe connects the regulator with the furnace, the outer end of the tube terminating in the regulator box and being fitted with a shut-off damper. The regulator contains a swinging plate diaphragm and covers the outer end of the gas pipe, forming a chamber in which the pressure is the same as in the furnace.

The swinging diaphragm is mounted on knife edges and its axis passes through its center of gravity, the broad plate above the center being balanced by a counterweight below, so that the plate swings easily outward and inward in response to the slightest change in pressure on its broad surfaces, and thereby operates a pilot valve. This valve is connected by suitable piping to one or more hydraulic cylinders conveniently located on the boiler setting.

The piston of hydraulic cylinder is connected to the flue damper so that movement of piston in one direction closes the damper and reverse movement opens it. By this action of the pilot valve and the piston, the damper may be opened, closed or held indefinitely in any intermediate position between wide open and entirely closed.

Balanced Draft

TRADE-MARK

When the furnace pressure becomes normal in response to the movement of the damper the swinging diaphragm gradually returns to the vertical.

The compensating feature should be clearly understood. The flue damper does not go from wide open to

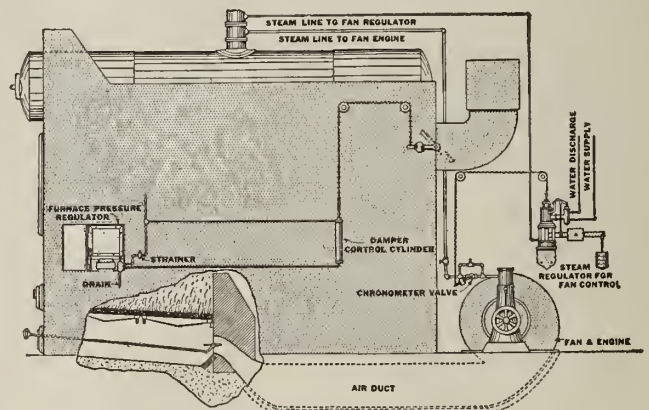
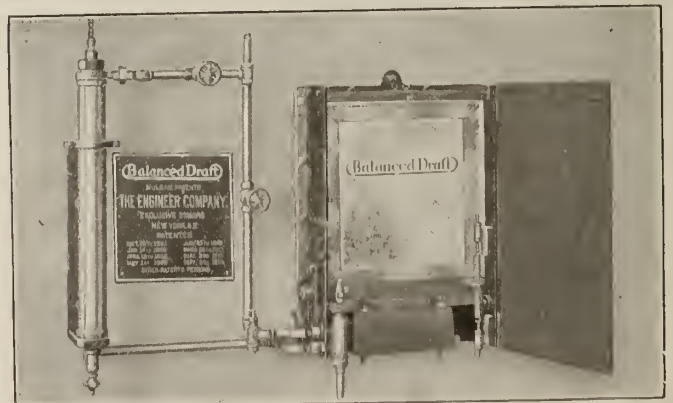


DIAGRAM OF BALANCED DRAFT SHOWING STEAM CONTROL OF FAN AND FURNACE AND FURNACE PRESSURE CONTROL OF FLUE DAMPER

tight shut and vice versa, but moves only as much as is required to restore the predetermined furnace pressure and is held indefinitely in that position until the furnace conditions require a further change.

The balanced draft fan speed regulator is of special design and is compensated, so that a slight drop of the steam pressure is immediately followed by only a slight increase of the fan speed which automatically is maintained until the steam pressure is restored or until a further drop in pressure again increases the speed to meet furnace and steam requirements. This prevents



BALANCED DRAFT FURNACE PRESSURE REGULATOR

the sudden "all on" or "all off" action of the blower so destructive to fuel beds and stokers.

The patents are broad and fundamental and cover any means of regulating simultaneously both the air supply to and the exit of the flue gases from any furnace so as to maintain a substantially uniform pressure in the furnace. This pressure may be at, above or below atmosphere as desired.

Balanced draft is used with all kinds of fuel, including coal, coke, breeze, oil and gas, and can be installed as part of the present plant.

By its use, any required amount of air can be forced through fuel beds of any thickness or density, thus maintaining whatever rate of combustion may be desired.

Turner Baffle Wall.

The Turner baffle wall is built by laying tile as diagonal shelves on the boiler tubes and filling the pockets thus formed with a plastic fire resisting cement. The cement hardens in place without application of heat, is non-porous and gastight and resists for years the hot-test stoker fires.

Turner Baffle Walls

TRADE-MARK

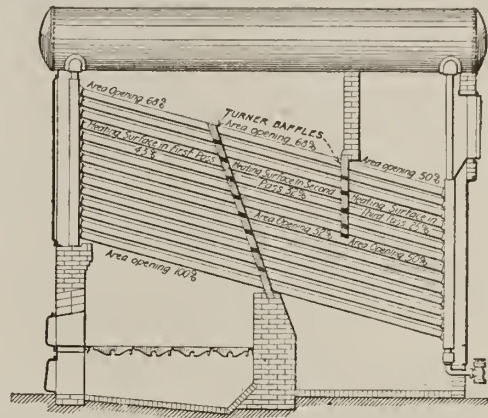
ADVANTAGES—The plastic material fills the space around bent tubes just as readily as around straight tubes. This feature is particularly valuable in rebaffling boilers. A bent tube makes the four spaces surrounding it irregular in shape. The fire brick ordinarily used and which is shaped to fill the space between the tubes on standard spacing may be cut to approximately fit the smallest of these spaces but can not be enlarged to fill the other three spaces.

Fire brick ordinarily used to repair boiler baffles are smaller than the fire brick used originally in the boiler when new, because the original size can only be gotten into place when the tubes are being laid up. Unless the tubes are sprung, a repair brick must be smaller to get in between the tubes, and its edges chamfered to allow it to be turned into place. It is inevitable, therefore, that the repaired wall built entirely of fire brick should be full of open joints and would not stop hot gases.

RETUBING—The plastic material used in the Turner wall shrinks in setting so that a straight tube may be easily pulled out and renewed without injuring the wall. The expansion of the tube when hot closes the small shrinkage space around it so there is no leakage of gas through the wall around the tubes. When replacing a bent or blistered tube the hole is enlarged to

get the tube out and when the straight new tube has been put in place, the hole in the wall is filled with plastic material by the fire room force and wall is as good as new. This feature is one of the advantages of the Turner wall.

SLOPING WALLS—Combustion engineers have discovered that a baffle wall sloping from the top of bridge wall to a point on the upper row of tubes halfway between the curtain wall and the front header gives surprisingly efficient results, as can be surmised by studying the accompanying illustration.



TURNER BAFFLE WALL INSTALLED IN SLOPING POSITION

The difficulty of building a sloping baffle wall by ordinary methods in a new boiler and the practical impossibility of rebuilding one by such methods after retubing the boiler are well known.

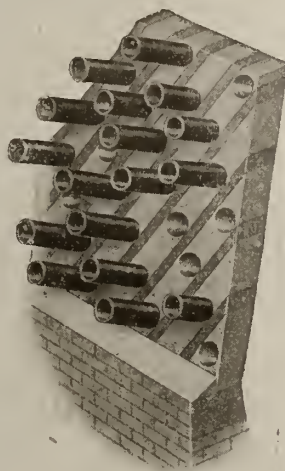
The Turner wall can be built sloping forward, vertically or at right angles of the tubes equally well, in either new or old boilers without disturbing the side or bridge walls.

CONSTRUCTION DETAILS—The tile used in the Turner wall are dovetailed into each other at the ends and are corrugated on both sides. The plastic material grips the tile by these corrugations and holds them in the wall. Each wall unit, whether tile or pocket filling, is self-contained and the expansion due to heat is taken up between them and is not transmitted to the side walls nor does the wall buckle.

On new settings the Turner baffle is bonded into a recess in the side wall of the furnace; on old work particular care is taken to make a gastight joint with side walls. This prevents leakage around the ends of the walls, a most difficult place to keep tight with ordinary construction. The material will not crumble, spall off or break down under the most intense heat developed in a furnace.

ERECTION—THE ENGINEER COMPANY contracts for walls complete in place. The company's specialists do nothing but this work. Boiler may be put on line 24 hours after wall is completed.

Submit make, horsepower and number of tubes in the boiler. Estimates will be gladly submitted and satisfaction guaranteed.



SECTION OF TURNER BAFFLE WALL
Showing plastic filling fire brick tile and bridge wall

M. H. DETRICK COMPANY

Manufacturers of Flat Suspended Fire Tile Arches

549 West Washington Street
CHICAGO, ILL.

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PITTSBURGH, PA.

SAN FRANCISCO, CAL.
ST. LOUIS, MO.
SALT LAKE CITY, UTAH
SEATTLE, WASH.
HAVANA, CUBA

Product and Service.

DETRICK FLAT SUSPENDED ARCHES, adaptable to all types of boilers, stokers and furnaces.

The experience gained through the installation of over 4000 of these arches, under various conditions, has enabled the M. H. DETRICK COMPANY to build up an organization consisting of combustion engineers who are specialists in furnace design. Each individual installation is studied thoroughly by the Engineering Department.

Description.

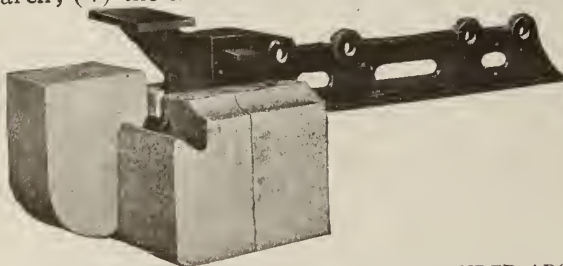
The Detrick flat suspended arch is the only type of flat arch in which the tile are suspended and not rigidly held. Each tile is individually hung from the center, so that each tile becomes a unit in itself and is allowed to expand and contract freely.

There is no thrust on the side walls in a Detrick flat suspended arch. The thrust due to the entire weight of the arch is downward on the cast iron hangers, which in turn are supported by steel beams resting on the side walls.

The Detrick flat arch will not only outlast a sprung arch, but will also insure a maximum efficiency from the boiler, because it is not required to withstand internal stresses due to expansion or contraction and distributes the gases uniformly over the heating surface of the boiler because of the flat surface provided by this construction.

Construction Details.

As the arch must withstand the most severe service at the rear end where the tile is exposed to the flames on two surfaces, special attention has been paid to this feature with the idea of providing: (1) sufficient support for the cantilevered portion of the arch; (2) flexible construction to enable repairs to be made easily and quickly; (3) the apron wall suspended independent of the arch; (4) the end tile of small dimensions.



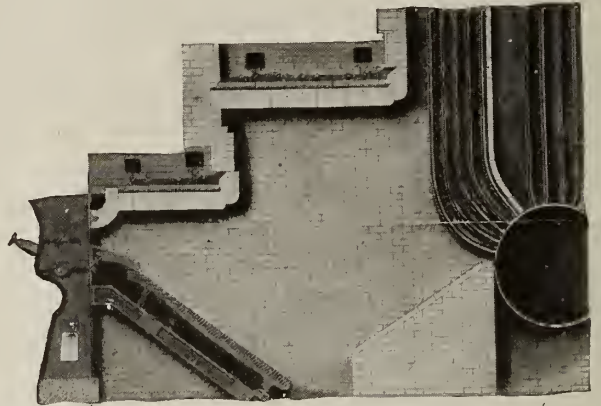
END CONSTRUCTION DETRICK FLAT SUSPENDED ARCH

Note ample fire brick protection from the end of the iron arch bar and removable end casting which is keyed to main arch bar by means of a cast iron wedge

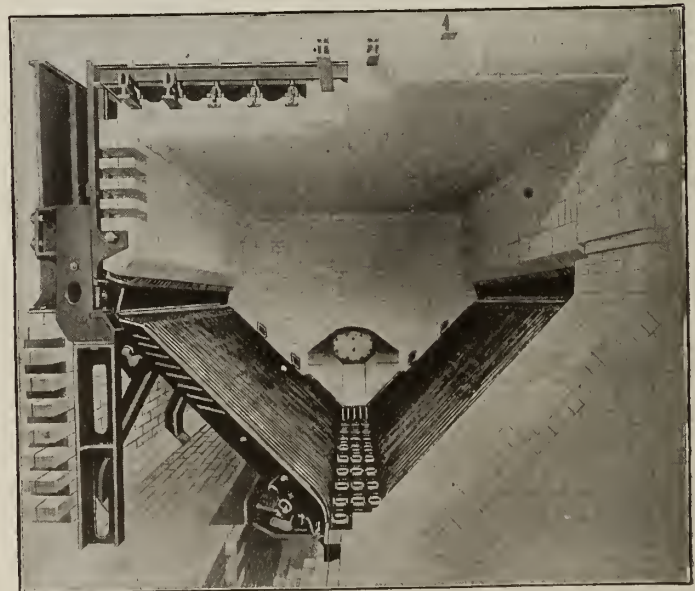
Installation and Repairs.

In the erection of the Detrick flat arch no skilled labor is required. It is only necessary to string the tile on the cast iron beams. In repairing a Detrick flat arch,

it is only necessary to replace the individual tile that is burned, without disturbing the balance of the construction. This work does not require skilled labor.



TYPICAL APPLICATION OF DETRICK FLAT SUSPENDED ARCHES TO FRONT FEED INCLINED STOKER



TYPICAL APPLICATION OF DETRICK FLAT SUSPENDED ARCH TO V-TYPE STOKER

Users.

There are over 1,500,000 boiler horsepower successfully equipped with Detrick flat suspended arches.

A few of the prominent users are:

American Rolling Mill Co., Middletown, Ohio
American Gas & Electric Co., New York, N. Y.
Atlantic Refining Co., Philadelphia, Pa.
Baltimore & Ohio Railroad Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Indianapolis Light & Heat Co., Indianapolis, Ind.
International Harvester Co., Chicago, Ill.
New York & Pennsylvania Co., Lock Haven, Pa.
Sinclair Refining Co., Chicago, Ill.

THE GREEN FUEL ECONOMIZER CO.

BEACON, N. Y.

BRANCH OFFICES

NEW YORK CHICAGO BOSTON PHILADELPHIA PITTSBURGH CLEVELAND ATLANTA
ST. LOUIS SALT LAKE CITY TUCSON HONOLULU SAN FRANCISCO SEATTLE LOS ANGELES

ASSOCIATED WITH

GREEN'S ECONOMISER, LIMITED, TORONTO, MONTREAL, WINNIPEG and VANCOUVER
E. GREEN & SON, LTD., WAKEFIELD, ENGLAND

Products.

GREEN'S FUEL ECONOMIZERS.

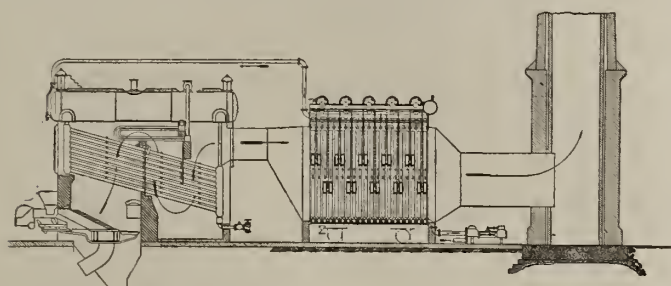
Also Green's Hi-efficiency Hi-speed Radial Flow Fans, Steel Plate Fans, Mechanical Draft Apparatus, Blowers, etc.

Fuel Economizers.

The Economizer consists of a number of cast iron tubes and headers through which the feed water passes on its way to the boiler and around which the waste gases of combustion pass on their way to the stack.

The average saving or increased capacity obtained by installing an Economizer varies from 10% to 15%, depending upon plant conditions, although in many cases greater savings have been made.

Economizers show an unusually high return on the investment due to the large saving in proportion to the small cost of installation, and they should be used in almost every boiler plant, especially as the conservation of fuel is a matter of national importance.



TYPICAL INSTALLATION OF GREEN'S FUEL ECONOMIZER

Economizer Practice.

The standard boiler rating is 10 sq. ft. of heating surface per horsepower and is based on the evaporation of 34.5 lbs. of water per hour from and at 212° Fahr. by the heat transmitted through that amount of heating surface or, the transmission of 33,480 B. t. u. per hour. Actual operating conditions, however, vary greatly, as the boiler may be operated at some point below this rating or perhaps at 400% of rating.

A percentage of the heat of the fuel always leaves the boiler in the flue gases as it is impractical and uneconomical to make the boiler surface large enough to transmit all of the heat generated in the furnace. This percentage of the heat of combustion present in the flue gases varies from 12% to 30% under average conditions.

Without an Economizer this heat would all be wasted, but by applying the "countercurrent" prin-

ciple and using the heat in the flue gases after they leave the boiler to heat the feed water before it enters the boiler, a large part of this heat may be saved.

By using an Economizer the temperature of the feed water may be raised from the water supply, hot well or exhaust steam feed water heater temperature to a temperature approaching that of the water in the boiler. The higher feed water temperature thus obtained results in a proportional saving in fuel as the transmission of less heat by the boiler surface combined with that recovered by the Economizer will produce the same amount of steam as would be produced if the Economizer were not used.

The average saving is 12.5%, and results under varying conditions of feed water temperature and boiler pressure may be approximated by estimating 1% saving of fuel for each 10° to 11° Fahr. added to the temperature of the feed water.

While this information will enable engineers to approximate the results that may be obtained with an Economizer, it is advisable to have this company's engineers calculate each case, taking into account all factors covering the individual installation before making any final plans or specifications for boilers or feed water heating equipment.

GENERAL DIMENSIONS OF GREEN'S ECONOMIZERS

Number of tubes wide	Length of tubes	Width inside chamber walls			Free area through Economizer			Weight of section full of water, lbs.	External heating surface per section	Number of sections	Length over Economizer
		Without side dampers	With 1 side damper	With 2 side dampers	Without side dampers	With 1 side damper	With 2 side dampers				
4	9'	3'-4"	4'-1"	4'-10"	16.60	23.85	31.10	1636	51.0	4	2'- 5"
4	10'	"	"	"	18.44	26.50	34.55	1756	55.8	8	4'-10"
4	11'	"	"	"	20.28	29.15	38.00	1877	60.7	12	7'- 3"
4	12'	"	"	"	22.13	31.80	41.46	2005	65.4	16	9'- 8"
6	9'	4'-8"	5'-5"	6'- 2"	21.85	29.10	36.35	2388	76.5	20	12'- 1"
6	10'	"	"	"	24.27	32.32	40.38	2570	83.8	24	14'- 6"
6	11'	"	"	"	26.70	35.55	44.40	2751	91.0	28	16'-11"
6	12'	"	"	"	29.13	38.78	48.46	2942	98.3	32	19'- 4"
8	9'	6'-0"	6'-9"	7'- 6"	27.00	34.25	41.50	3096	102.0	36	22'-11 1/2"
8	10'	"	"	"	30.00	38.05	46.11	3337	111.7	40	25'- 4 1/2"
8	11'	"	"	"	33.00	41.86	50.72	3578	121.4	44	27'- 9 1/2"
8	12'	"	"	"	36.00	45.66	55.33	3835	131.0	48	31'- 5"
10	9'	7'-4"	8'-1"	8'-10"	32.25	39.50	46.75	3760	127.5	52	33'-10"
10	10'	"	"	"	35.83	43.88	51.94	4061	139.6	56	36'- 3"
10	11'	"	"	"	39.41	48.27	57.14	4363	151.7	60	38'- 8"
10	12'	"	"	"	43.00	52.66	62.33	4684	163.8	64	42'- 3 1/2"
12	9'	8'-8"	9'-6"	10'- 3"	39.25	44.75	51.50	4380	153.0	68	41'- 8 1/2"
12	10'	"	"	"	43.61	49.72	57.22	4742	167.5	72	47'- 1 1/2"
12	11'	"	"	"	47.97	54.69	62.94	5104	182.0	76	49'- 6 1/2"
12	12'	"	"	"	52.33	59.67	68.67	5488	196.6	80	53'- 2"

Height over sections, 10'-2 1/4" for 9-ft. tubes.

Height over gearing, 13'-5 1/4" for 9-ft. tubes.

Increase height 1 ft. for each 1-ft. increase in tube length above 9 ft.

POWER SPECIALTY COMPANY

Manufacturers of Superheaters

TELEPHONE:
RECTOR 111

111 Broadway
NEW YORK, N. Y.

BRANCH OFFICES

BOSTON, 50 Congress Street

CHICAGO, Harris Trust Building

PHILADELPHIA, Land Title Building

PITTSBURGH, Park Building
SAN FRANCISCO, Balboa Building

AGENCIES

SEATTLE, WASH., J. D. HULL

OTTAWA, CAN., GENERAL SUPPLY CO. OF CANADA, LTD.

Products.

SUPERHEATERS: Stationary, Portable, Locomotive and Marine.

Superheated Steam.

Steam as generated in a boiler has a fixed temperature, which is determined by the pressure. When steam from a boiler is subjected to further heating, its temperature and volume increase, and it becomes what is known as superheated steam.

The process of superheating consists of passing the saturated steam through tubes exposed to the hot gases of the furnace. In this way the temperature of the steam is raised without changing its pressure, and the heat energy in each pound is increased.

temperature at low pressure for special manufacturing requirements.

Steam Saving.

For various kinds of engines, it may be stated, generally, that the steam saving effected by superheating 100° Fahr., as compared with saturated steam, would be for turbines 10%, triple expansion engines 12%, compound engines 14%, and simple engines 18% and over.

Scope.

The Foster superheater is built in four general types, as follows:

Attached type for adding up to 200° or 250°



FIG. 1. TYPICAL INSTALLATION OF FOSTER SUPERHEATER IN BABCOCK & WILCOX WATER TUBE BOILER

Fuel Saving.

Fuel saving is, of course, the principal reason for installing superheaters, and this saving ranges from 6% to 40%, depending upon the type of power plant; the less economical the plant, the greater the saving with superheat.

Advantages.

Superheated steam possesses the following advantages over saturated steam, which effect fuel saving and augment the efficiency of a plant:

Elimination of condensation losses in cylinders and pipe lines; increase in efficiency of steam turbines by at least 10% due to absence of water, which causes friction and wear; reduction of lubrication required in cylinders, since there is no water present to wash oil from the walls; smaller steam lines required, due to reduced friction; same power can be obtained from old boilers when pressure has to be reduced; high

Fahr. superheat; Separately Fired type, for any variety of fuel and any range of superheat up to final temperature of 1200°; Waste Heat type for steel mills and smelter plants, or marine practice; Portable type, for heating steam, oil or air, with oil, coal or gas fuel.

The Foster superheater, for attachment within the boiler setting, is designed for installation in all types and makes of vertical and horizontal water tube boilers, return tubular boilers (Fig. 2), Scotch marine and other fire tube boilers. A total of many million horsepower is in successful operation.

Typical Construction.

Fig. 1 illustrates a water tube boiler equipped with Foster superheater. As may be seen, the superheater is located above the water tubes and underneath the drums, where it is exposed to the hot gases passing through the boiler. The superheater consists of a series of U-bend tubes or sections set parallel to each other, expanded into two steel manifolds running the full

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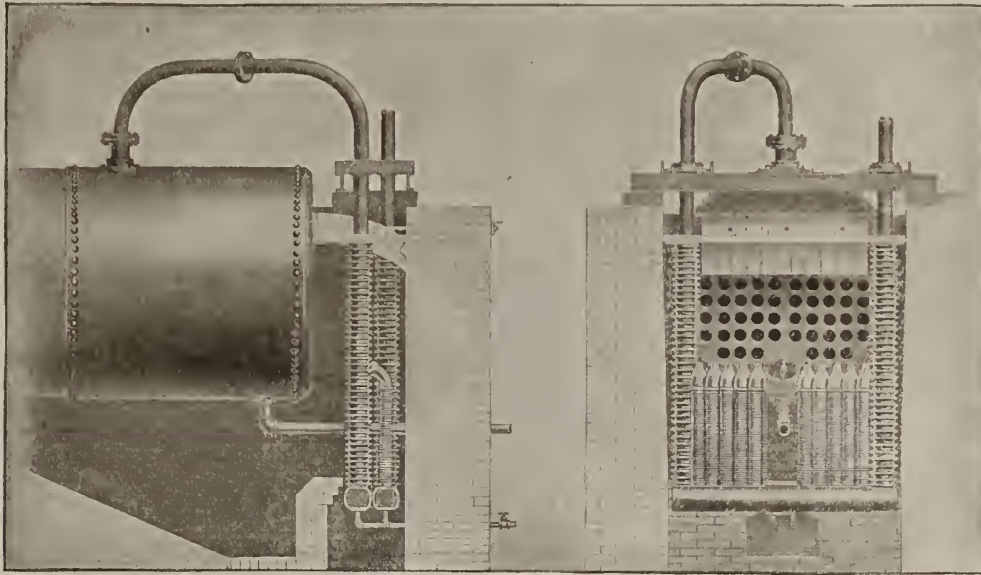


FIG. 2. FOSTER SUPERHEATER IN HORIZONTAL RETURN TUBULAR BOILER

width of the boiler, the saturated steam being led to one of these and thence through the U-bend tubes to the other, and through the outlet piping to the steam main.

An inspection of Fig. 3 shows the construction of the heating elements of the Foster superheater. These elements are U-shaped steel tubes covered with cast iron rings and split cast iron sleeve over the U-bend. The ends are expanded into inlet and outlet manifolds having reamed holes.

Where U-bend construction can not be used, or where straight elements are required, steel return

protects the steel tubes from the erosive and corrosive action of the furnace gases.

This construction provides a section of great ultimate strength with absolute freedom from internal strains, and forms a large reservoir for the storage of heat which is given up to the steam as required by the variations in gas temperature. This keeps the temperature of the steam constant.

Central inner cores provide annular spaces through which all steam must pass close to the heating surface. Fig. 3 shows the construction including headers and handhole plugs.

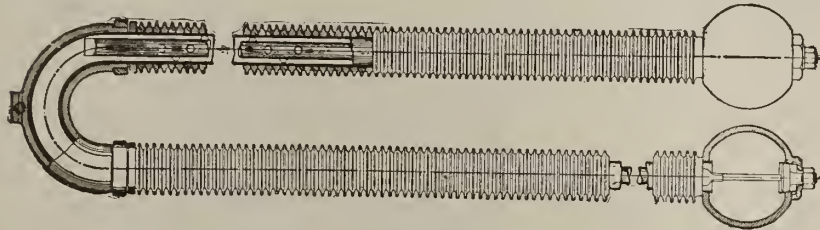


FIG. 3. CROSS SECTION OF RETURN BEND ELEMENT AND CONNECTING HEADERS USED IN CONSTRUCTION OF FOSTER SUPERHEATERS

headers with expanded joints and handhole plugs replace the U-bends.

Material.

All parts exposed to steam pressure are of steel, thus giving maximum strength. All parts exposed to gases of combustion are of cast iron, thus insuring long life.

Handholes.

Opposite the end of each element a handhole is fitted with a steel plug and metallic gasket, in order to give free access to every part of the interior for inspection and cleaning. The holes, into which the tubes are expanded and the handhole plates fitted, are reamed to gage.

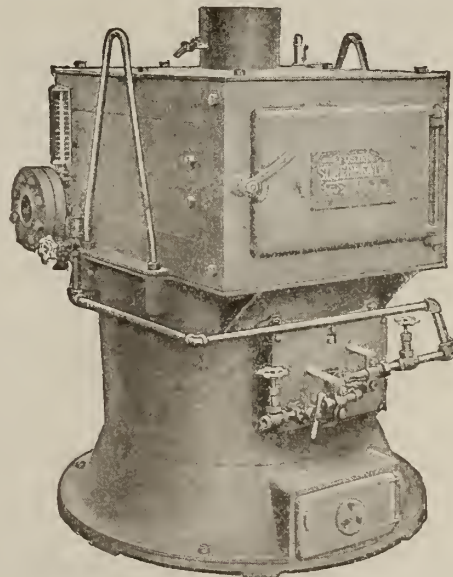
Advantage of Extended Surface.

The extended surface formed by the cast iron annular rings or gills on the outside of the steel tubes greatly increases the absorption of heat from the hot gases, thus making the heat transfer to the steam flowing through the tubes, much more effective than that of a base construction. The cast iron outer surface also pro-

Advantages Obtained by Reheating Air.

The efficiency of compressed air is greatly increased by reheating.

The volume increases directly in proportion to the absolute temperature, and owing to the low specific heat of air the volume of 1 lb. of air may be greatly increased by the expenditure of a very small additional amount of heat.

FIG. 4. SMALL PORTABLE FOSTER SUPERHEATER
For special purposes or field work, such as heating air for drilling, hoisting or general contractor's work

BETSON PLASTIC FIRE BRICK CO., INC.

P. O. Box 386-13

ROME, N. Y.

BRANCH OFFICES

NEW YORK, N. Y., 30 Church Street

CHICAGO, ILL., 1514 Kimball Building

Products.

BETSON'S PLASTIC FIRE BRICK and
BETSON'S HI-HEAT CEMENT.

Uses of Plastic Fire Brick.

Betson's Plastic Fire Brick is the pioneer and ideal one-piece furnace lining. It is used in place of bricks, moulded blocks or special tiles in any make and style of boiler, old or new, for lining the furnace, making the front arch and wall, side walls, bridge wall, combustion chamber, back arch and baffles.

Betson's Plastic Fire Brick is made of the highest grade refractories, properly proportioned to take up the strains of expansion and contraction, due to varying temperatures. It is shipped in 650-lb. barrels, in a moist condition, ready for use.

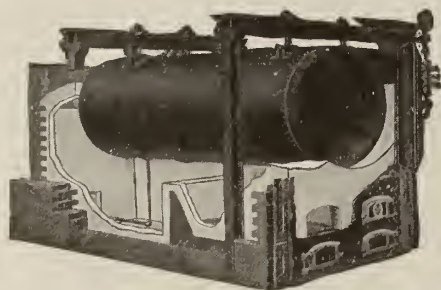
FURNACE LININGS—Permanent, gastight furnace linings for water tube and return tubular boilers are easily made right in place, by any one. No special moulds, forms or tools required.

Betson's Plastic Fire Brick is first placed in chunks or balls. Next it is pounded in with a mallet. Then it is smoothed off with a trowel—and the job is done. The result is a one-piece furnace lining that has no joints, is leakless and lasts for years.



APPLYING BETSON'S PLASTIC FIRE BRICK FURNACE LINING

Made in one piece and of any desired thickness. Job can be done by any one in old or new boilers



BETSON'S PLASTIC FIRE BRICK AS USED FOR LINING FURNACE OF RETURN TUBULAR BOILER

SIDE WALLS—Betson's Plastic Fire Brick makes the most serviceable side walls in any boiler furnace. With ordinary fire brick or blocks, the extreme furnace temperatures make the joints loosen, then the mortar crumbles and the bricks finally fall out. With Betson's Plastic Fire Brick the construction is in one piece, without joints, so there is nothing to give way.

FRONT WALLS—Door openings, bridge walls, and other boiler furnace parts can be easily and quickly

There Is Only One
Plastic Fire Brick



TRADE-MARK

formed. These are made in one solid block, from the dead plate to a perfect fit around the boiler shell on fire tube boilers or up to the tube header on water tube boilers, and bonded in as a solid monolithic part of the side walls. Compared with ordinary construction the number of repairs or renewals can be reduced at least three to one.

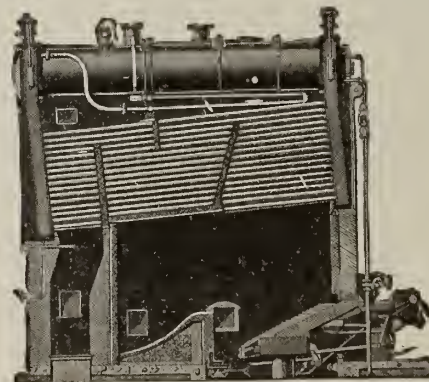
Gastight Boiler Baffles.

Gastight baffles, of the right shape and slope are essential to the efficient operation of water tube boilers. Baffles made of special blocks or tiles are difficult to slope and shape, and because of the joints, they can not be made gastight.

Baffles made of Betson's Plastic Fire Brick (patented) are formed in one piece, without joints. Special tools are not required and the tubes do not have to be pried apart. The baffles can be made horizontal, vertical, and inclined to give the desired tapering gas passages so necessary for uniform velocity and high boiler efficiency.



HOW A BETSON VERTICAL BAF-
FLE IS FORMED



GASTIGHT BAFFLES OF BETSON PLASTIC FIRE BRICK
Easily formed to give the tapering gas passages necessary in modern high power boilers

Betson's Hi-Heat Cement.

For laying up fire brick and tile in settings, furnaces and retorts, Betson's No. 3 Hi-Heat Cement will give the best service. Fire brick usually begins to soften at 3000°, but Hi-Heat Cement withstands temperatures of 3100° and over. It will therefore maintain a perfect bond as long as the brick or tile lasts. The material is shipped in 500-lb. barrels and is ready for use by the addition of water.



Catalogues.

Specialized booklets dealing with the applications of Betson's Plastic Fire Brick, Boiler Baffles and Hi-Heat Cement are available. These practical and instructive catalogues are gladly sent on request.

CHARLES V. HOFFMAN COMPANY, INC.

Refractories and Furnace Cements

GENERAL OFFICE

97 Liberty Street
NEW YORK, N. Y.

FACTORY
LINCOLN,
BOUND BROOK, N. J.

Products.

"AlSiO" REFRACTORIES, FURNACE CEMENTS and MORTARS and COATINGS for High Temperatures.

Also, Fire Brick and Special Tile for various types of furnaces; Combustion Appliances: Flue Gas Analysers, CO₂ Recorders, Gas Collectors, Draft Gages, Pyrometers and Boiler Wall Covering; Steam Specialties.

"AlSiO" Refractories.

"AlSiO" is composed of materials and chemical elements possessing high temperature resisting qualities and mixed in such proportions as to produce a highly refractory combination for application where fire clay is commonly used, but with a wider range of use and far greater durability. It is in dry form and requires only the addition of water to obtain required consistency for use. It can be used as a mortar and applied with a trowel. It can be made thin for dipping the brick or to be used as a grout or wash on the face of finished brickwork. "AlSiO" is also made in special mixtures for special uses.

"AlSiO" High Temperature Cements or Mortars.

Originally formulated for use in laying up fire brick in boiler furnaces, it has been found to have a much greater adaptability. It can be used wherever it is desired to develop a high temperature in furnaces that must carry an overload, causing conditions that can be met only by the most durable of furnace material. The development of the highest furnace efficiency results in the highest furnace temperatures mainly through the use of correct amount of air.

When used as a mortar, a thin joint is all that is needed to make a durable job; and in finishing the joint, the material may be troweled smooth over the joints, which will leave no corners exposed to allow the hot gases to cut away the brick. A thick joint is not a disadvantage, but a thin joint is more economical. While "AlSiO" High Temperature Cement does not bond the bricks together in such a way that they can not be separated without breaking the brick, its adhesive qualities are such that it is possible to chisel the face of the furnace wall laid with "AlSiO" Cement without disturbing the joints or producing air or gas leaks.

ADVANTAGES—"AlSiO" High Temperature Cement being a very high fusion material (3300° Fahr.) it does not fuse between the bricks. Whether fused at the exposed face of the joint by high temperature, vitrified by moderate heat, or hardened under atmospheric conditions, the space between the bricks properly filled with "AlSiO" makes the joint perfectly airtight.

Should the temperature be high enough to fuse "AlSiO," the fusion will not penetrate between the bricks. When it is necessary to make local repairs, there will be a greater salvage of bricks, and repairs will be less expensive in consequence.

By building up furnace efficiency, high furnace temperatures result. A furnace built of inferior material and poorly constructed will not stand the high temperatures developed. Excess air or insufficient air can be determined readily by flue gas analysis, showing per-



TRADE-MARK

centage of CO₂ and drafts can be corrected, resulting in higher furnace temperatures. These high temperatures must be met by the use of the best furnace material, or a part of the economy effected will be lost through rapid destruction of furnace structure.

From the following table it is easy to determine that the more durable and heat resisting the furnace material is, the greater the possibility of economy of operation from its use.

FURNACE TEMPERATURE AND FUEL LOSSES BY CO₂ READINGS

CO ₂ , per cent	Furnace temperatures, degrees	Air excess per cent	Fuel loss per cent	Preventable loss per cent
15	3750	38	12	0
14	3500	47.8	13	1
13	3250	59.2	14	2
12	3000	72.5	15	3
11	2750	88.1	16	4
10	2500	107	18	6
9	2250	130	20	8
8	2000	158.7	23	11
7	1750	195.7	26	14
6	1500	245	30	18
5	1250	314	36	24
4	1000	417	45	33
3	750	590	60	48
2	500	935	90	78
1	250	1970	....	....

The presence of excess air is not always due to oversupply through grate, but often through side walls and other parts of the furnace and heat passages. Every part of the heating surfaces should be protected from the chilling effects of excess air by tight furnace and boiler walls from grate to stack. All these walls can be made perfectly airtight with "AlSiO," as it is not necessary to vitrify by high temperature when used in the cooler parts of the structure. It hardens sufficiently at atmospheric temperature.

ADAPTABILITY—"AlSiO" lends itself to many more uses than could be here enumerated. It is adapted to practically all types of furnaces whether coal, gas or oil fired, and can be used with all kinds of clay or silica fire brick. Special mixtures for brass foundries and chemical furnaces. Can be fired wet or dry.

APPLICATION—"AlSiO" High Temperature Cement or Mortar requires just enough water in the mixing to make it the proper consistency for use determined by the requirements of the work. Mix quite stiff for tamping or moulding into forms, for special shapes and baffles. Follow closely same practice as with portland cement, but add water only. Should a batch become "set" it can be worked over again with water without detriment, preventing waste.

SHIPMENTS—"AlSiO" is put up in 100-lb. bags, paper lined or of a close weave to prevent sifting and loss in handling.

Shipments are usually made day following receipt of order.

QUANTITY REQUIRED—About 500 lbs. for the 1000 brick laid with not more than $\frac{1}{16}$ -in. to $\frac{1}{8}$ -in. joint.

Co-operative Service.

This company will be glad to correspond and co-operate with all who are interested in furnace efficiency and fuel economy.

JOINTLESS FIRE BRICK CO.

TELEPHONE:
LINCOLN 9184

1130-1150 Clay Street
CHICAGO, ILL.

PLIBRICO IS WAREHOUSED IN ALL PRINCIPAL CITIES FOR PROMPT DELIVERY

Products.

Manufacturers of PLIBRICO JOINTLESS FIRE BRICK, a Plastic Refractory for all kinds of boiler settings, furnace linings, and baffles. Better than fire brick, and used wherever fire brick can be used. JOINTLESS FIRE BRICK CO. also manufacture a HIGH TEMPERATURE BOND for laying up ordinary fire brick, that will last as long as the brick.

Uses of Plibrico Jointless Fire Brick.

Plibrico forms a jointless one-piece lining in the front door arches, entire fronts, side walls, arches, bridge walls, baffles, etc. It can be used in any boiler, furnace or oven, and can be used wherever fire brick is employed.

Plibrico is used in all kinds of industrial plants, public and private institutions. It can not be excelled for patching broken and burned out linings.

Description.

Plibrico jointless fire brick is an unbaked high grade fire brick. It is plastic and is shaped and pounded into place like moulded clay. The furnace lining is thus made first, and is afterward baked out and vitrified. The result is a *one-piece jointless furnace lining*, better than any fire brick, guaranteed to stand 3100° Fahr., that will not leak air or gas, and will not crack or spall.

Plibrico should not be applied as a plaster over ordinary fire brick. It should never be used less than 4½ in. thick.

Fuel Economy and Efficiency.

Plibrico constitutes one of the largest factors in fuel economy and efficiency that can be installed in any power plant. The saving of fuel is not the only consideration but also the satisfaction and efficient results to be had from good equipment.

A jointless fire brick lining is a sure and determinable saving of one of the largest preventable losses of economy in a boiler plant.



SHOWING HOW EASILY PLIBRICO CAN BE PUT IN

Method of Application.

Instead of first baking fire brick and laying up



TRADE-MARK

with fire clay joints, apply putty form Plibrico (fire brick material), shape it not less than 4½ in. thick, and then bake into a one-piece monolithic, vitrified, finished furnace lining without joints, making the fire brick setting airtight and gas tight.

Advantages of Plibrico.

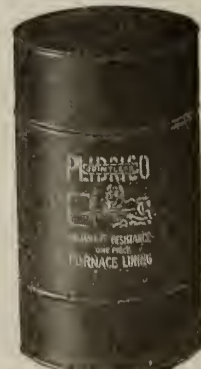
- (1) It is jointless.
- (2) It is plastic.
- (3) It is airtight and gastight.
- (4) It will stand 3100° Fahr.
- (5) It will save fuel.
- (6) It can be installed by inexperienced labor.
- (7) It will outlast fire brick.
- (8) It can be used in any boiler, furnace or oven.
- (9) It can be used wherever fire brick is used.
- (10) It can not be equalled for patching.



PLIBRICO CAN BE MOULDED TO FIT ANY PLACE IN FURNACE OR SETTING

How Supplied.

Plibrico comes in steel containers of about 650 lbs. in a stiff, moist, plastic consistency, ready for use. It weighs 120 lbs. to the cubic foot. The amount required is easily estimated by measuring the length, thickness and height of the particular arch or wall to be installed or replaced, thus arriving at the contents (expressed in cubic feet). Then multiply the number of cubic feet by 120 which will give the number of pounds required. High Temperature Bond comes in 100-lb. bags and 500-lb. steel drums.



PLIBRICO CONTAINER

Co-operative Service.

Estimate on requirements furnished on receipt of blue prints.

Book of instructions on setting all types of boiler furnaces sent on request. Gives full directions on how to build and maintain tight furnace linings.

McLEOD & HENRY CO.

Manufacturers of Forms for Boiler Settings

TROY, N. Y.

NEW YORK OFFICE: 1400 Broadway

BOSTON OFFICE: 141 Milk Street

Products.

"STEEL MIXTURE" FORMS for Boiler Settings, as follows: Boiler Door Arches, Firebox Blocks, Combustion Chamber Arches, Blow-off Pipe Protectors.

Also, Dutch Oven Arches, Fire Brick, Fire Clay.

"Steel Mixture" Forms.

Forms are made of a material which has been named "Steel Mixture." It is a hard and refractory substance especially produced for boiler setting use, and is noted for its ability to give long service under boiler furnace conditions.

"Steel Mixture" is installed in thousands of power plants, where it is used regularly in preference to other forms of construction.

On receipt of order a special point is made of furnishing just what is wanted.

Special shapes made to order.

Boiler Door Arches.

The boiler door arches are of standard form and made in suitable sizes, so that practically any size or shape can be supplied. The arches flare up and to the sides so as not to obstruct the spreading of the fuel. Not being bonded to the brickwork above, any disturbance of the latter due to expansion does not tend to destroy them.

They are easy to install, as they are composed of a very few simple parts, which come all ready to put together. These parts have tongue and groove joints, which hold them rigidly in place.

Tongued and Grooved Firebox Blocks.

These blocks are made in three thicknesses: 6, 8 and 9 ins.; and in two heights: 12 and 18 ins. All sizes come in three lengths: 12, 18 and 24 ins.

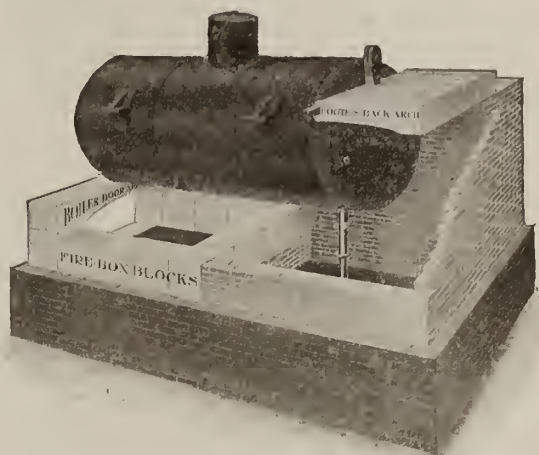
Their use greatly reduces the number of joints in the furnace wall, which thus exposes a smoother and more durable surface to the action of the fire. Clinkers do not adhere to them as easily as to small brickwork.

They can be laid up, according to individual ideas, for lining the firebox or building bridge walls. For the latter, they will be bullnosed or beveled in any specified way.

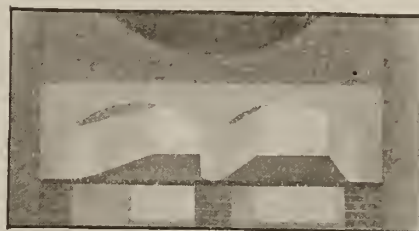
Back Combustion Chamber Arch.

Foote's combustion chamber arch fits any horizontal boiler. It is carried by the walls of the setting and is not affected by the expansion of the boiler. The clevis arm bar, which can be supported from above, is furnished in most cases. The bar is protected by being set in a groove of the material as shown in the illustration. The pieces are shiplapped together so as to produce a gastight joint.

There is ample headroom for working in the com-



"STEEL MIXTURE" BOILER SETTING



"STEEL MIXTURE" BOILER DOOR ARCH



"STEEL MIXTURE" FURNACE ROOF ARCH BLOCKS



FOOTE'S BACK ARCH

bustion chamber, so that once in place the arch should last indefinitely.

Write for our "measurement cards," so we can quote prices.

THE S. OBERMAYER CO.

Manufacturers of Furnace Cement

2835 Smallman Street
PITTSBURGH, PA.

BRANCH OFFICES

DENVER, COLO., 211 Tramway Building
MILWAUKEE, WIS., Loan & Trust Building

DETROIT, MICH., 570 Penobscot Building
ST. LOUIS, MO., 1313-15 North Broadway

FACTORIES: PITTSBURGH, CHICAGO, CINCINNATI, RILLTON, PA.
WAREHOUSES: ST. LOUIS, PITTSBURGH, DENVER, LOS ANGELES

Product.

"HOTT PATCH" FURNACE CEMENT.

"Hott Patch" Furnace Cement.

DESCRIPTION—"Hott Patch" furnace cement is a patented compound containing chemicals which make it permanently adhesive, even under very high operating temperatures. It is the product of many experiments, and has been used with satisfaction in some of the largest plants in the United States.

Has the same coefficient of expansion and contraction as fire brick, insuring a firm and continuous adhesion between the brick and the bonding material. It has to be air dried or baked before it is refractory.

Put up in barrels weighing approximately 500 lbs. Sold on approval.

USES—Adapted to boiler settings, furnace linings, foundry ladles, cupola, and electric furnace spouts.

ADVANTAGES—Shipped dry, thus saving weight of water which is in the semipaste form.

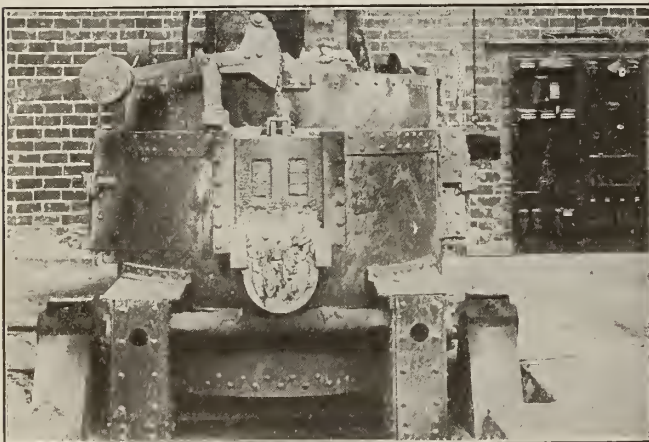
No unequal expansion, contraction, disintegration, or loosening of bricks, as is the case where fire clay is used as a bonding material.

Saves the expense of replacement of boiler settings and furnace linings.

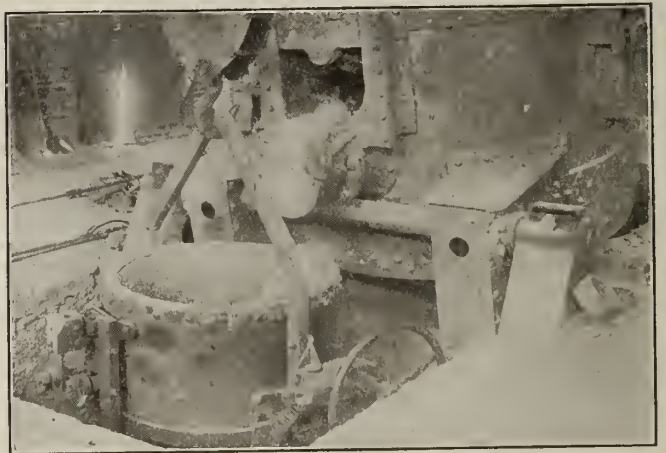
No need of moistening the fire brick before the use of "Hott Patch" furnace cement.

APPLICATION—Applied the same way as fire clay mortar. It is recommended that the material be laid with a close joint. One coat of "Hott Patch," applied with a stiff brush, will complete the job. The high temperature causes the formation of a glaze, which prevents clinkers from sticking, stops air seepage, and protects the brick.

COVERING CAPACITY—About 350 lbs. per thousand 9-in. brick.



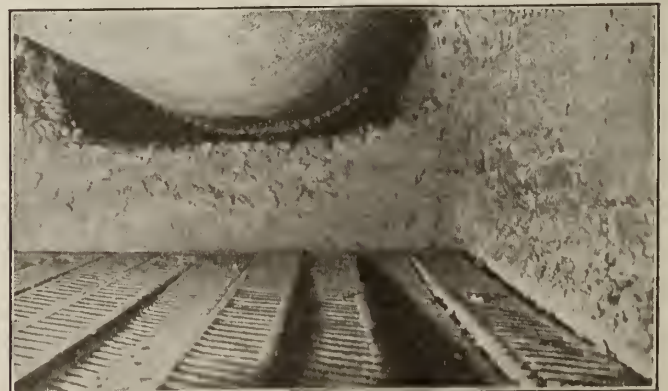
ELECTRIC FURNACE SPOUT LINED WITH "HOTT PATCH" CEMENT



STEEL LADLE DAUBED AND LINED WITH "HOTT PATCH" CEMENT



REPAIRED WITH FIRE CLAY



REPAIRED WITH "HOTT PATCH" FURNACE CEMENT

QUIGLEY FURNACE SPECIALTIES COMPANY, INC.

CABLE ADDRESS:
"QUIGLECO"

GENERAL OFFICES
26 Cortlandt Street
NEW YORK, N. Y.

CODE USED:
Western Union, 5 Letter

FACTORIES: JAMAICA, N. Y., FREDERICKSBURG, VA.

SALES OFFICES
BALTIMORE BUFFALO DENVER PHILADELPHIA PITTSBURGH PROVIDENCE
Representatives in 35 cities in the United States and Canada

Products and Services.

HYTEMPITE, a Refractory Cement for bonding silica and fire clay brick, and for kindred uses.

INSULBRIX, a specially prepared Cellular Insulating Refractory Brick which keeps heat in or out.

POWDERED COAL EQUIPMENT: Quigley System for preparing, distributing and burning powdered coal and other fuels.

Carbosand, a highly Refractory Granular Material for making rammed-in linings, special tile, patches, and repairs in furnace structures.

Hytempite.

A high temperature furnace cement which forms a lasting union between materials to be joined. It sets at normal temperatures and retains its strength up to temperatures at which the best quality of brick loses its strength and becomes soft.



HYTEMPITE FOR CUPOLAS
AND LADLES



HYTEMPITE FOR BOILER
SETTINGS

Hytempite, when used in place of fire clay for laying up brickwork, greatly adds to the life of the structure.

It is successfully used for furnace and boiler settings and repairs; for setting tile, retorts, oil stills; lining metal melting furnaces, pit furnaces, open flame melting furnaces, foundry cupolas and ladles, and as a core wash.

Tests have proven that Hytempite used as a binder, when air set, forms a joint as strong as the refractory material united, and that the strength is not impaired but increased by the action of heat. This property makes a wall or structure impossible to obtain with fire clay, or



HYTEMPITE FOR SPECIAL
SHAPES AND TILE



MIXING REFRACTORY MA-
TERIALS WITH HYTEM-
PITE FOR RAMMED-IN
LININGS



HYTEMPITE FOR PIT FUR-
NACES

other materials which depend on heat to effect a bond or vitrification.

Hytempite withstands the cutting action of flames and is especially recommended for oil furnaces where the gases are usually of high velocity.

Hytempite can be used as a coating or wash, or to smoothen and harden the surface of a furnace lining to protect it from abrasion, etc.

Hytempite can be used wherever fire brick or tile is used.



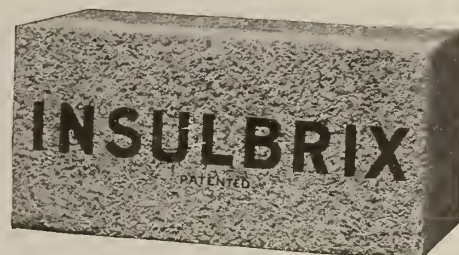
HYTEMPITE FOR LAYING
UP LININGS OF LARGE
LADLES



HYTEMPITE FOR COATING
CORES

Insulbrix.

A specially prepared cellular insulating refractory brick for furnaces or other structures. These brick are made in standard fire brick size and special shapes. Their weight is about one-half that of ordinary fire brick. They have low thermal conductivity—1 in. of Insulbrix being equal to six to ten times the same thickness of fire, or red brick, depending upon conditions such as furnace temperature, conductivity of other brick, etc. They have high heat resisting quality, their fusing point being over 2900° Fahr. without showing shrinkage at 1800° Fahr. They have a crushing strength of 425 lbs. to the sq. in. They are used as an insulating course in boiler settings, furnaces, kilns, ovens, or other structures where the conservation of heat in the heating chamber is an important item.



INSULBRIX

Quigley Powdered Coal System.

For preparing, transporting and burning powdered coal. Pulverized coal is transported in bulk through small diameter standard wrought pipe to bins at furnaces.

Entire equipment is dusttight from coal siding to furnaces.

With this improved method of burning powdered coal, the fuel is automatically weighed as sent to the furnace bins. By turning a hand or chain wheel absolute control of fuel fed to the burners is obtained.

Send for bulletins describing complete system, with illustrations of plants now in successful operation.

WALSH FIRE CLAY PRODUCTS COMPANY

Manufacturers of Fire Brick and Refractory Material

4070 North Main Street
ST. LOUIS, MO.

BRANCH OFFICES

CHICAGO, ILL., 7 W. Madison Street

NEW YORK, N. Y., 220 Fifth Avenue

Products.

The WALSH BRAND of STANDARD FIRE BRICK and SPECIAL SHAPES used in Linings for Blast Furnaces, Stoves, Cupolas, Brass Furnaces, and for the construction of all kinds of Iron and Steel Furnaces, Malleable Iron Air Furnaces, Heating Furnaces, Copper Smelting and Copper Refining Furnaces, also in the construction of Smelting Furnaces, tin, zinc, lead, silver, and gold, Linings of Cement Rotaries, Boiler Furnaces and special material for the modern powerhouse and high powered stokers, including all special work for drawing.

Also Standard Brick, Glass Tank Flux and Refractory Blocks and Specials used in the construction of Glass Furnaces, Lehrs, Annealing Ovens, etc.

Service.

The Walsh brands of fire brick have been on the market many years, an old tried out line of furnace material. The output is large, therefore, this company is in shape to take care of large orders quickly and always glad to receive small favors. The greater part of this business is repeat orders, showing the popularity of these brands of fire brick. They are manufactured for quality and are considered among the best produced.

In the early part of 1919 this company brought into operation its third fire brick plant, it being one of the largest and most modern in the country. Every consideration was given to latest devices and machinery for the work intended, and it has, after a year's service, met all demands.

The engineering department of this company is composed of men competent in their line and will be found an aid whenever needed in problems of construction, furnishing plans and specifications when necessary.

This organization, in all departments, is composed of experts, qualified with years of experience in the manufacture, sales, and use of fire brick.

Much progress has been made in the glass product line, the material being of the highest quality and is received with much favor by glass manufacturers.

Clays.

This company produces all its own clays and selects the various kinds and grades for the work intended.

Walsh XX Brand.

A brand of brick in the standard 9 in. and 9 in. series, also in special shapes.

It is of an open, porous structure, manufactured from selected Missouri flint clays, made to resist high heats and sudden changes in temperature.

It is a brick of quality and very popular where much is expected and where furnace temperatures are high.

Walsh Brand.

A brand of brick, made in the standard 9 in. and 9 in. series, also special shapes.

It is made in two kinds. First, a tough, dense material, of selected high grade clay, made to resist high heats and abrasion. Second, brick made semiopen, of the same clays as above, to resist high heats and quick changes.

Both of these brick have many uses, the dense brick is popular where there are fluxes such as in lead, tin and other smelting operations.

Full information concerning these splendid brick gladly furnished on request.

Information.

This company solicits inquiries. Information will be cheerfully given concerning the various kinds of material required in furnace construction.

Shipping Facilities.

Being conveniently located on the various railroads, with direct connections, prompt shipments may be expected.

Export Trade.

The large stocks carried at the various plants enable this company to make prompt shipments. The export trade is increasing very fast, indicating that the high quality of these brands of fire brick are being appreciated and repeat orders are the result.

BADENHAUSEN CO.

Manufacturers of Steam Engines

1425 Chestnut Street
PHILADELPHIA, PA.

SALES OFFICES

NEW YORK, N. Y., 111 Broadway
PITTSBURGH, PA., Jenkins Building
CHICAGO, ILL., Marquette Building

DENVER, COLO., Tramway Building
BIRMINGHAM, ALA., Brown-Marx Building
SAN FRANCISCO, CAL., Rialto Building
WORKS: CORNWELLS, PHILADELPHIA, PA., and BOUND BROOK, N. J.

Products.

AMERICAN-BALL ENGINES, including Angle Compound, Duplex Compound and Simple Engines; Triple Expansion 4-cylinder Pump and Dredge Engines; 4-cylinder and 2-cylinder Angle Type Variable Speed Paper Mill Engines; 2-cylinder Horizontal Variable Speed Paper Mill Engines; Constant Speed Engines for Paper Mill Work.

MARINE ENGINES, including United States Shipping Board Standard Triple Expansion Vertical Inverted Type.

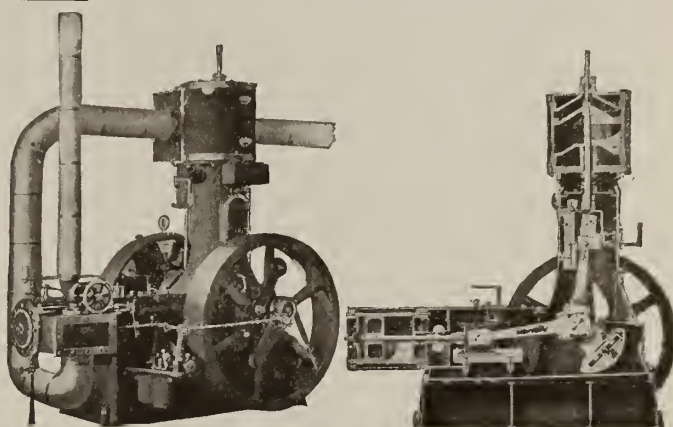
For Boilers and Superheaters, see page 641.

American-Ball Engines.

These so well and favorably known engines—fundamental features of design originated by Frank H. Ball and F. O. Ball—embody the best modern engineering practice in the following features of design and construction: marine type connecting rods, balanced crank shaft, automatic pressure system of lubrication, sensitive balanced automatic governor, attached indicator reducing motion.

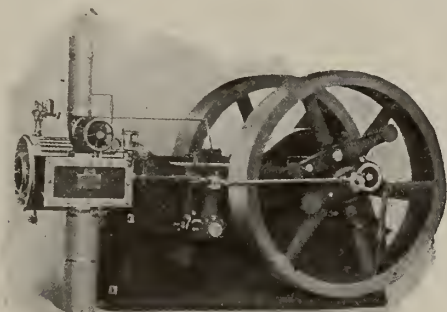
See specific descriptions under illustrations.

Send for bulletins giving detailed specifications.



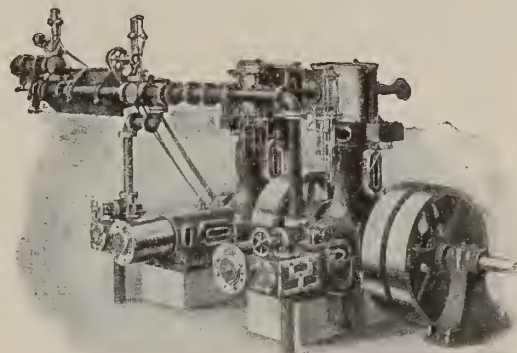
ANGLE COMPOUND ENGINE

Sizes up to 650 h.p. for belted and for direct connected service. A special advantage of the angle construction with its cylinders at right angles is in its four impulses per revolution. This gives a nearly uniform torque and makes it especially adaptable for driving alternators run in parallel, as well as electric generators in isolated steam plants. Small floor space. Twice the power on the floor space required by a simple engine; perfect balance and high speeds without vibration, pounding or noise; requires only light and inexpensive foundations and may be installed on upper floors without foundations.



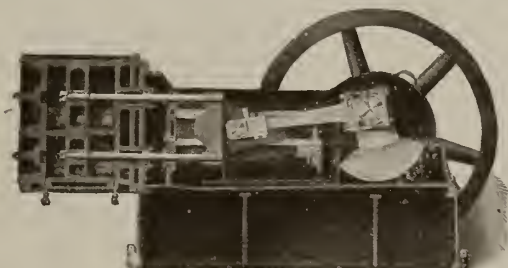
SIMPLE ENGINE

Sizes up to 325 h.p. for both belted and direct connected service. Operate at high speed. Of fully enclosed self-oiling type. Equipped with balanced automatic shaft governor and the well-known American-Ball valves which take up wear automatically and remain tight indefinitely, as proved by 10,000 engines in operation. Moving parts easily accessible.



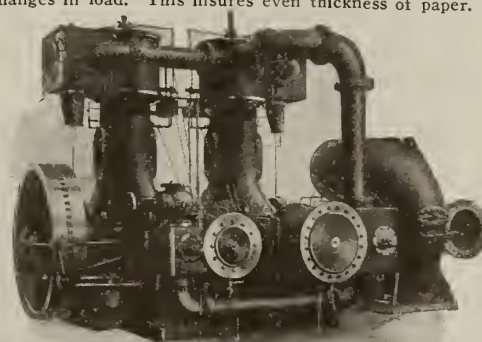
4-CYLINDER VARIABLE SPEED PAPER MILL ENGINE

Sizes to meet the load demand. Another application of the Angle construction. 4 cylinders arranged in pairs at right angles. 8 power strokes per revolution evenly distributed 45° apart and engine may be operated at extremely high speeds as well as low speeds, so that a speed range of 8:1 and even 10:1 is obtained for direct connected paper machine drive. A special system of governing makes speed regulation perfect, regardless of severe changes in load. This insures even thickness of paper.



DUPLEX COMPOUND ENGINE

Sizes up to 325 h.p. for belted and for direct connected service. An improved form of piston valve provides practical means of adjustment for wear. Crosshead designed to secure greatest strength and rigidity with least weight. Smoothly running independent of unequal division of work between the pistons if such should occur. Simultaneous cut-offs in both cylinders divide the work almost exactly between the two pistons at all stages of load, from the simple friction load to the fullest overload capacity. Pistons easily accessible.



4-CYLINDER TRIPLE-EXPANSION PUMP ENGINE

For driving centrifugal pumps in dredges, for sewage, or for water irrigation or water works plants, wherever high economy is imperative.

With 4 cylinders arranged in pairs at right angles, the balance is perfect and high rotative speeds can be used, suitable for driving pumps. Usual sizes 160 to 1300 h.p.

CHANDLER & TAYLOR CO.

High Grade Steam Engines and Boilers
INDIANAPOLIS, IND.

Products.

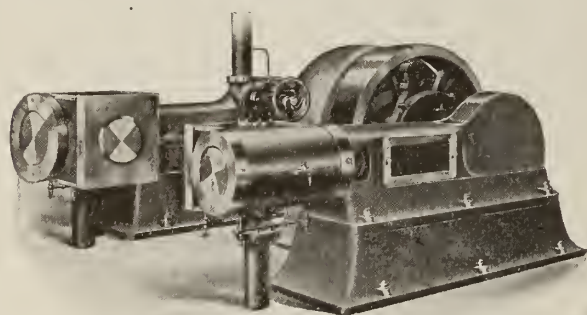
Manufacturers of STEAM ENGINES, Simple, Tandem and Cross Compound, for direct connection to electric generators; VARIABLE SPEED STEAM ENGINES, for paper mills and other places where variable speeds are required; BELTED STEAM ENGINES, Throttling and Automatic; SPECIAL STEAM ENGINES, for direct connection to fans, ice machines, etc.

STEAM BOILERS, Horizontal Tubular and Locomotive Firebox; STEEL CASINGS; STACKS and BREECHINGS; HEAVY GRAY IRON CASTINGS.

Direct Connected Steam Engines.

Simple and tandem compound engines of this type furnished from 25 to 300 kw. in capacity and cross compound in from 50 to 500 kw. Compound engine effects saving of approximately 20% compared with simple engine.

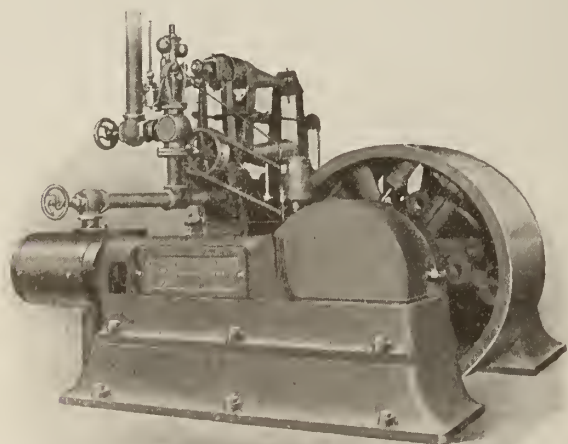
Above engines can be equipped with valve guaranteed to remain steamtight for 5 years and to operate properly under any steam pressure or superheat.



CROSS COMPOUND DIRECT CONNECTED ENGINE

Variable Speed Steam Engines.

Open and enclosed frame variable speed engines furnished for practically any horsepower required and with speed change ratios from 1 to 10. Built for belting to back lines of paper machines and, when made with center crank frames, can be directed right into

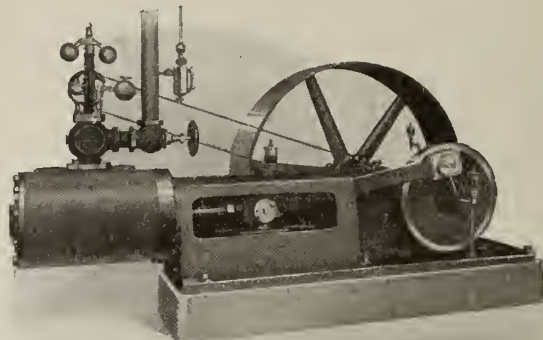


ENCLOSED TYPE VARIABLE SPEED ENGINE

back line. Enclosed type, with our safety stop device, is rapidly becoming a standard product for paper mills.

Belted Steam Engines.

Open or enclosed type with throttling or automatic governors. Open types built from 15 to 250 h. p. and enclosed types up to 450 h. p.



OPEN TYPE THROTTLING ENGINE

Special Steam Engines.

Special engines for direct connection to fans, blowers, ice machines, etc., and for operating under extremely low or extremely high steam pressure. Engines furnished for any reasonable horsepower in low, medium or high speed, single or double reversing.

Steam Boilers.

Horizontal tubular boilers in sizes from 15 to 250 h. p. All boilers built to a factor of safety of 5 and will pass inspection of all well-known insurance companies. Firebox boilers furnished in from 15 to 60 h. p. and built to a factor of safety of 5.

Steel casings for single boilers, or in batteries, or any special form of furnace construction. Standard stacks and breechings, or made to special order.



STATIONARY TUBULAR BOILER

Heavy Castings and Machine Work.

Our equipment permits the execution of moderate sized contracts for heavy castings and machine work.

FAIRBANKS, MORSE & CO.

Manufacturers of Oil Engines

CHICAGO, ILL.

Products.

OIL ENGINES, 10 to 200 h.p.

Kerosene Engines, 1½ to 20 h.p.

All kinds of Scales, Railway Supplies, Motor Cars, Standpipes, Coaling Stations, Water Systems, Tanks and Towers, Hoists, Air Compressors, etc.

For Centrifugal, Steam and Power Pumps, see page 737; for Electric Motors, see page 1113.

"Y" Oil Engine.

EXCLUSIVE FEATURES—(1) The "Y" oil engine gives unfailing, reliable power from a wide variety of low priced fuel oils.

(2) *Operation without Water in the Cylinder*—Water could be used with the fuel to increase the power of the engine but it would result in certain rapid wear on both cylinder and piston. In other words, a possible higher rating has been sacrificed to insure long life to the engine. So the "Y" engine is made with all parts large enough to easily give full power without the use of water injection.

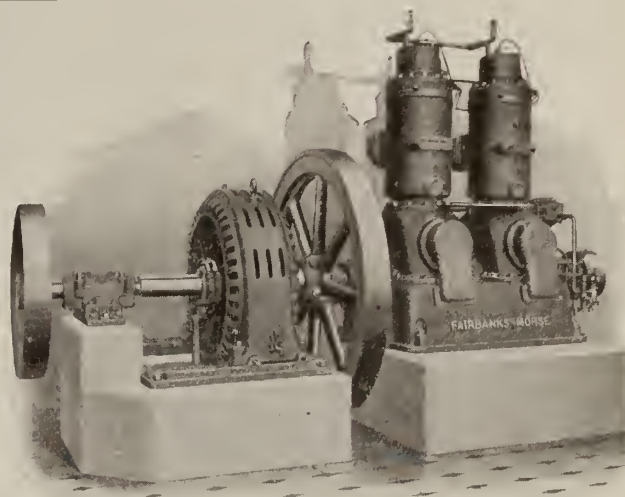
(3) *Perfect Lubrication*—Fuel is injected into the combustion chamber, not into the cylinder where it would impair lubrication. The fuel never comes into contact with the lubricating oil. The main bearings are ring oiling with large oil reservoirs. Piston, piston pin and crank pin are lubricated from a force feed pump.

(4) *No Excessive Temperature*—There is no hot ball or hot bulb to overheat or burn out. The combustion chamber is water jacketed and its temperature is thereby always under control.

(5) *Airtight Crank Case*—Special air seals on the crank shaft are used instead of stuffing boxes which would require repacking. With this construction the main bearings are not inclosed in the crank case; thus lubrication is not interfered with by air pulsations and the bearings may be inspected readily.

(6) *Special Quick Starting Arrangement.*

(7) *New Standard of Low Power Costs*—The "Y" oil engine produces power at a lower cost than any other



75 H.P. "Y" OIL ENGINE DIRECT CONNECTED TO FAIRBANKS-MORSE ALTERNATOR

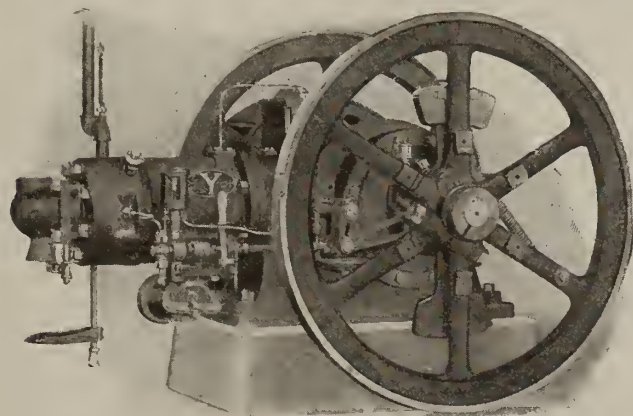
type of plant figured on a basis of first cost including interest and depreciation, fuel, attendance and all other power plant expenses.

It is simple, without carburetors, mixers, timers, batteries, electric igniters, spark plugs, magnetos, switches or high pressure air compressors, etc. It is practically automatic in operation.

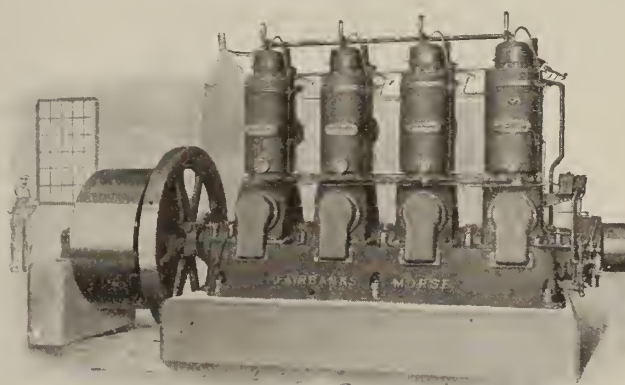
All of the above facts prove economy in maintenance and attendance costs.

DESCRIPTION—This engine operates on the 2-stroke moderately high pressure principle with the fuel injected under pressure in amounts positively governed in proportion to the load; the heat remaining in the combustion chamber, together with that from compression of the air, ignites the oil which then burns and creates a pressure which is more than that in the ordinary internal combustion engine. It operates reliably and continuously on low priced fuel oils.

Thousands of "Y" engines are giving continuous satisfaction in the performance of varied work, proving that its many advantages are appreciated and meet with the approval of discriminating engine users.



25 H.P. HORIZONTAL "Y" OIL ENGINE



200 H.P. "Y" OIL ENGINE

THE FOOS GAS ENGINE CO.

SPRINGFIELD, OHIO

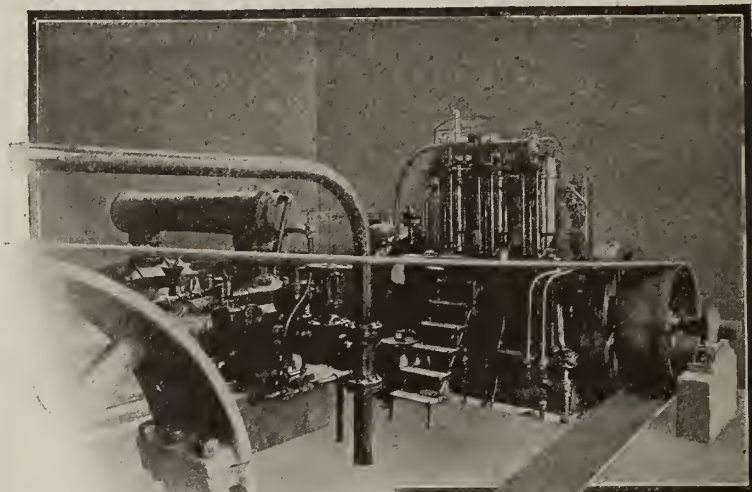
Products.

INTERNAL COMBUSTION ENGINES for industrial service and operating all kinds of stationary or portable machinery, electric generators, pumps, compressors, gasoline plants, refrigerating machinery, etc.

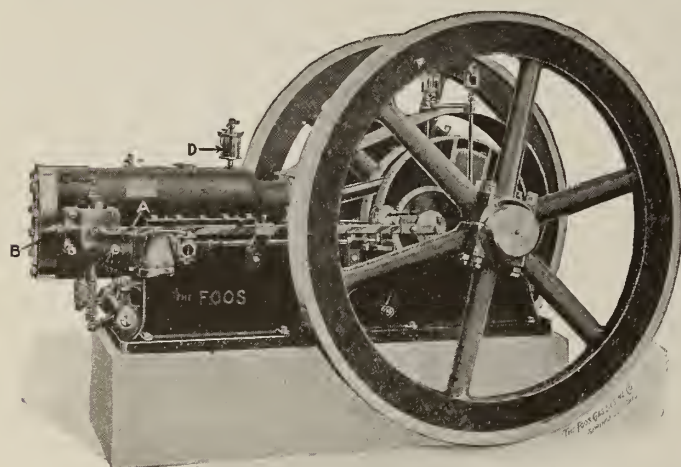
Description.

Four-cycle; throttling governors; electric ignition; single cylinder horizontal, and vertical of 2, 3 or 4 cylinders.

These engines are built in a factory that has followed the best steam engine practice in its machine shop and testing departments for the last 32 years.



TYPE V ENGINE INSTALLED BY UNITED STATES GOVERNMENT



TYPE S ENGINE

The work is manufactured under the limit system. Every detail is permanently standardized by a thorough system of jigs and gages. Testing is by prony brake.

The Foos factory is equipped with every modern device suggested by experience for the economical manufacture of gas engines, and all the stability required by a purchaser who expects to operate his engine from 25 to 30 years.

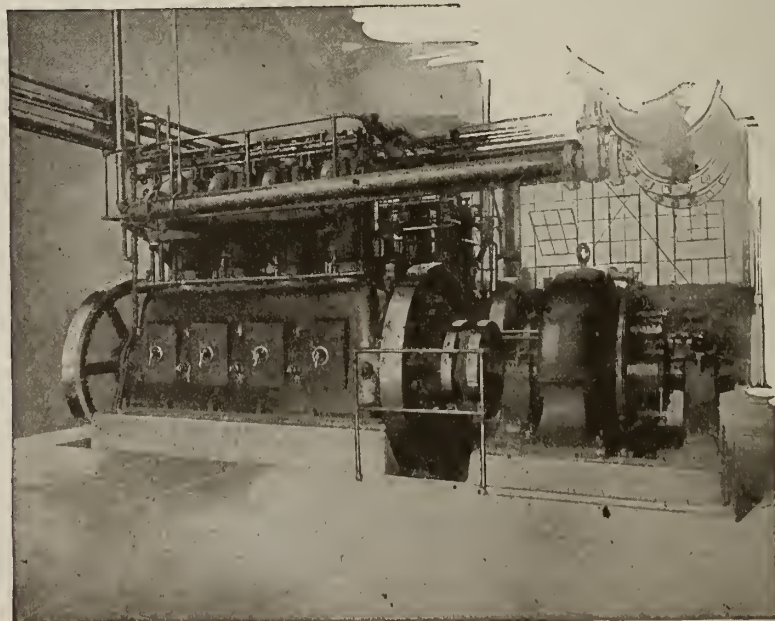
Horsepower Ratings.

TYPE V ENGINE—Natural gas or producer gas, vertical multiple cylinder; 50 to 325 h. p.

TYPE S ENGINE—Natural gas, producer gas, kerosene, 38° distillate, alcohol, gasoline. Single cylinder horizontal; 8 to 90 h. p. according to fuel and service. Suitable for electric light up to 50 h. p. and for practically any other power requirement in all sizes.

Engineering Service.

This company will give expert advice to prospective purchasers and may be depended upon to make suitable recommendations in every case where it is permitted to make a thorough investigation of the customer's requirements. It offers the co-operation of experienced gas engine men (engineers) in its promotion and service departments. Dimension sheets sent to engineers on application to the factory.



TYPE V ENGINE

325 h. p. One of 27 engines in the Hazel-Atlas Glass Co., Washington, Pa.

ESTABLISHED 1845

THE HOOVEN, OWENS, RENTSCHLER CO.

Engines and Machinery

HAMILTON, OHIO

OFFICES IN MOST LARGE CITIES

Products.

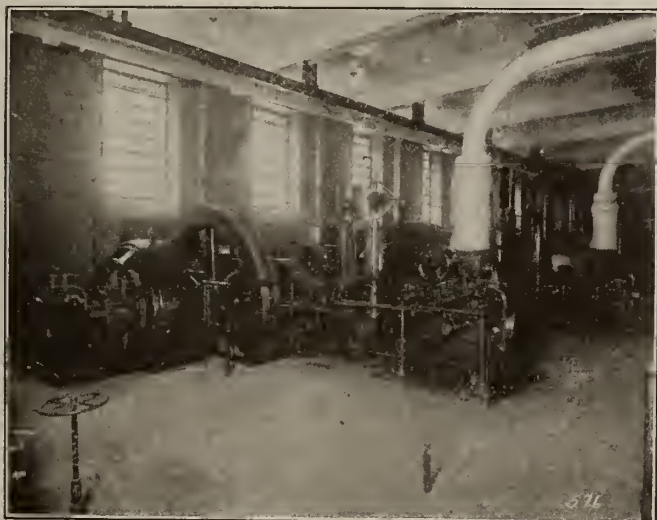
HAMILTON CORLISS ENGINES, POPPET VALVE and UNIFLOW ENGINES, GAS and GAS-STEAM ENGINES, MARINE ENGINES, SUGAR MILLS and CRUSHERS.

Hamilton Pumping Engines, horizontal and vertical; Blowing Engines for blast furnaces; special heavy Cast Iron and Semi-steel Castings.

Hamilton Corliss Engines.

For slow and medium speeds, with releasing gear. Hamilton Corliss Engines have been made since 1882. The first engine built is still in perfect running order. Nearly 5000 have been installed in hundreds of industries.

For heavy work where absolute reliability counts, for plants where steam is used for heating, for all conditions where shutdowns would be costly, the Hamilton Corliss Engine is the ideal power producer. Particularly suitable for paper mills, iron and steel plants, hotels and office buildings, textile industries, etc. Send for bulletin.



CORLISS ENGINES, NOS. 4052, 4053 AND 4054

Three 16x30 simple heavy duty Hamilton Corliss Engines direct connected to 200 kw. generators. Installed in the new Hamilton Co. Court House, Cincinnati, Ohio

Hamilton Poppet Valve and Uniflow Engines.

The latest improvements are incorporated in the Hamilton Poppet Valve and Uniflow Engines. They permit use of higher steam pressures with higher steam temperatures and greater rotative speeds. For economical efficiency the highest type developed in steam engine field. Send for bulletin.

Hamilton Gas and Gas-steam Engines.

This company built Henry Ford's power plant at Detroit, Mich. These big gas-steam units aggregate nearly 60,000 h.p. Nothing is too big for THE HOOVEN, OWENS, RENTSCHLER Co. to undertake with their large

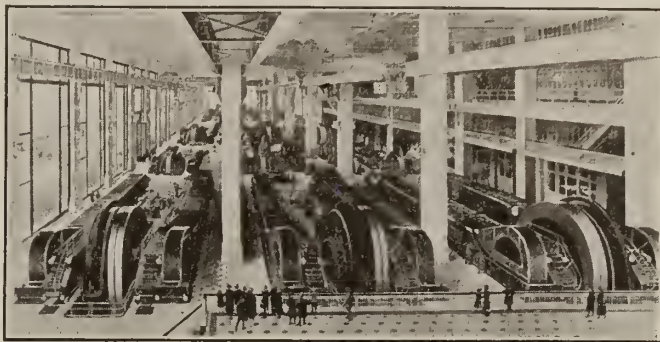
HAMILTON

TRADE-MARK

human and mechanical facilities. Send for detailed technical information.

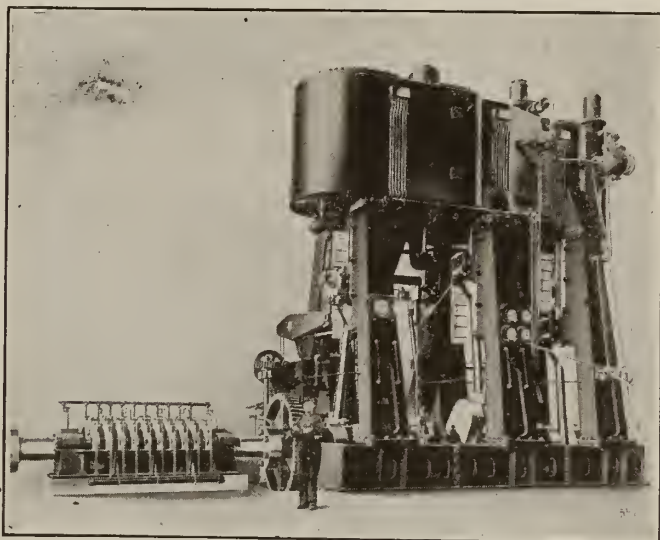
Hamilton Marine Engines.

Standardized production on marine engines from 500 to 5000 h.p. During the war 200 en-



INTERIOR FORD POWER PLANT

gines were built for the Emergency Fleet Corporation working up the production to four complete 2800 h.p.



2800 H.P. TRIPLE EXPANSION MARINE ENGINE

engines a week. Send for booklet, "Building Marine Engines on a Quantity Basis."

Hamilton Sugar Mills.

Cane crushing and grinding mills built complete with power equipment. Many large "Centrals" in Cuba have Hamilton mills. One produced 55,000,000 lbs. of sugar from 1918-19 crop. Send for Sugar Mill Catalogue containing complete mechanical details with illustrations.

Hamilton Service.

This company maintains a large staff of engineers who are authorities in their respective lines. Use them as consulting engineers. Ask them to solve any power problems—to answer any question. This service is free.

THE HOUSTON, STANWOOD & GAMBLE CO.

Manufacturers of Engines, Boilers and Boiler Settings
CINCINNATI, OHIO

Products.

STEAM ENGINES: Throttling Governor and Shaft Governor, Open, also Enclosed Self-oiling.

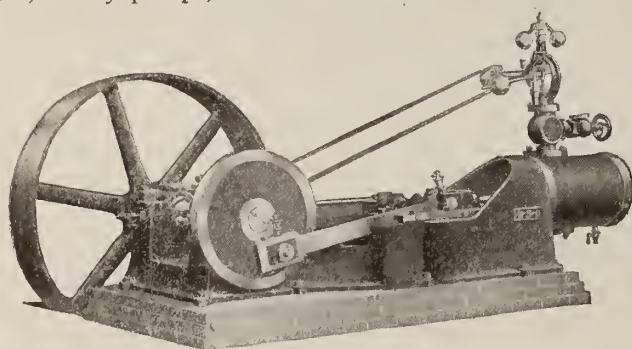
BOILERS: Horizontal Tubular, Scotch Marine and Locomotive Firebox.

Feed Water Heaters, Stacks, Sheet and Plate Work.

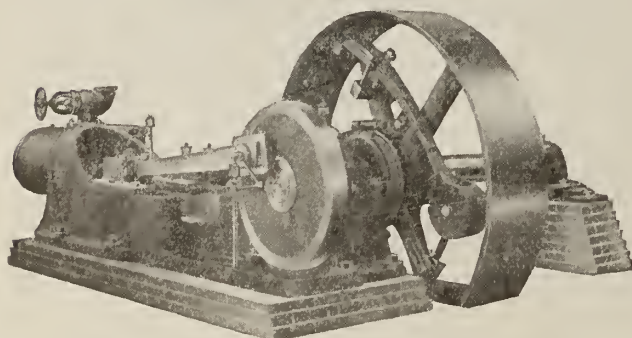
Steam Engines.

This company builds single valve steam engines in sizes from 20 h. p. to 350 h. p.; in the case of engines with throttling governor twin engines with capacity up to 700 h. p. are built.

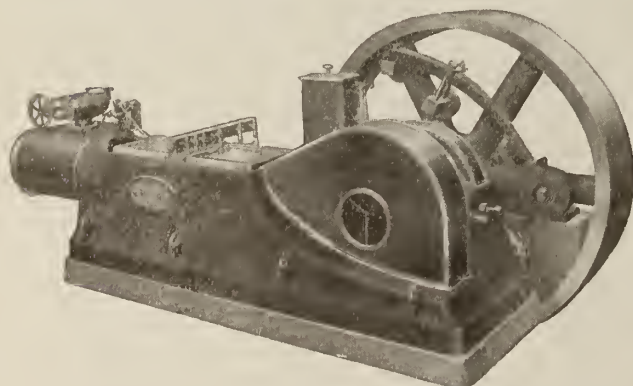
The larger sizes are all side crank, but it also builds center crank engines in sizes up to 75 h. p. Most of these engines are for medium speed, so that this company does not specialize on direct connected dynamo driving. These engines can be used for many kinds of direct connected service, such as fans, blowers, rotary pumps, etc.



THROTTLING ENGINE



SHAFT GOVERNOR ENGINE, OPEN STYLE



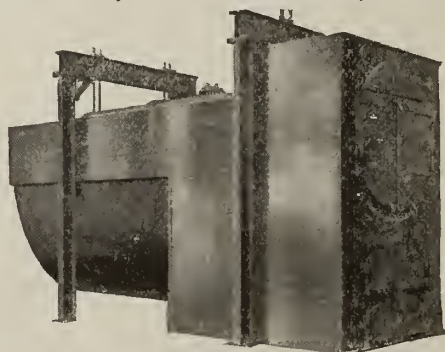
ENCLOSED SELF-OILING ENGINE WITH SHAFT GOVERNOR

Horizontal Tubular Boiler with Steel Casing Setting.

The steel casing setting is a steel jacket which surrounds and supports a heat resisting wall, consisting of a layer of non-conducting material (such as asbestos) and courses of fire brick. A few common brick are used where not exposed to the heat.

This steel jacket reduces the expense of operating horizontal tubular boilers very substantially by almost eliminating leakage of air through the walls into the furnace, thus reducing the fuel consumption; and by holding fire brick together and in place. The repairs are very much reduced, as the cracking of the walls is the cause of most of the repairs required by the ordinary all brick setting. There are other advantages, such as the elimination of most of the common brick; a reduction in space because of thinner walls; cleanliness and neatness in appearance.

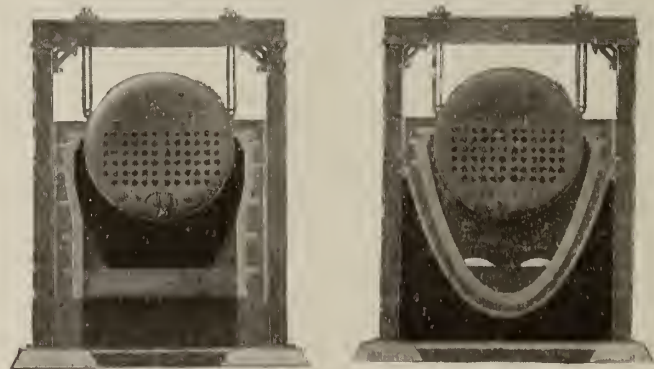
The steel casing is very easy to install. The casing is riveted up at the factory into a small number of sections, which have only to be bolted together, not riveted, at destination. The casing is assembled complete at the factory, fitted and carefully marked.



HORIZONTAL TUBULAR BOILER WITH STEEL CASING SETTING



APPLICATION OF STEEL CASING SETTING



CROSS SECTION VIEWS OF HORIZONTAL TUBULAR BOILER SUSPENDED WITH STEEL CASING SETTING

MUNCIE OIL ENGINE COMPANY

MAIN OFFICE AND WORKS

MUNCIE, IND.

EASTERN OFFICES AND EXPORT DEPARTMENT HEADQUARTERS, 39-41 Cortlandt Street, NEW YORK, N. Y.

Products.

MUNCIE SEMI-DIESEL CRUDE and FUEL OIL ENGINES.

M & G Straight Drive Friction Clutch Pulleys, Roller Bearing Type; Muncie Reversible Friction Clutch Pulleys and Cut-off Couplings.

Muncie Oil Engine.

DESCRIPTION—The Muncie Oil Engine is of the Semi-Diesel type, single cylinder, horizontal construction, operating on the two-cycle principle, obtaining temperature for ignition on the second stroke by means of an especially designed igniter head, which upon starting is preheated by outside means. When engine is in operation temperature of igniter head is maintained by heat of the combustion of fuel.

Crank case is enclosed and front end of piston is used as a scavenging pump. When on the back stroke, it draws air, only, into crank case, through automatic air inlet valve chamber attached to crank case near cylinder. The air is compressed on the next, or forward stroke, within crank case, to a pressure of about 3 lbs.; is then admitted into combustion chamber through transfer ports uncovered by piston.

When on the next, or rearward stroke, a charge of fuel is forced by the governor driven injection pump through injector nozzle in cylinder head, as a finely vaporized mass, directly on to igniter spoon in combustion chamber. Here it is volatilized and ignited by heat from the igniter head, compression plate, and increasing heat of compression, ignition occurring only at end of compression stroke upon closest contact of the gaseous vapor with igniter head and other heated portions.

Exhaust takes place through the lower ports, when uncovered by piston at the completion of the expansion or working stroke, and is aided by inrushing air from crank case admitted slightly later on opposite side.

Principles of combustion employed embody patented devices without whose uses such success as is produced in the Muncie can not be obtained. The particular design of the combustion chamber is patented.

The Muncie Oil Engine is a slow speed engine, all sizes developing their rated capacity at or near 750 lin. ft. per minute piston travel. Even the 20 h. p. engine operates at as low speed as 250 r. p. m. (with piston travel of 540 ft. per minute). The reduced piston travel as compared to other engines means many years of life added.

The Muncie is also of *medium compression type*, and will give better economy, even, than many engines so proudly referred to as high compression

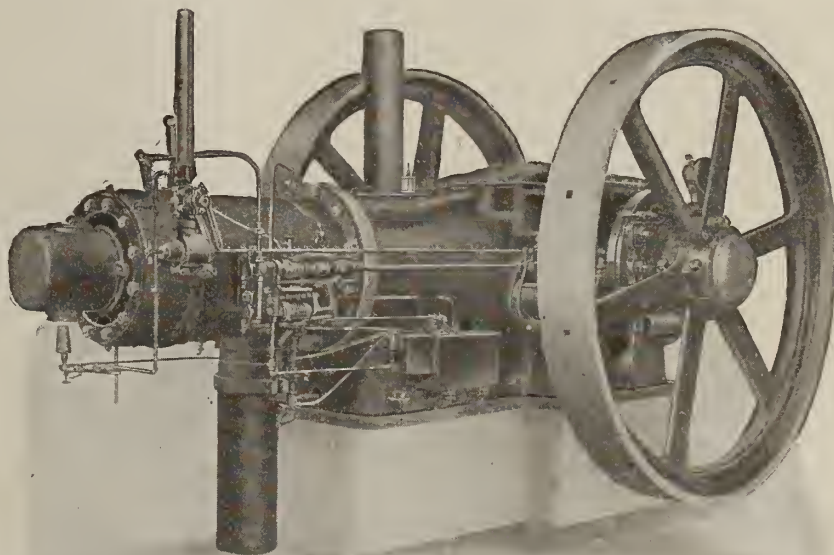
engines. Our design permits of a better efficiency, and the actual use of as low and lower grades of fuels, successfully than any other semi-Diesel engine with higher compression, and in the Muncie the user is not submitted to the trials that such engines encounter through dangerous explosions, bumping and pounding, reduced fuel economy due to losing compression, etc., since such design engines will not maintain their economy at any but their height of compression, and ideal functioning of all accessories.

FUELS USED—Heavy crude oils, heavy fuel oils, 18° to 28° Baumé or higher, kerosene, distillate, naphtha, solar oil, gas oil, or other distillates of petroleum commonly used as liquid fuels, which are free from dirt or grit, or non-combustible matter, and contain less than 1% of water or sulphur, with flashing point 100° Fahr. (open cup) of above.

FUEL CONSUMPTION—From .60 to .70 lbs. ($\frac{2}{3}$ to $\frac{3}{4}$ pts., average run of fuels) per b.h.p. hour, the higher efficiency obtaining in larger sizes. Best economy resulting from oils of 24° to 28° Baumé.

GENERAL USAGE—For any stationary requirement where the duty is heavy or severe and constant and reliable service is expected, and the sizes offered will suffice; such as ordinary industrial or municipal plants, lighting or pumping, machine shops, ginning plants, flour mills, feed mills, gravel boats, heavy dredges, mine pumping or power plants, pipe line service pumping stations, or operation in crude oil fields. Sizes, 10 to 125 h.p. single units; 250 h.p. twinned units.

SPECIFICATIONS—Catalogue 23 contains full specifications.



FULL RIGHT-HAND VIEW 100 H.P. TYPE "C" SPECIAL HEAVY DUTY MUNCIE OIL ENGINE
16-in. bore by 24-in. stroke, speed 190 r.p.m., weight 32,500 lbs. Sizes, 100 and 125 h.p. only

NORDBERG MANUFACTURING CO.

Designers and Builders of Engines, Mine Hoists, Air Compressors and Condensers
MILWAUKEE, WIS.

Products.

DIESEL TYPE STATIONARY and MARINE OIL ENGINES.

STEAM, AIR and ELECTRIC MINE HOISTS.

AIR COMPRESSORS; BLOWING ENGINES.

CORLISS POPPET VALVE and UNIFLOW POPPET VALVE STEAM ENGINES.

STEAM STAMPS and CONDENSERS.

GAS COMPRESSORS.

NORDBERG



MACHINERY

TRADE-MARK

parallel motion* prevents the brake blocks from dragging on the brake ring when the hoist is in operation and insures a perfect contact and equal pressure on all parts of the brake blocks. Hence even wear and maximum effective life of the blocks are secured.

The Nordberg axial plate type clutch as used on Nordberg hoists is the only type of friction clutch that has equal driving power in both directions of rotation. Gripping of clutch is accomplished without producing any end thrust on drum shaft or drum.

The specially designed features, on the brake and clutch operating cylinders, for controlling oil, combined with the floating lever control between the platform and operating valve, make the operation of the brakes and clutches as perfect as if operated directly by hand. However, the parts may be moved with only a few pounds exerted on the operating levers.

Diesel Type Stationary and Marine Oil Engines.

Nordberg Diesel type stationary and marine oil engines are especially adapted for heavy duty work, and range in sizes from 330 to 3000 boiler h.p. For stationary service they are used extensively in electric light and power plants, flour mills, mining industries, machine-shops, textile works, cement industries, water works, shipyards, chemical works, refineries, compressor plants, irrigation plants, ice manufacture, etc. Nordberg Diesel engines are made for either constant or variable speed and when operated at variable speed can be used in connection with compressors, blowing engines, pumps, ice machines, etc. For operation in high elevations and for continuous non-stop service they will be found particularly well adapted. They burn a large variety of fuel oils with exceptional economy. Particular attention is called to the large sizes of Nordberg marine and stationary units.

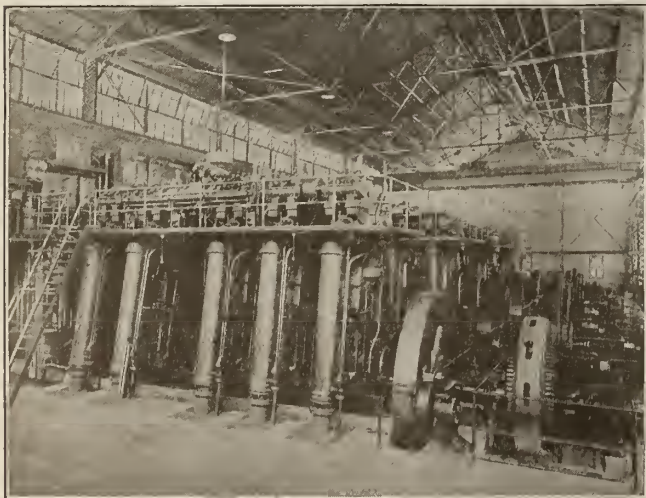
Coal Mine Hoists.

For coal mines where depth is not excessive and rapid hoisting is desired, Nordberg coal mine hoists will be found especially well adapted and economical. Equipped with oil-operated post brakes and where cylindro-conical drums will prove advantageous Nordberg hoists are fitted with them. A Nordberg safety stop which will safeguard the hoists under all operating conditions can also be furnished. Sizes range from 100 h.p. with drums of 4-ft. diameter to larger sizes with immense drums and greater horsepower.

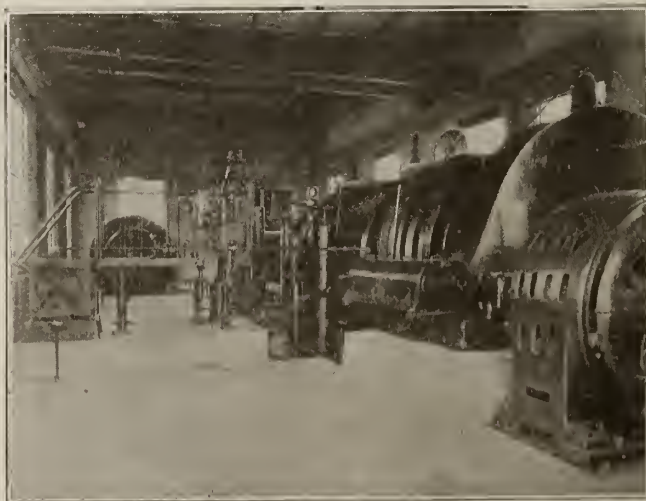
All post brakes are so designed that the posts move with parallel motion when engaging and releasing. The

Air Compressors and Blowing Engines.

Nordberg air compressors and blowing engines are built in the larger sizes only, the air compressor having capacities of 2,000 cu. ft. per minute and larger and the blowing engines 10,000 cu. ft. per minute or more. They are arranged for motor, steam or oil engine drive. Owing to the demand for higher speeds, Nordberg air compressors are equipped with plate valves in place of Corliss valves operated by wrist plates and eccentrics. Nordberg plate valves consist of thin strips of steel seated on cast iron seats. The cast iron seats, carrying the valves, guides and guards, are built in the form of a cylinder which fits into the same set of parts formerly used for the Corliss valves. This form of construction makes it possible to convert any of the older types of Nordberg air compressors into the most modern compressors on the market, simply by dispensing with the valve gear and Corliss valves and substituting Nordberg plate valves. Air compressors of the two-stage type equipped with Nordberg plate valves can be operated at no capacity, half capacity or full capacity and these are under control of an air governor which will operate to maintain a constant discharge pressure.

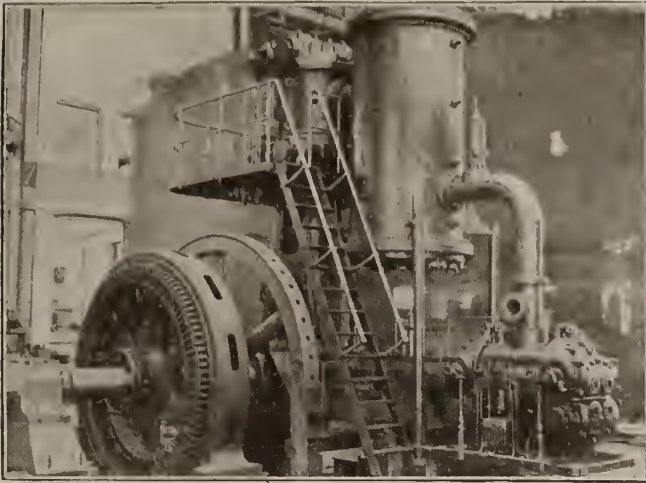


FOUR 1250 B.H.P. NORDBERG-CARELS DIESEL ENGINES DIRECT CONNECTED TO GENERATORS, AND ONE 750 B.H.P. ENGINE DIRECT CONNECTED TO AIR COMPRESSOR, BURRO MOUNTAIN COPPER CO., TYRONE, N. M.



A LARGE NORDBERG COAL HOIST, AMERICAN COAL MINING COMPANY, BICKNELL, IND.

Capable of hoisting 4 tons of coal per trip—6000 tons in 8 hours



A NORDBERG COMPRESSOR BUILT FOR THE UNITED VERDE EXTENSION MINE
Capacity 4000 cu. ft. at 163½ r.p.m.

Steam Engines.

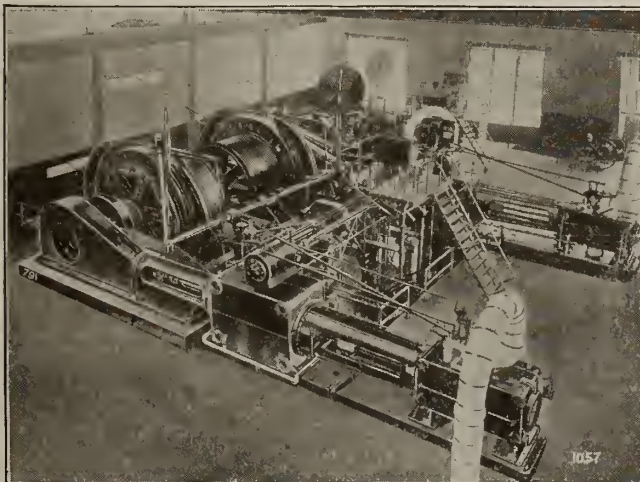
The Nordberg-Todd Uniflow and poppet valve engines are the highest type of steam prime movers known to the engineering profession. Producing exceptional operating economies when new, they maintain them over a long period of years. The Uniflow engines have poppet valve gears; furnished in sizes of 200 h.p. and up. Suitable for operating condensing, non-condensing or with high back pressure and with any steam pressure or superheat; when operating under any of these conditions, with wide variations of load, steam consumption is exceptionally low.

Nordberg poppet Corliss compound engines are used when the power required is constant and the lowest possible steam consumption is desired. They are for condensing operation only.

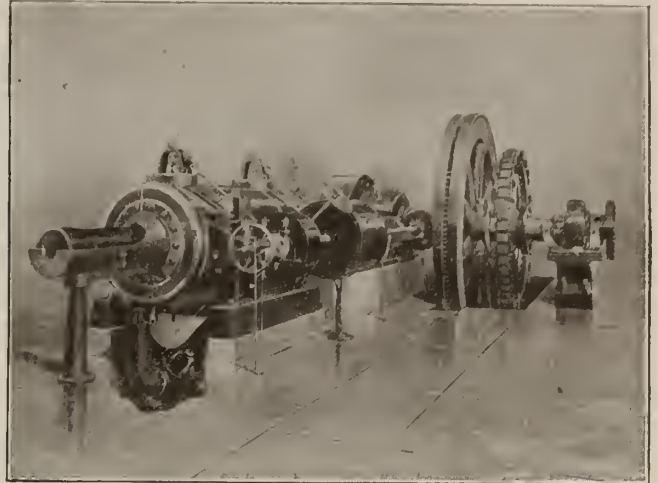
Both simple tandem and cross compound Nordberg Corliss engines may be had in sizes of 100 h.p. and up.

Metal Mine Hoists.

STEAM DRIVEN—When the depth is from 1,000 ft. to 14,000 ft., Nordberg mine hoists are specially designed to meet the conditions. The motive power may be simple Corliss or compound condensing Corliss engine. Nordberg post brakes operated by oil, Nordberg oil-operated axial plate clutches, and Nordberg safety stops are used. Cyliandro-conical drums are specified when their use is advantageous. Safety is the first consideration of Nordberg engineers.



NORDBERG TWIN TANDEM COMPOUND CONDENSING HOIST AT ANVIL MINE OF NEWPORT IRON CO., BESSEMER, MICH.
Rope pull, 24,000 lbs.



NORDBERG-TODD UNIFLOW POPPET® VALVE ENGINES
Consume less steam per horsepower than any other steam prime mover

ELECTRICALLY DRIVEN—Nordberg electrically driven metal mine hoists are equipped with drums 4 ft. or larger in diameter and have motors of 100 h.p. capacity or more. They comprise the direct coupled, the single reduction gear, and the double reduction gear types. Post brakes, axial plate clutches, hydraulically operated devices and Nordberg safety stops are among the features worthy of note.

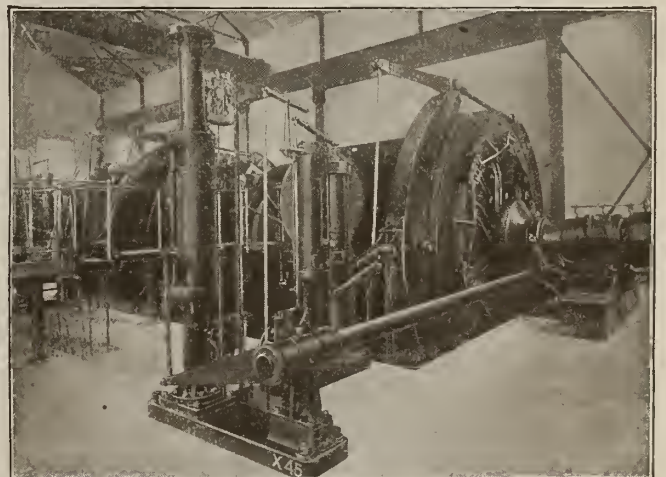
Steam Stamps and Condensers.

Nordberg steeple compound steam stamps are generally used to crush the ore leaving the jaw crushers to a size that will pass an ⅛-in. mesh screen. A single Nordberg stamp has a capacity of 700 tons of ore per 24 hours. They operate compound condensing and are extremely economical in steam consumption.

Nordberg condensers comprise jet condensers, either steam or power driven; surface condensers, with either steam or power operated air pumps; and, where the quantity of steam to be condensed is large, counter-current jet condensers with Corliss engine-operated air and circulating pumps are recommended.

Nordberg Service.

Nordberg's corps of highly trained engineers will gladly assist in the solution of engineering problems involving the use of any of the above mentioned apparatus. State the conditions to Nordberg.



FIRST MOTION MINE HOIST, ELM ORLU MINE
One of the largest first motion mine hoists used in this country. It winds 3500 ft. of rope at a speed of 2500 ft. per min.

RIDGWAY DYNAMO & ENGINE CO.

RIDGWAY, PA.

BRANCH OFFICES AND AGENCIES

NEW YORK, N. Y., 38 West 32d Street
PITTSBURGH, PA., Oliver Building
WASHINGTON, D. C., Woodward Building
PHILADELPHIA, PA., Real Estate Trust Building
CLEVELAND, OHIO, Schofield Building
CINCINNATI, OHIO, 238 Senator Place
CHICAGO, ILL., Marquette Building

WILKES-BARRE, PA., Second National Bank Building
ATLANTA, GA., Healey Building
ST. LOUIS, MO., Chemical Building
DENVER, COLO., LINDROOTH, SHUBART & Co.
NEW ORLEANS, LA., ELECTRIC APPLIANCE Co.
SEATTLE, WASH., HALLIDIE MACHINERY Co.
SAN FRANCISCO, CAL., COAST EQUIPMENT Co.

Products.

SINGLE-VALVE and FOUR-VALVE, SIMPLE, TANDEM COMPOUND and CROSS COMPOUND STEAM ENGINES; STEAM TURBINES.

DIRECT and ALTERNATING CURRENT GENERATORS, direct connected, belted and coupled types; MOTOR GENERATORS, BOOSTERS and BALANCERS; TURBO-GENERATOR UNITS, direct and alternating current.

BLOWERS, turbine and motor driven.

Engines, Single-valve and Four-valve Type.

BEARINGS—The main bearing on all sizes is of the quarter box type. Shells are lined with genuine babbitt, carefully pened in place and bored out in accurate jigs, and are, therefore, interchangeable; and all shells may be quickly and easily removed without taking shaft out of bed. Horizontal adjustment is secured by a wedge, and vertical adjustment by drawing down the cap.



MAIN BEARING

CROSSHEAD—Crosshead body is made of annealed cast steel. Shoes are of cast iron, faced with genuine babbitt, and are of the cylindrical type.

Crosshead pin is made of hardened steel, ground perfectly true. Ends are tapered where they fit the body, and provision is made for turning 90° as it wears.

CONNECTING ROD—Connecting rod is forged from the best open hearth steel, insuring ample strength under the most severe operating conditions. Straps at both ends are slotted out of the solid forging, and there is no strain on loose parts, such as keys or bolts. Crosshead pin box is of solid phosphor bronze, while the crank pin box is of bronze, lined with babbitt, pened and bored.



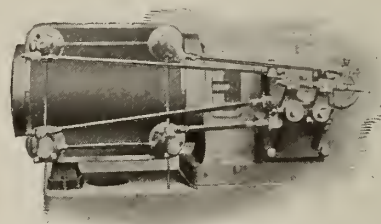
CONNECTING ROD

GOVERNOR—The governor used on all Ridgway engines is the pioneer centrifugal-inertia governor, and is distinctive for its refinement of construction and perfection of operation.

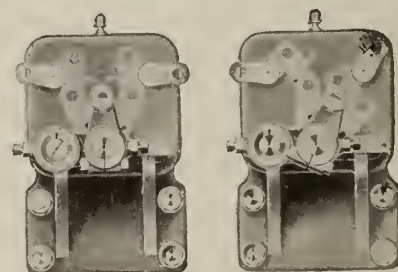
TYPES—Ridgway side crank, single-valve and four-valve engines are built in the simple, tandem compound, and cross compound types. The sizes of simple and tandem compound engines range from 30 to 900 h.p., and cross compound engines up to 1500 h.p.

SINGLE-VALVE ENGINE—Cylinder and valve on this engine are the same that the company has used for over 25 years on its center crank engines.

FOUR-VALVE ENGINE—The accelerating gear is a system of toggle joints, by means of which the motion from the eccentric is so modified that the valves are at rest during one-half of the stroke, and opening and closing occurs when they have their maximum velocity. The travel of the valves after closing is only enough to secure a satisfactory seal, and is much less than with any similar type of gear. As a result, friction in, and the strains on, the accelerating gear are reduced to a minimum, and it operates easily and noiselessly, even when comparatively loose. The port openings are unusually liberal at points of cut-off up to and including one-quarter, without being greater at later points than is necessary or desirable.

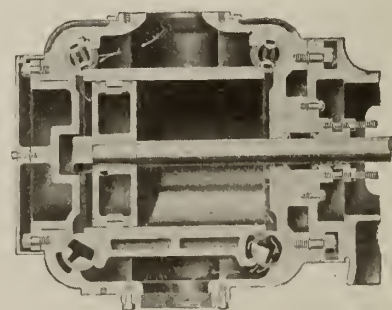


DETAIL SHOWING VALVE GEAR



PHANTOM VIEW OF GEAR CASE

The exhaust valve gear is identical with that used on releasing gear Corliss engines. It is the usual wrist-plate motion; but instead of being mounted on the cylinder, it is located on the same bracket which carries the steam valve gear.

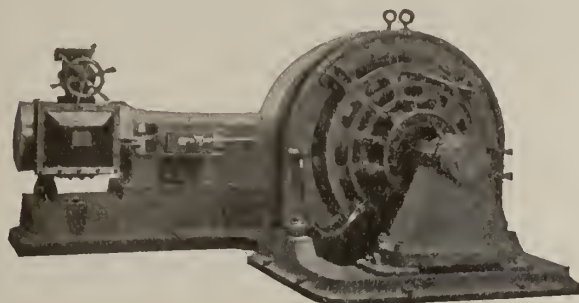


SECTION OF CYLINDER AND VALVES

Direct Current Generators.

Ridgway direct current generators are provided with a compensating field winding, making them capable of handling the most extreme overloads without sparking or injury. For haulage, hoisting, and industrial work, where there are frequent overloads, they

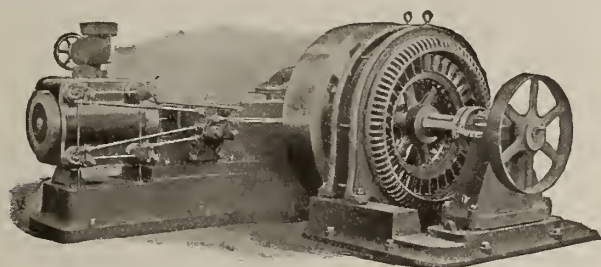
are without an equal. The field is of laminated construction throughout and responds almost instantly to changes in the magnetizing current. This feature means better regulation than is possible with a cast iron or cast steel field. Three-wire generators are built from the two-wire designs, with but slight changes in the connections and the use of a single choke coil.



SINGLE-VALVE, SIDE CRANK ENGINE WITH DIRECT CONNECTED, DIRECT CURRENT GENERATOR
Sizes 25 kw. to 750 kw.

Alternating Current Generators.

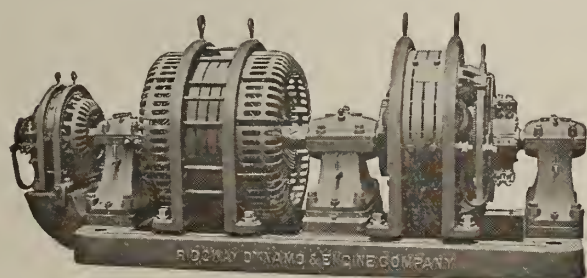
Ridgway alternating current generators are of the revolving field type, with strip wound field coils on the large sizes and wire wound coils on the small. The armature core is built of thin laminations of transformer steel, clamped between heavy cast iron rings in such a way as to leave the outside of the core exposed, thereby securing the maximum ventilating effect. Standard alternating current generators are wound two-phase or three-phase, for 25 and 60 cycles, and in the usual voltages. Special machines can often be built from standard patterns. The line covers direct connected, belted and coupled, or water wheel type of machines.



FOUR-VALVE, SIDE CRANK ENGINE WITH DIRECT CONNECTED ALTERNATING GENERATOR
Sizes 35 k.v.a. to 750 k.v.a.

Motor Generator Sets.

The increasing use of central station power in certain industrial plants has created a demand for motor generator sets of various characteristics, especially for transforming alternating to direct current.



MOTOR GENERATOR SET, SYNCHRONOUS MOTOR AND DIRECT CURRENT GENERATOR
Sizes 10 kw. to 1000 kw.

Ridgway direct and alternating current generators, when combined into a motor generator set, possess all of the good features of the separate machines, and make a unit having the highest possible efficiency and overload capacity. Combinations can be made of self-starting synchronous motors, with or without exciters, induction motors, direct current two-wire and three-wire generators, series boosters and direct current motors. Sets with synchronous motors can be arranged to operate with either end acting as the motor.

Turbo-generator Units.

The Ridgway-Rateau-Smoother turbine is built under a license to use the well-known Rateau patents. This turbine is of the impulse type, in which the steam acts solely by its velocity. Simplicity in the governor and valve gear, together with large clearances between stationary and moving elements, are features which should appeal to every prospective user.

Ridgway direct and alternating current generators, turbo-type, follow the most advanced practice in the design and construction of such machinery.



TURBO-ALTERNATOR UNIT. RATEAU TURBINE
Sizes 300 kw. to 3000 kw.

Blowers (Turbine and Motor Driven).

High speed blowers, for blast furnace, smelter, and similar work, have many advantages over low speed engine driven blowers. The RIDGWAY DYNAMO & ENGINE CO. has built a number of such blowers, both turbine and motor driven, and each installation has been a marked success. The variations, requirements and conditions of operation are so great as to preclude any description in this book, but inquiries for such equipment are invited and will be given prompt attention.



TURBINE DRIVEN BLOWER

Service.

Courtesy, strict attention to all details, and an efficient organization, coupled with the best facilities for promptly and satisfactorily filling all orders, are directly responsible for the success gained by this company.

The Engineering Department is always at the command of prospective customers requiring information regarding the best type of equipment to use for special purposes.

STERLING ENGINE COMPANY

Marine and Stationary Gasoline Engines

BUFFALO, N. Y.

Products.

"STERLING" GASOLINE MOTORS for stationary work for driving centrifugal pumps and electric generators.

"Sterling" Marine Gasoline Engine.

"Sterling" Prestige.

The "Sterling" engines, designed for driving centrifugal pumps and electric generators, are backed by an organization represented in practically every country on the globe. The marine product has been manufactured for over 16 years, during which time it has been extensively used by the United States Navy and many foreign navies. The racing engine, built by this company, holds the world's marine speed record for 6, 30 and 90 miles and has held the American championship for 8 consecutive years.

Maximum Fire Protection Service.

The "Sterling" engine provides a dependable source of auxiliary power to meet fire emergencies.

The wonderful records made by the motors, and the reputation they have gained in the marine field for exceptional power and longevity, has led to the redesigning and adaptation of the engines for stationary work, and today there are numerous units installed in townships, villages and factories as standby plants for fire protection; driving centrifugal pumps, and also generators. The motors are admirable for this service as they develop their rated power at speeds up to 1400 r.p.m.

Notable Advantages.

The "Sterling" is a quiet and smooth running engine. Vibration has been practically eliminated by scientific precision in design and construction. Longevity is assured through the extensive use of drop forgings for crank shaft (chrome nickel steel), cam shafts and connecting rods, for bearing caps and timing gears, in addition to which, bronze and aluminum castings of great tensile strength are specified throughout the motors, the material being the best procurable. An examination of the motors will readily disclose a high standard of workmanship.

As required by state laws governing factory equipment, all moving parts including the flywheel are neatly enclosed. However, unusual provision has been made for accessibility. All covers are easily removed and attached and ample space is provided in which to make adjustments if required. Accurate dimensions are ad-

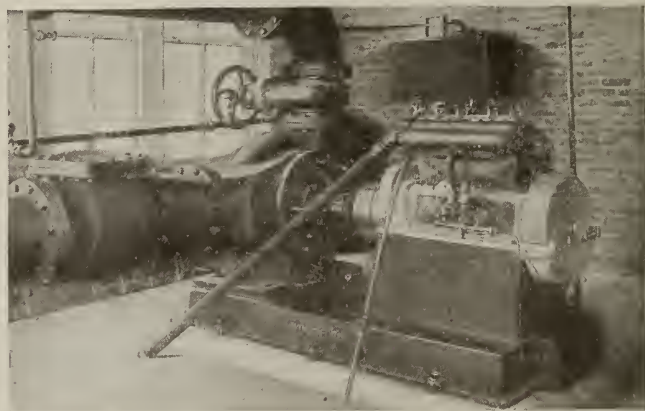


TRADE-MARK

hered to so that parts ordered in replacement will always fit properly.

The equipment of electric starter and electric generator, with battery, assures power immediately to meet any emergency. This power is constant, as the motors may be de-

pended upon to run satisfactorily for long periods at maximum revolutions per minute under full load.



MODEL EC2, 25 H.P. "STERLING" MOTOR DIRECT CONNECTED TO A KINGSFORD CENTRIFUGAL SANITARY PUMP

STANDARD SIZES UNDERWRITERS' FIRE PUMPS AND THE "STERLING" ENGINES REQUIRED

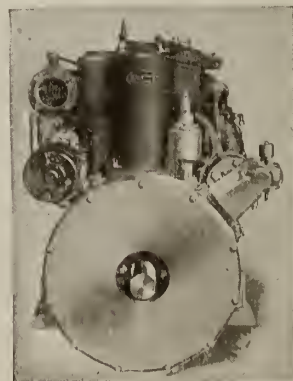
Gallons per minute	No. 1½-in. streams	H. p.	Engine, Sterling Model
500	2	60 to 64	FC-4
750	3	80 to 88	FC-6 (at 1400 R. P. M. Model FC-4)
1000	4	100 to 107	FC-6
1500	6	133 to 148	FC-8

"Sterling" Model EC2, 25 H. P. Motors.

The regular equipment of this model comprises high tension dual magneto, impulse starter type; primary and secondary wires; spark plugs; hexagon ball nut terminals; complete hollow crank shaft pressure oiling system with gauges, tank, tubing and pumps; water circulating pump; carburetor; gasoline strainer; engine controls; emergency starting lever; governor; stub shaft machined for mounting flexible coupling.

Where electric starter-generator is ordered, the equipment will include, in addition, electric starter-generator, storage battery and starting switch.

Extra equipment will be furnished on request.



FORWARD END, FC ENGINE ARRANGED FOR FORWARD DRIVE

DETAILS OF MODEL EC2, 25 H.P. "STERLING" ENGINE AND TABLE OF DIMENSIONS OF ALL MODELS OF STERLING ENGINES

Model	No. of cylinders	Bore, in.	Stroke, in.	R. p. m.	H. p.	Weight, lbs.	Base,	Floor space, in.	Price
FC*	4	5½	6¾	800-1200-1400	60-85-100	1625	Iron	50¾x24	\$2000.00
FC*	6	5½	6¾	800-1200-1400	85-125-145	2050	Iron	68 ½x24	2500.00
FC*	8	5½	6¾	800-1200-1400	120-180-200	2600	Iron lower, bronze upper	84 1½x24	3350.00
FC*	8	6¾	9	800-1000	240-300	5600	Iron lower, bronze upper	102x26½	On application
DC-12	2	5½	7	400-500	12-15	1000	Iron	— —	On application
†EC2-25	4	3¾	5½	600-1000-1200	17-25-30	550	Aluminum upper, iron lower	40 1½x18½	\$1100.00 925.00

*Regular equipment includes electric starter and generator (2 units).

†Regular equipment includes electric starter-generator (single unit). Price \$925.00 is without starter-generator. Information concerning engines not illustrated or described here will be sent on request

“Sterling” Model FC, 60-300 H. P. Motors.

Regular equipment includes electric starter and generator; storage battery; starter and generator cable; electric switches; hydrometer; ammeter; high tension dual magneto, impulse starter type; primary and secondary wires; spark plugs; hexagon ball nut terminals; complete hollow crank shaft oiling system with gauges, tank, tubing and pumps; water circulating pump; carburetor; gasoline strainer; engine controls; emergency starting lever; governor; forged stub shaft, machined for mounting flexible coupling.

Extra equipment furnished on request.

DESCRIPTION
— “Sterling”

commercial engines are built heavier than the average motor offered for similar purposes, assuring exceptional strength. The upper base is quite rigid, due to the fact that it has no two parallel sides and is strongly ribbed.

In addition, the arch webb construction for holding the journal caps, renders practically impossible the bending or distortion of either base or crank case under heavy load.

Large handhole plates are provided on both sides of the upper base. The lower base is a single rigid jointless casting extending the full length of the engine and designed expressly for stationary work.

The crank shafts on all Model F “Sterlings” are in revolving balance, provided for by counterweights on the crank sheet opposite each throw. The crank shaft is of exceptionally large diameter drop forged from chrome nickel steel, double heat treated, and has a tensile strength of 115,000 lbs. per sq. in. The important item is to have sufficient bearing surface. Connecting rod bearings throughout the Model F motors are 3½ in. long, intermediate bearings 4 in. long. The end main bearings are 3¾ in. long on the 4-cylinder model, and 4⅞ in. long on the 6- and 8-cylinder models. The total bearing surface on the 4-cylinder model is 200.23 sq. in., the 6-cylinder 305.86 sq. in., and the 8-cylinder 392.59 sq. in.

The inner wall of the cylinder is skirted into the base, providing a guide for the piston during the full length of the stroke. Spark plugs pass through water jacketed bosses in the cylinders, keeping them cool and giving them longer life. Valve seats water jacketed completely around circumference.

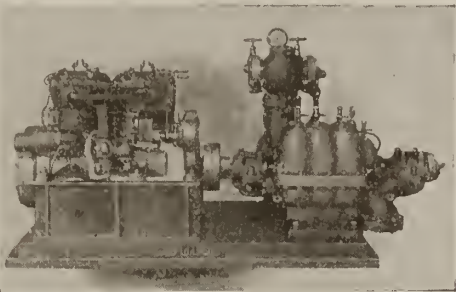
The oiling system of all Model EC and FC “Sterlings” is the hollow crank shaft force feed lubricating type, whereby oil is supplied to main bearings under pressure and conducted to connecting rod bearings, also under pressure, by holes drilled in the crankshaft. A pressure of approximately 15 lbs. of oil is maintained on these bearings. An oil sight gauge and an oil pres-

sure gauge provide a constant, accurate check on the oiling system.

A 2-spark dual magneto firing 2 plugs simultaneously in each cylinder is furnished with each FC motor, assuring the absolute dependability of this vitally important function.



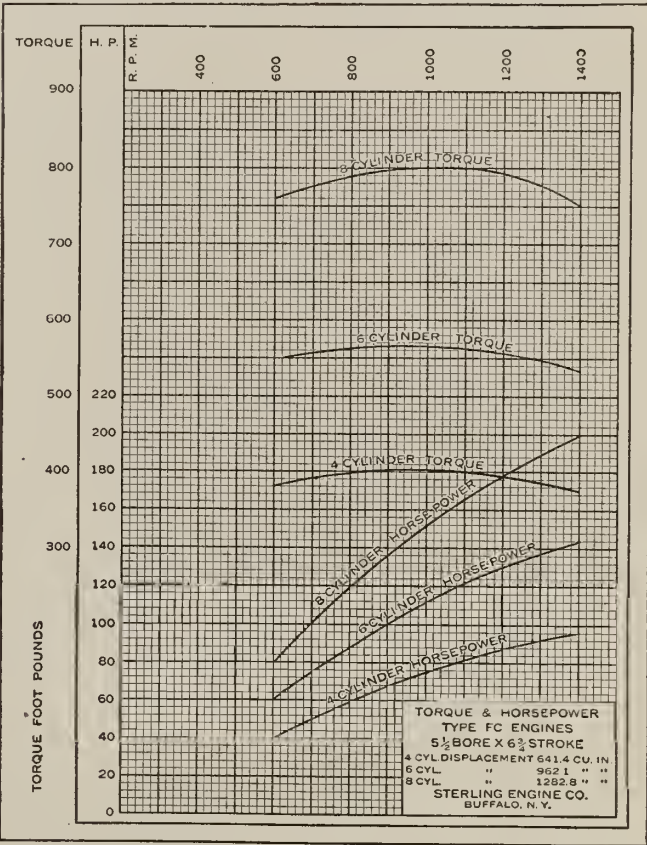
FC 8-CYLINDER “STERLING” DIRECT CONNECTED TO 3-STAGE DAYTON-DOWD TURBINE FIRE PUMP



FC 4-CYLINDER “STERLING” MOTOR DIRECT CONNECTED TO 3-STAGE GOULDS CENTRIFUGAL UNDERWRITERS’ PUMP

Tests and Guarantee.

Every “Sterling” engine is subjected to a severe and rigorous test and never leaves the plant until it is in perfect order and has been thoroughly “run in” and limbered up. The company guarantees every engine for one year from date of shipment and will replace within that time, all parts giving out under normal service, because of defect in material or workmanship.



GUARANTEED FUEL AND H.P. CURVES, MODEL FC, “STERLING”

The FC 5½-in. bore motors at 1200 r. p. m. or even at 1400 r. p. m., are, from a standpoint of fuel economy, a most desirable size for the Underwriters’ Fire Pumps. Less power would be insufficient, more power superfluous. The FC motors possess just the right reserve

PITTSBURGH FILTER & ENGINEERING CO.

Heavy Duty Oil Engines

GENERAL SALES OFFICE, ENGINE DEPARTMENT

280 Broadway

NEW YORK, N. Y.

TELEPHONE:
WORTH 213

GENERAL OFFICE, PITTSBURGH, PA.

BRANCH OFFICE, KANSAS CITY, MO.

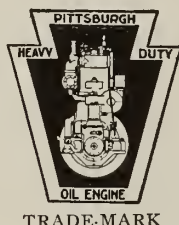
CABLE ADDRESS:
"FILTWATER N Y"
Codes: ABC, 5th Edition
Liebers, Western Union
and Bentley
WORKS, OIL CITY, PA.

Products.

BRONS HVID TYPE HEAVY DUTY OIL ENGINE, 50, 75, 100 and 150 b.h.p. units for marine and stationary service.

Also, Oil Engine Direct Connected Generator Sets for electric light and power.

For Water Filters and Water Softening Plants, see page 807.



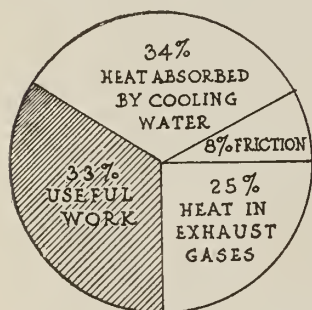
TRADE-MARK

Pittsburgh Heavy Duty Oil Engine.

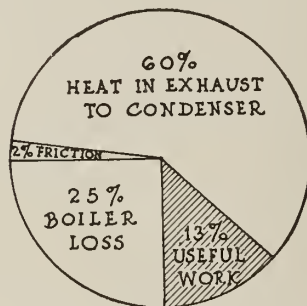
The Pittsburgh Brons Hvid heavy duty oil engine is a scientifically designed and highly efficient type of prime mover, utilizing crude petroleum or its refined products, such as fuel oil. It operates on the "constant pressure" combustion principle.

The fuel, entering air heated to about 1000° Fahr., due to high compression is completely and rapidly burned. This means that low grade fuels may be used with high thermal efficiency. The percentage of heat units which do useful work in heavy duty oil engines, high compression types, is higher than in any other type of commercial engine.

Where the heat units go may be seen in the diagram below, paying particular attention to the shaded portion.



100 h.p. Brons Hvid Heavy Oil Engine

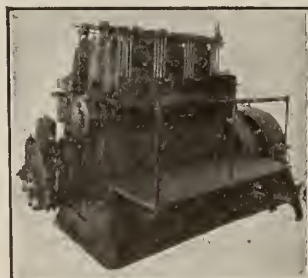


1,000 h.p. Condensing Steam Plant

DIAGRAM SHOWING UTILIZATION OF HEAT UNITS

The Pittsburgh heavy duty oil engines have been developed after an intimate study of the subject and by carefully conducted experiments by engineers of many years' experience in designing oil engines. This engine is built on a quality basis with a satisfactory and economical performance the principal aim.

All engines are thoroughly tested and are fully guaranteed for material and workmanship.

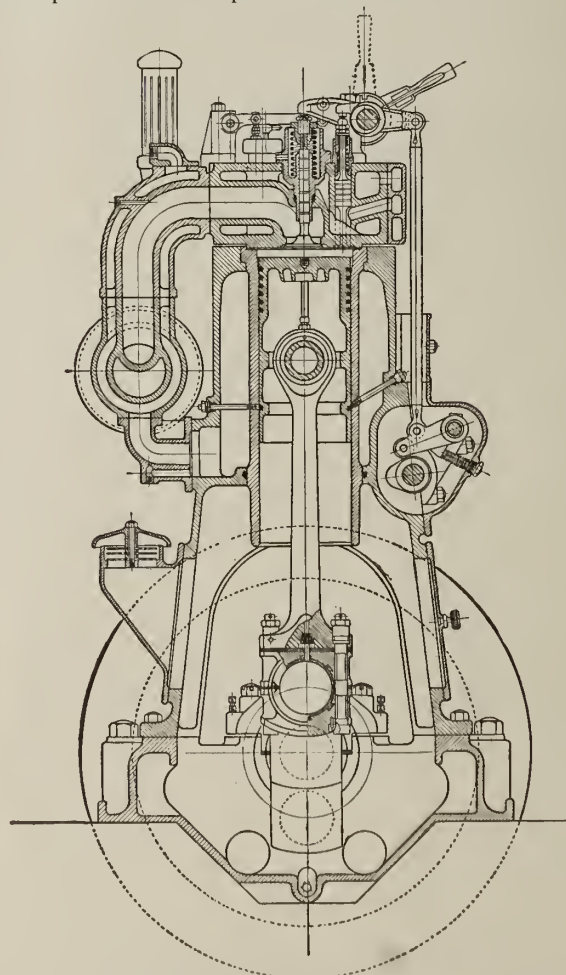


FRONT VIEW OF 4-CYLINDER
100 B.H.P. PITTSBURGH
HEAVY DUTY OIL ENGINE
Direct connected to a 65 kw.
generator

vertical, single acting, trunk piston Brons Hvid type, having cylinders with 8½-in. bore and 12-in. stroke, operating at speed of 400 r.p.m. and developing 25 b.h.p. per cylinder.

The engine design has been carried along the thoroughly tested practice of modern Diesel engine construction. The engine is rugged in construction for heavy duty service, yielding a complete, self-contained and compact unit easy to operate. Takes up the least amount of engine room space. Fully meets the demand of a well balanced, quiet running, simple, reliable and economical power. Excellent shop facilities, and use of jigs and templates insure exactness and interchangeability of parts.

FUEL—Fuel shall consist of crude petroleum or its refined products such as fuel oil, etc., and shall be of suitable quality. With a heat value of 18,500 B.t.u. per lb. it will be consumed at the rate of not more than 0.6 lbs. per brake horsepower hour at full load.



CROSS SECTION OF PITTSBURGH HEAVY DUTY OIL ENGINE,
TYPE M.V.

Description.

ENGINE—Engine is of enclosed, heavy duty, 4-cycle,

TROY ENGINE & MACHINE CO.

Manufacturers of Steam Engines Exclusively

TROY, PA.

Products.

TROY VERTICAL and HORIZONTAL STEAM ENGINES for every service, within capacities of 2 to 120 h. p.

Troy Vertical Automatic Engine.

Self-oiling with enclosed frame, or cup lubrication; with 2 wheels for belted service or extended base for direct connection to generator. Equipped with Rites inertia governor, giving perfect balance. Regulation and stability obtained by weighting arm at one or both ends and by adjustment of coil spring. Variation between no load and full load seldom exceeds 2%.

Speed adjusted at standard revolutions as per table unless otherwise ordered. Standard driving pulley has same diameter and face as governor wheel. Equipment includes lubricator, drain cocks, throttle valve, wrenches, etc.

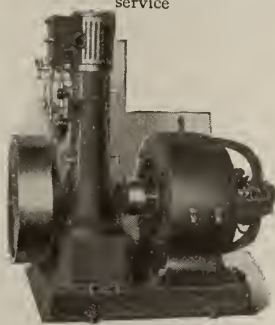
Several hundred vertical direct connected engine sets similar to illustration have lately been supplied to the United States Government.

Troy Horizontal Automatic Engine.

Two methods of lubrication—self-oiling or tank gravity system. Steam pressures, 60 to 160 lbs.; special cylinders for higher pressures. Subbase used with self-oiling engines contains oil reser-



VERTICAL AUTOMATIC SELF-OILING ENGINE
Two wheels for belted service



VERTICAL DIRECT CONNECTED ENGINE

DATA, VERTICAL AND HORIZONTAL AUTOMATIC ENGINES

Cyl- inder, ins.	Revolutions				Brake h. p. ¼ cut-off	Gov. wheel driving pulley	Shaft, ins.	Pipes, ins.	Floor, space, ins.	Approx. shipping wt., lbs.				
Diam.	Stroke	Lowest Standard Highest	100 lbs. press., 300 revs.	1 lb. press., 1 rev.	Diam., ins.	Face, ins. Wt. of Gov. wheel, lbs.	Diam.	Length	Supply Exhaust	Belted, 2 wheels	Belted, 2 wheels D. C. extended base			
VERTICAL AUTOMATIC ENGINES														
3 1/4	4	400	400	600	12.96	.000074	20	3 1/2	130 13 1/2	22 1/2	3 1/4 1 1/4	20x 23	750	950
4 1/4	5	400	400	600	16.44	.000161	24	4 1/2	175 15 1/2	27	1 1/2 1 1/2	24x 27	950	1150
5	7	300	300	500	9.36	.000312	30	6 1/2	415 23 1/2	32 1/2	1 1/4 1 1/2	31x 33	1850	2100
6	7	300	300	500	13.35	.000449	30	6 1/2	415 23 1/2	32 1/2	1 1/2 1 1/2	31x 33	1900	2200
7	7	300	300	500	18.36	.000612	30	6 1/2	415 23 1/2	32 1/2	1 1/2 2	31x 33	1980	2250
8	8	300	300	475	20.97	.000699	36	8 1/2	610 33 1/2	39 1/2	2 2	36x 41	2900	3200
9	8	300	300	450	27.39	.000913	36	8 1/2	610 33 1/2	39 1/2	2 2 1/2	36x 41	2960	3250
10	9	225	300	450	39.03	.001301	40	9 1/2	930 31 1/2	46 1/2	3 1/2	40x 48	4300	5600
11	9	1025	300	400	43.20	.001440	44	10 1/2	1050 53	53	3 3/4	44x 53	5200	6600
12	10	1025	300	400	53.52	.001784	44	10 1/2	1050 53	53	3 4	44x 53	5400	6800
13	10	1025	300	400	64.74	.002158	44	10 1/2	1050 53	53	3 4	44x 53	5600	7000
14	11	1275	300	350	64.26	.002142	54	12 1/2	1500 57 1/2	54	5	54x 62	8200	9700
15	12	1275	300	350	92.52	.003084	60	12 1/2	1700 57 1/2	54	5	60x 62	8700	10200

† Power rating as 400 r.p.m.

† Power rating as 400 r.p.m.

HORIZONTAL AUTOMATIC ENGINES

8	8	300	300	475	20.97	.000699	36	8 1/2	610	3 1/2	2	41x 72	3750	3900
8	8	300	300	445	27.39	.000913	36	8 1/2	610	3 1/2	2 1/2	41x 72	3800	3950
9	9	275	300	453	30.93	.001301	40	9 1/2	930	3 1/2	4	47x 82	5600	6800
9	9	275	300	403	43.20	.001440	44	10 1/2	1050	4	4	53x 89	6400	8100
10	10	275	300	400	53.52	.001784	44	10 1/2	1050	4	4	53x 89	6600	8300
11	10	275	300	400	64.74	.002158	44	10 1/2	1050	4	4	53x 89	6800	8500
12	12	275	300	350	84.26	.002427	54	12 1/2	1500	5	5	62x 105	9600	11000
12	12	275	300	350	92.52	.003084	60	12 1/2	1700	5	5	62x 105	10000	11200

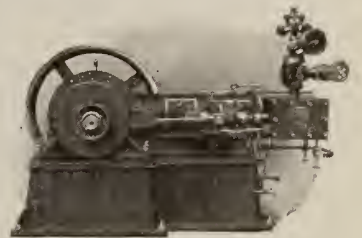
voir and fittings. Full equipment. Speed and direction of rotation should be specified.

Troy Vertical Throttling Engines.

Plain slide valve, in smaller sizes; but balanced valve can be substituted for steam pressures from 100 to 160 lbs. Special cylinders made for higher pressures or for superheat. Engine self-oiling, or cup lubrication. Full equipment supplied. Also built duplex or in pairs to suit customers.

Troy Horizontal High Pressure Throttling Engines.

Sizes from 15 h. p. up. Massive frame and base. Self-oiling system or tank gravity lubrication. Left-hand engines, as illustrated, are standard. Special equipment for direct connection to fans, blowers, pumps, etc.



HORIZONTAL THROTTLING ENGINE

Experience.

Troy engines are the result of 25 years' experience in the design and construction of steam engines. The benefit of this experience is offered to our patrons.

DATA, VERTICAL AND HORIZONTAL THROTTLING ENGINES

Cylinder, ins.			Brake h. p. ¾ cut-off		Flywheel, ins.		Shaft, ins.		Pipes, ins.		Floor space, ins.	Approx. ship. wt., lbs.
Diam.	Stroke	R. p. m.	90 lbs. steam press.	1 lb. press. 1 rev.	Diam.	Face	Diam.	Length	Supply	Exhaust	Engine, with stand, pulley	Engine, with stand, pulley
VERTICAL THROTTLING ENGINES												
HIGH PRESSURE TYPE												
3¼	4	300	2.21	.000082	16	3½	1½	23¾	¾	1	20x 23	500
4¼	5	300	4.81	.000178	20	4½	1½	29½	1	1¼	24x 30	750
5	7	250	7.80	.000346	26	6½	2½	36	1½	1½	31x 36	1380
6	7	250	11.20	.000499	26	6½	2½	36	1½	1½	31x 36	1460
7	7	250	15.34	.000682	26	6½	2½	36	1½	2	31x 36	1550
7	8	250	17.32	.000770	36	8½	3	42¾	1½	2	36x 43	2300
8	8	250	22.80	.001014	36	8½	3	42¾	2	2	36x 43	2500
9	9	250	32.40	.001440	40	9½	3½	53	2½	3	40x 49	3800
9	10	250	36.00	.001600	44	10½	4	57	3	4	44x 56	4400
10	10	250	44.55	.001980	44	10½	4	57	3	4	44x 56	4600
11	10	250	54.00	.002400	44	10½	4	57	3	4	44x 56	4800
11	12	250	53.55	.002380	54	12½	5	64⅜	3½	5	54x 68	6800
12	12	250	77.10	.003427	54	12½	5	64⅜	3½	5	54x 68	7000
14	12	250	102.44	.004664	54	12½	5	64⅜	4	5	54x 68	7300
LOW PRESSURE TYPE												
8	5	250	3.15	.00063	20	4½	1½	29½	1½	2	23x 30	950
10	7	250	6.50	.00130	26	6½	2½	36	2	2½	31x 36	1800
12	7	250	9.50	.00190	26	6½	2½	36	2½	3	31x 36	2000
14	7	250	13.50	.00272	26	6½	2½	36	3	3½	31x 36	2400
15	8	250	11.40	.00228	36	8½	3	42⅞	3	3½	36x 43	3000
15	8	250	17.65	.00353	36	8½	3	42⅞	3	3½	36x 43	3200
12	9	250	12.85	.00257	40	9½	3½	53	3	4	40x 53	4000
18	9	250	28.90	.00578	40	9½	3½	53	4½	6	40x 53	4600
15	10	250	22.30	.00446	44	10½	4	57	3½	4	44x 57	5000
16	12	250	30.45	.00609	54	12½	5	64⅜	4	5	54x 68	7600
18	12	250	38.50	.00770	54	12½	5	64⅜	5	7	54x 68	7800
HORIZONTAL THROTTLING ENGINES												
HIGH PRESSURE TYPE												
7	8	250	17.32	.000770	36	8½	3	42¾	2	2	43x 72	3300
8	8	250	22.80	.001014	36	8½	3	42¾	2	2½	43x 72	3400
9	9	250	32.40	.001440	40	9½	3½	53	2½	3	53x 82	4700
9	10	250	36.00	.001600	44	10½	4	57	3	4	57x 89	5600
10	10	250	44.55	.001980	44	10½	4	57	3	4	57x 89	5800
11	10	250	54.00	.002400	44	10½	4	57	3	4	57x 89	6000
12	12	250	53.55	.002380	54	12½	5	64⅜	3½	5	65x105	7800
12	12	250	77.10	.003427	54	12½	5	64⅜	3½	5	65x105	8000
14	12	250	102.44	.004664	54	12½	5	64⅜	4	5	65x105	8200
LOW PRESSURE TYPE												
12	8	250	11.40	.00228	36	8½	3	42⅞	3	3½	43x 73	3800
15	8	250	17.65	.00353	36	8½	3	42⅞	3	3½	45x 73	4000
18	9	250	12.85	.00257	40	9½	3½	53	3	4	54x 82	5000
18	9	250	28.92	.00578	40	9½	3½	53	4½	6	56x 82	5200
15	10	250	22.30	.00446	44	10½	4	57	3½	4	57x 90	6200
16	12	250	30.45	.00609	54	12½	5	64⅜	4	5	65x106	8600
18	12	250	38.50	.00770	54	12½	5	64⅜	5	7	65x106	8800

DE LAVAL STEAM TURBINE CO.

560 Johnson Avenue
TRENTON, N. J.

Products.

DE LAVAL STEAM TURBINES; CENTRIFUGAL PUMPS; BOILER FEED PUMPS; BLOWERS and COMPRESSORS; STEAM TURBINE GENERATORS and DYNAMOS; SPEED REDUCING GEARS.

Special Centrifugal Machinery.

Service.

Our Engineering Department will supply detailed information regarding characteristics and best manner of using turbines, pumps, gears, compressors, etc.

General Description.

De Laval steam turbine driven pumps, blowers and dynamos give continuous service and require little attention.

All De Laval turbines, pumps and blowers are, so far as possible, of the horizontally split casing type, with all piping connections on the lower half of the casing.

All De Laval machinery is interchangeable. Parts can be inserted in the machine by relatively unskilled persons.

Turbine driven machinery occupies little space and requires only light foundations.

De Laval Steam Turbines.

Made in single stage, velocity stage, and pressure stage types, in capacities from 1 to 15,000 h. p. and for all steam and exhaust conditions.

De Laval Speed Reducing Gears.

For steam turbine service in driving ship propellers, centrifugal fans and pumps, direct current generators and other slow and medium speed machinery.

De Laval Centrifugal Pumps.

These pumps include single stage and multistage, for all heads and capacities, from direct driven boiler feeders to the largest geared pumps for water works service.

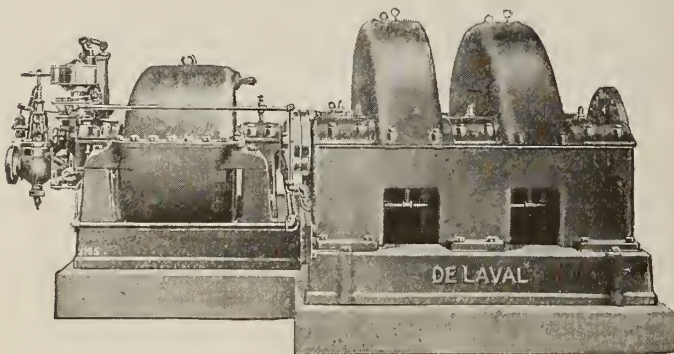
De Laval Centrifugal Blowers and Compressors.

Made for all deliveries and for all pressures up to 125 lbs. per sq. in.

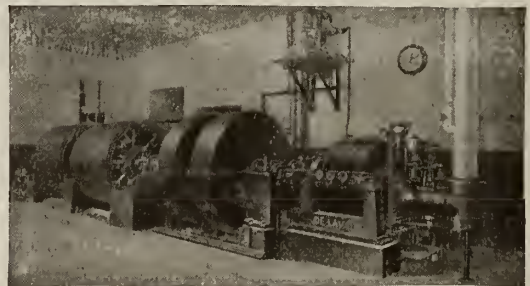
Guarantee and Further Information.

Every De Laval machine is guaranteed as to efficiency and operating characteristics, and is tested before leaving the shop.

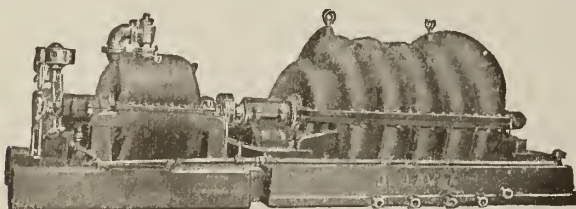
State the character of work and literature will be sent.



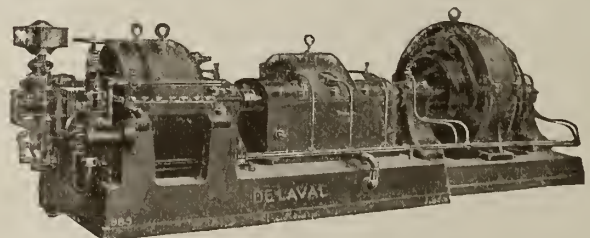
GEARED TURBINE FOR DRIVING MODERATE AND SLOW SPEED MACHINERY



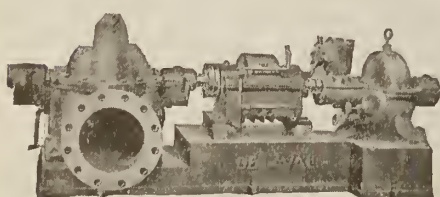
GEARED TURBINE FOR ROPE DRIVE



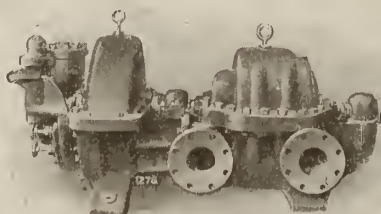
TURBINE DRIVEN CENTRIFUGAL COMPRESSOR



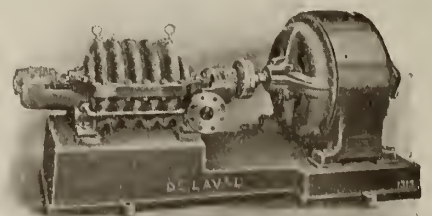
GEARED TURBINE DRIVING DIRECT CURRENT GENERATOR



GEARED TURBINE DRIVEN CIRCULATING PUMP



COMBINED TURBINE DRIVEN BOILER FEED PUMP



FIVE-STAGE MOTOR DRIVEN CENTRIFUGAL PUMP

ESTABLISHED 1862

THE JAMES LEFFEL & CO.

Manufacturers of Turbine Water Wheels, Engines and Boilers

426 East Street
SPRINGFIELD, OHIO

Products.

TURBINE WATER WHEELS: High and Low Head. WATER WHEEL GOVERNORS.

HYDRAULIC MACHINERY and FITTINGS: Gate Hoists; Steel Pipe; Shafting; Gearing; Pulleys; Bearings; Bridgetrees.

STEAM ENGINES: Automatic and Throttling; Horizontal and Vertical; Stationary.

BOILERS: A. S. M. E. Code; Firebox; Internally Fired; Locomotive; Portable; Scotch; Steam; Horizontal Return Tubular; Vertical Tubular.

Leffel Turbine Water Wheels.

VERTICAL LEFFEL TURBINE WATER WHEELS—Equipped with latest type of Leffel double steel bucket runners mounted on vertical steel shafts. Revolving parts are carried on large top and bottom lignum-vitae step bearings. Gate casings are fitted with balanced swing type gates, each gate removable separately and fitted with adjustable steel connections. Gates are operated with Leffel's latest type of gate equipment. Bearings are of special design and large dimensions.

HORIZONTAL LEFFEL TURBINES—Built in various types and designs, single and double discharges. Frequently, to suit requirements, two or more turbines are built on one horizontal shaft, developing high horsepower and speeds, for direct connection to driven machinery. Some are constructed with steel casings and others for open penstocks.

TYPE "Z" LEFFEL TURBINES—Specially designed for developing highest speed, horsepower and efficiencies. Vertical and horizontal designs for direct connection to the electric generators, milling machines, saws, grinders, pumps and other high speed machinery. The most modern designs in all details are embodied in these turbines.

CO-OPERATIVE SERVICE—This company is prepared to inspect locations and requirements, and will promptly submit drawings and proposals for complete turbine installations for developing maximum results at lowest initial cost and minimum operating expenses.

Water Wheel Governors.

This company furnishes governors for regulating the speed of the different designs and capacities of turbine water wheels. These governors are of the very latest types and designs throughout.

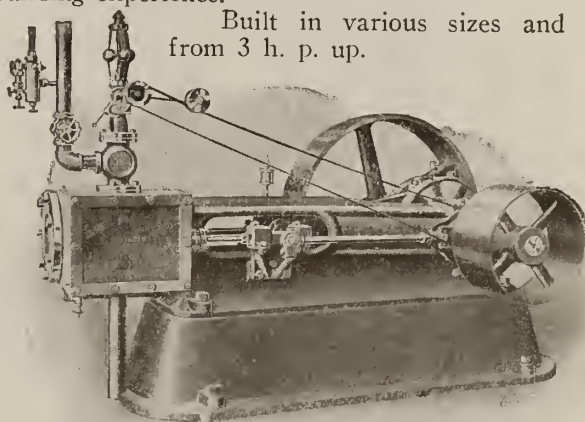
Special Hydraulic Machinery and Fittings.

This company builds many designs of hydraulic machinery, including head gate hoisting machinery, steel pipe and fittings, shafting, gearing, pulleys, bearings and bridgetrees.

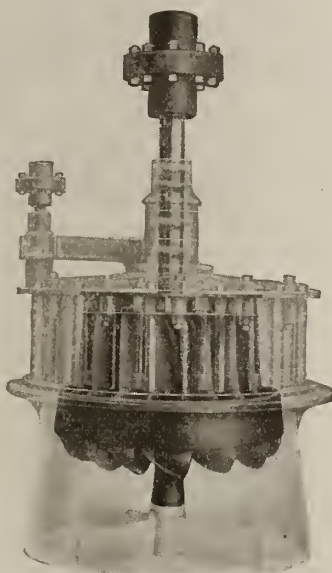
Leffel Engines and Boilers.

Leffel horizontal and vertical steam engines and boilers combine those principles of design and construction found best through 54 years of engine and boiler building experience.

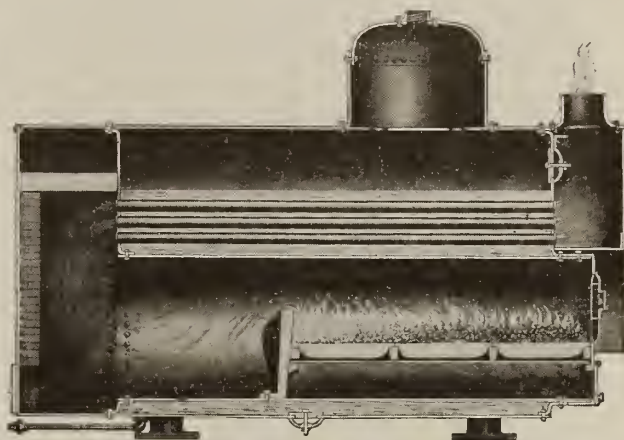
Built in various sizes and types from 3 h. p. up.



LEFFEL CLASS "A" THROTTLING ENGINE ON BASE



VERTICAL LEFFEL TURBINE WATER WHEEL



SECTIONAL VIEW OF LEFFEL INTERNALLY FIRED RETURN TUBULAR OR SCOTCH MARINE TYPE OF PORTABLE BOILER

Guarantee.

All Leffel products are guaranteed to be first class throughout and of the latest designs of their respective types, built strong and substantial.

Their rated capacity, power, speed and efficiency values are also guaranteed, when properly installed and operated. Any part proving defective within one year from date of shipment, because of imperfect material or design, will be replaced free of charge on cars at factory.

Catalogues.

Catalogues containing complete data will be furnished on application.

MOORE STEAM TURBINE CORPORATION

WELLSVILLE, N. Y.

BOSTON, MASS.
DETROIT, MICH.

NEW YORK, N. Y.
CHICAGO, ILL.

SALES OFFICES

PHILADELPHIA, PA.
ST. PAUL, MINN.

PITTSBURGH, PA.
CLEVELAND, OHIO

ST. LOUIS, MO.
BIRMINGHAM, ALA.

Sales Offices in other large cities

Products.

MOORE CONDENSING and NON-CONDENSING, SINGLE STAGE and MULTISTAGE STEAM TURBINES in sizes from 5 to 1000 horsepower.

Double Helical Reduction Gears; Turbo-alternator Units; Geared Direct Connected Turbo-generator Units; Geared and Direct Connected Turbo-blowers for forced draft, etc.; Turbo-pumps; Geared Belted Turbines.

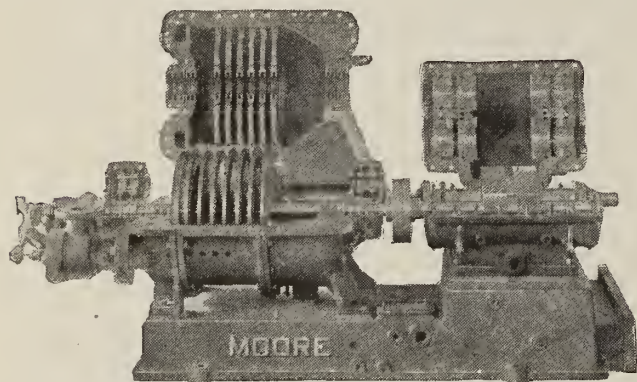


TRADE-MARK

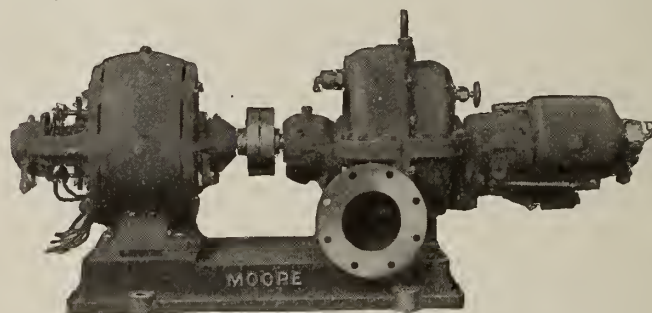
of turbine in large sizes, and our tests show this type to be equally as efficient, relatively, when built in small sizes.

Speeds.

It is our policy to limit speeds of larger turbines to 3600 r.p.m. and of the smaller sizes to 5000 r. p. m. as a maximum, and to obtain required steam consumption by multistaging if necessary. By this means, rotation stresses are kept at a low figure, affording a large margin of safety, a very important feature, and one which should not be lost sight of by the prospective purchaser.



MOORE STEAM TURBINE AND REDUCTION GEAR AS BUILT IN SIZES FROM 10 TO 500 H.P.



TYPICAL DIRECT CONNECTED, DIRECT CURRENT TURBO-GENERATOR UNIT

Built in sizes from 5 kw. to 50 kw.

General.

Designers and users of steam turbines have found that the most efficient type of steam turbine is the combination type, that is, one type of turbine is used for the high pressure part of the expansion, combined with another type for the low pressure stages. A familiar example of this is the combination of a single velocity stage for the high pressure element, with Parsons or Rateau stages for the low pressure.

Moore Single Stage Turbine.

Consists of a single velocity stage, made up of a set of diverging expanding nozzles and a wheel carrying two rows of moving blades, with a set of stationary reversing vanes following the first row of moving blades.

Moore Multistage Turbine.

Consists of the same single velocity stage used in the single stage turbine, followed by two or more single

Construction Features.

TURBINE CASINGS—Casings and diaphragms split horizontally, so that upper half can be removed, exposing the rotor. Halves of diaphragms attached permanently to upper and lower halves of casing, so that when upper half of casing is lifted, the upper half of diaphragm comes with it, leaving rotor so it can be removed.

Ample surfaces at joints prevent steam leakage. Vertical joints reduced to a minimum.

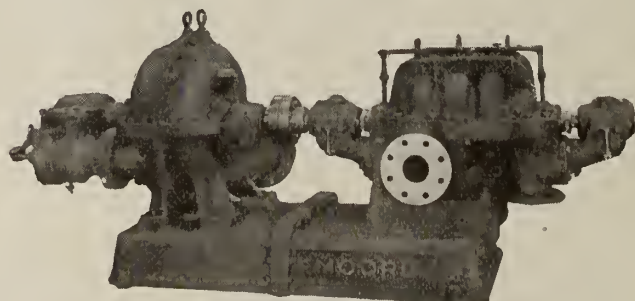
ROTOR—Consists of a single velocity stage wheel carrying two rows of moving buckets, followed by two or more single pressure stage wheels, all mounted on the same shaft.



TYPICAL "MOORE" 3600 R.P.M. DIRECT CONNECTED TYPE TURBO-ALTERNATOR UNIT WITH DIRECT CONNECTED EXCITER

Turbine is equipped with oil relay and emergency governor

pressure stages. Each of these single stages consists of a set of nozzles and a wheel. This form of multistage turbine has proved to be the most efficient type



MOORE STEAM TURBINE DIRECT CONNECTED TO MULTISTAGE CENTRIFUGAL PUMP

Co-operative Service.

The engineering department is always prepared to go into engineering requirements in detail, and give advice and recommendations without any obligation whatever.

THE TERRY STEAM TURBINE CO.

HARTFORD, CONN.

BRANCH OFFICES

ATLANTA, GA., 1521 Candler Building
BIRMINGHAM, ALA., 3 South 20th Street
BOSTON, MASS., 141 Milk Street
CHICAGO, ILL., 1328 McCormick Building
CLEVELAND, OHIO, 536 Engineers' Building
DENVER, COLO., First National Bank Building
DETROIT, MICH., 715 Dime Bank Building
FORT WORTH, TEX., 608 Flatiron Building
GRAND RAPIDS, MICH., Michigan Trust Building
HOUSTON, TEX., 423 Southern Pacific Building
KANSAS CITY, MO., Reliance Building

LOS ANGELES, CAL., 625 Washington Building
NEW YORK, N. Y., 95 Liberty Street and 90 West Street
MEMPHIS, TENN., 24 South Front Street
MINNEAPOLIS, MINN., 423 South Front Street
NEW ORLEANS, LA., 525 Baronne Street
PHILADELPHIA, PA., 1101 Widener Building
PITTSBURGH, PA., 2547 Oliver Building
RICHMOND, VA., 301 American National Bank Building
SAN FRANCISCO, CAL., 1070 Folsom Street
SEATTLE, WASH., 220 Railway Exchange Building
ST. LOUIS, MO., 1607 Chemical Building

Products.

STEAM TURBINES.

CENTRIFUGAL TURBO-PUMP SETS for all classes of service.

TURBO-GENERATOR SETS, D. C. or A. C., direct connected or through Terry Reduction Gears.

DUPLEX EXCITERS.

TURBO-BLOWERS for forced or induced draft.

REDUCTION GEARS; combined TURBO-GEAR UNITS.

Capacities of Terry Turbines.

Horizontal Terry turbines are built in sizes up to 1000 h.p., combined gear units in sizes up to 125 h.p., while the vertical types cover a range from 1 to 600 h.p.

Terry Non-condensing Turbines.

PRINCIPLE OF OPERATION—The outstanding feature which makes the Terry turbine so simple and reliable is its principle of operation.

It is of the compound velocity stage impulse type, i. e., the steam is expanded to desired point in a correctly formed jet or nozzle, wherein its pressure energy is converted into kinetic or velocity energy.

Steam is distributed by a steam chest or steam ring to a series of nozzles.

In these nozzles the steam is expanded from approximately boiler pressure to exhaust pressure.

Issuing from the nozzle at high velocity, it strikes the side of the steam bucket in which its direction is reversed 180°.

As the initial impact absorbs only a part of the total energy, the jet of steam passes into a reversing chamber which returns it to the wheel bucket.

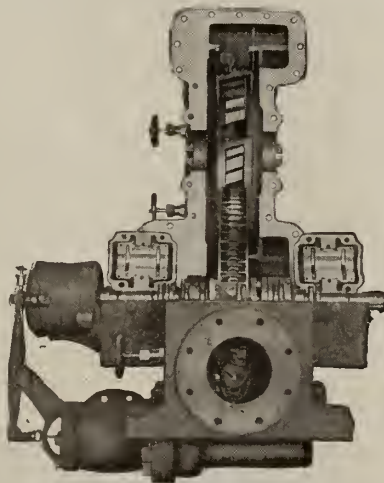


FIG. 1. NON-CONDENSING TERRY TURBINE WITH COVERS LIFTED

Split case, short shaft span, large interchangeable bearings and maximum accessibility. Low temperature and constant alignment. Indestructible wheel

This action is repeated several times until all of the available energy is exhausted.

A distinct advantage of the Terry principle of operation is that the highest economies are obtained at lower speeds.

FEATURES OF DESIGN—*Accessibility*—The Terry turbine may be completely dismantled, including removal of rotor without disturbing the alignment or the steam and exhaust piping.

This is accomplished by splitting the casing on the shaft center line, including bearings and glands, and locating steam and exhaust connections in the lower half.

Simplicity, Safety and Reliability—The Terry turbine is built with a totally enclosed one-piece wheel with uniform rotary motion.

This indestructible wheel is made of special composition steel with semicircular buckets milled from the solid metal (Fig. 4).

The bladelike portion between these buckets receives no power-producing action from the steam, but merely serves to split the jet.

The power-producing action of the steam takes place entirely on the curved surface at the back of the bucket (Fig. 2), therefore erosion does not alter the angle at which the steam enters or leaves the bucket.

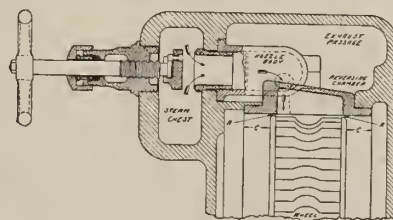


FIG. 3. DIAGRAM SHOWING WHEEL CLEARANCES

AA—rim clearance. B—large blade clearance. CC—side clearance (about 1 in.). Blades can not foul, as they are protected by rims. Rubbing at AA will do no damage. Side clearance is so large that end play from excessive external thrust can not damage wheel

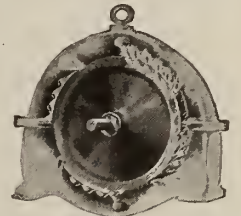


FIG. 2. ACTION OF STEAM IN TERRY TURBINE

Action is such that steam is returned to the wheel again and again until all available energy is utilized. Power producing action of steam takes place on back of buckets, so that erosion of blade edges has little effect on economy or power



FIG. 4. INDESTRUCTIBLE WHEEL OF TERRY TURBINE

Buckets cut from the solid and protected from rubbing by raised wheel rim. Notch at center of blade reduces blade weight and stresses. Wheel can not burst and injure operators

This construction enables the Terry turbine to maintain its original efficiency after a great many years of service.

The fact that steam impinges against the wheel in a direction perpendicular to the axis makes it unnecessary to provide for end thrust.

The large wheel clearances are shown in Fig. 3. It is impossible for wheel buckets and reversing chamber buckets to foul. The blades of the wheel are protected by projecting rims (Figs. 3 and 4), which will take care of any rubbing that might occur if for any reason the radial clearance should become reduced.

Its rugged, simple construction makes it a fool-proof piece of apparatus that can be operated by engineers not familiar with turbine operation.

CRITICAL SPEED WELL ABOVE ANY OPERATING SPEED—The short span permitted by the single wheels in Terry turbines, combined with the stocky shafts used, bring the critical speed well above any operating speed. This eliminates all shaft whipping and excessive vibration.

HIGH EFFICIENCY AT PARTIAL LOADS AND OVERLOADS—Each nozzle of the Terry turbine acts independently of the others and produces its own proportion of the total power. Partial loads may, therefore, be procured at practically full load economy by closing the desired number of nozzles by means of hand valves furnished for the purpose.

See Fig. 5, showing variation in steam consumption from full load to lower loads.

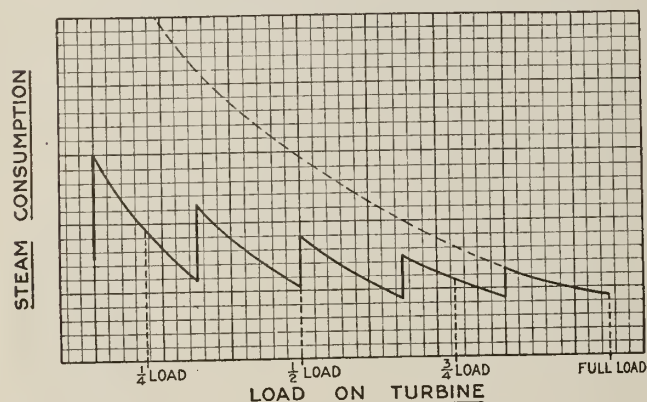


FIG. 5. CURVE SHOWING VARIATION IN STEAM CONSUMPTION OF TERRY TURBINES AT VARIOUS LOADS

Vertical lines show where a nozzle has been closed. High points show steam consumption with nozzle open, low points with nozzle closed. This high efficiency at low loads is due to fact that shutting of nozzles as load decreases prevents throttling in governor valve so that steam reaches remaining nozzles with full energy. This hand control does not in any way interfere with automatic speed governor

READILY ADAPTABLE TO CHANGES IN PLANT CONDITIONS—The design of the Terry turbine makes it readily adaptable to the development or changes in plant conditions.

The feature of the independent nozzle control previously described makes it possible to install a turbine which will operate at high efficiency under present load conditions and have reserve power in the form of a nozzle continually kept closed.

Should it become necessary to operate at a lower steam pressure or should the pressure be increased for higher plant efficiency, the nozzles can easily be changed to meet new conditions with minimum shutdown and slight expense.

HIGH PRESSURES AND SUPERHEATS—The Terry turbine is particularly adapted to the special cast steel

construction so vital to long life under high steam pressures and superheats where cast iron will not stand up.

Terry Condensing Turbines.

Furnished as straight high pressure, low pressure, mixed pressure or bleeder type turbine.

A very important feature incorporated in the design of the Terry condensing turbine is known as "composite design." The combination of a single velocity wheel for the high pressure end, with multipressure elements in the low pressure end, secures maximum efficiency.

This "composite design" reduces the over-all length to a minimum, or with a given over all length, makes it possible to use a greater number of multipressure stages in the low pressure end with consequent higher efficiency.

Terry condensing turbines possess the same features of accessibility, high efficiencies at partial loads, etc., as do the non-condensing turbines. The bearings, glands, interstage diaphragms, casing and bearing pedestals are all horizontally split and the steam and exhaust connections are on the lower half.

Short shaft span with operating speed well below critical speed and low temperature in the casing, insure reliable operation and long life.

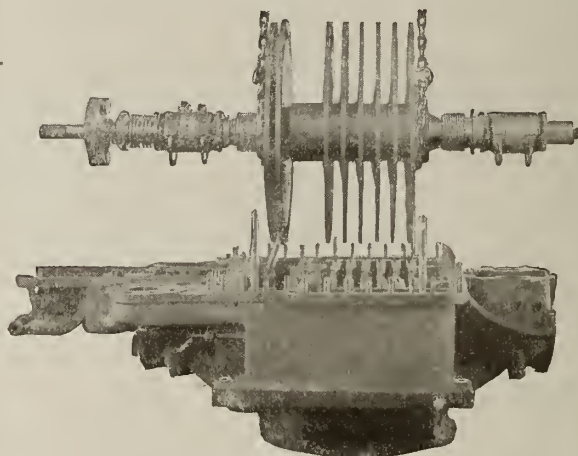


FIG. 6. TERRY "COMPOSITE DESIGN" CONDENSING TURBINE SHOWING SPLIT CONSTRUCTION

Centrifugal Turbo-pump Sets.

Terry centrifugal turbo-pump sets are adapted for all classes of service, including boiler feed, condenser circulation, hot well, dredging, fire service, vacuum, water works and general service.

The advantages embodied in these pump sets are reliable operation, high efficiency, low maintenance charges and absence of waterhammer, valves and rubbing reciprocating parts.

They may be automatically governed by pressure regulators. In this way the speed of the unit is automatically varied so as to maintain constant pressure in the discharge line regardless of the amount of water used.

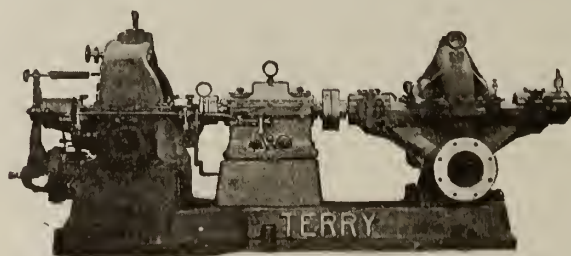


FIG. 7. TERRY CONDENSER CIRCULATING SET
Note the rugged appearance, compactness and simplicity. Where high efficiency is required, a Terry geared unit is used

Turbo-generator Sets.

Turbo-generator sets furnished in sizes from 1 kw. to 750 kw., geared or direct connected, condensing or non-condensing. Used extensively for main units in small plants or auxiliary sets for night lighting, week-end service, marine work, lifting magnet sets, etc. In non-condensing work, the turbine may be designed to exhaust against most any back pressure desired for heating, manufacturing or other purposes.

The nozzles may be so arranged that efficient operation may be obtained with varying back pressures. In condensing work, the turbine may be designed to operate on exhaust steam entirely or may be equipped with the well-known Rateau control where the supply of exhaust steam is intermittent. Bleeder turbines are also furnished, permitting the extraction of exhaust steam for heating or other purposes at desirable pressures.

Terry turbo-generator units have many individual advantages, such as small space, light foundations, absence of vibration, low cost of upkeep, long life and clean exhaust steam.

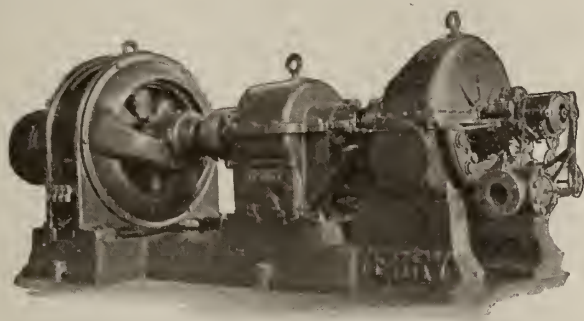


FIG. 8. TERRY TURBO-GENERATOR SET

D. C. units geared to permit high turbine speed and efficiency and low generator speed for good operating characteristics

Duplex Exciters.

These sets consist of an exciter-generator driven from one end by a motor and from the other end by a specially governed Terry turbine. Exciter ordinarily is driven by the motor. Should the motor fail, the turbine will automatically take hold without causing appreciable fluctuation in the exciter voltage.

A governor on the unit not only controls its speed but may be adjusted while running to take the load off the motor and throw it on the turbine when more steam is needed by the feed water heater. The control from motor to turbine and vice versa may be handled entirely from the switchboard.

These sets have met with marked success because of their inherent reliability.

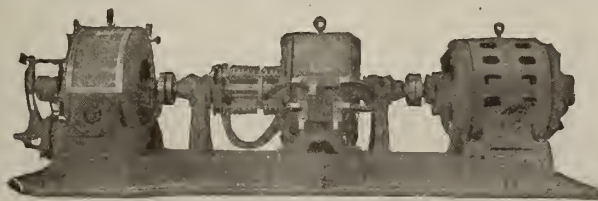


FIG. 9. TERRY DUPLEX EXCITER UNIT

Insures continuous excitation, and is used extensively because of reliability and adaptability to automatic heat balance

Turbo-blower Sets for Forced and Induced Draft.

Fan units are usually installed in objectionable locations, often requiring very light foundations in places

where they are subject to excessive heat and dirt. The Terry turbine, with its freedom from vibration, its ability to operate over long periods under adverse conditions without attention, is particularly adaptable to this service. Turbine drive also obviates the objectionable large fans necessary with engine drive, because of the low speed required by the engine for reliable service.

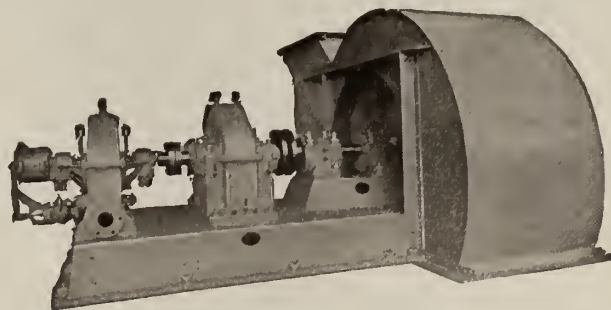


FIG. 10. TERRY INDUCED DRAFT FAN

Small space and light foundations make it readily adaptable to plant conditions. Its high speed avoids the necessity of large bulky fans

Reduction Gears.

Terry gears and pinions are of the stub-tooth double helical type, cut by the most accurate method and are interchangeable. The lubricating system is unusual in the ample supply of cool oil under pressure to the bearings.

All Terry gears have forced feed lubrication, ring oiling not having been found satisfactory.

Cooling is effected by large water chambers, cored in the walls of the gear case, eliminating risk of leakage where pipe cooling coils are used.

Bearings are split horizontally to permit their replacement without removing the couplings.

Gears furnished for either direction of rotation, the only change being the location of the oil spray piping above or below the contact point.



FIG. 11. TERRY REDUCTION GEAR

Note horizontally split casings, giving complete accessibility

Combined Turbo-gear Units.

In sizes up to 125 h.p., geared turbine units may be obtained in one common rigid frame casing.

Each part of the unit possesses the same features of design contained in the separate turbine and gear.

The advantages embodied in this type of unit are: decreased cost, light weight, compactness, maintained correct alignment and no flexible coupling. Both turbine and gear are horizontally split to permit easy access to interior for inspection or repairs.

ALLIS-CHALMERS MANUFACTURING COMPANY

Complete Centrifugal Pumping Units

MILWAUKEE, WIS.

For District Offices see page 1114

Products.

Specialists in the selection, design and manufacture of the following:

CENTRIFUGAL PUMPS and CENTRIFUGAL PUMPING UNITS for every service: Mill and Factory Water Supply Pumps, City Service Pumps, High Pressure Fire Pumps, Underwriters' Fire Pumps, Drainage Pumps, Sewage Pumps, Boiler Feed Pumps, Condenser Pumps, Hot Well Pumps, Heating System Pumps, Filter Pumps, Sugarhouse Pumps, Paper Mill Pumps, Mine Pumps, Irrigation Pumps and Pumps for Special Service.

For Power and Electrical Equipment, see pages 1114-15.

Service.

Co-operative service begins with a careful consideration of the customers' pumping conditions by our engineering organization, after which a suitable pump and drive will be selected from our complete lines so as to give the best economy and service when operated in the customer's plant. Before shipment, the majority of the standard pumps are given a careful shop test in the centrifugal pump testing laboratory without extra charge, under contract conditions or approximate contract conditions, so that the customer is assured that the unit when carefully installed in place will perform in accordance with the guarantees.

Combined Units.

The ALLIS-CHALMERS MANUFACTURING COMPANY recommend their combined units, consisting of pump and motive power of their own manufacture as insurance that each part of the complete machine will be properly selected for its share of the work.

With complete data at hand on the pumps and whatever drive has been determined, whether motor, turbine, steam engine or oil engine, all of which this

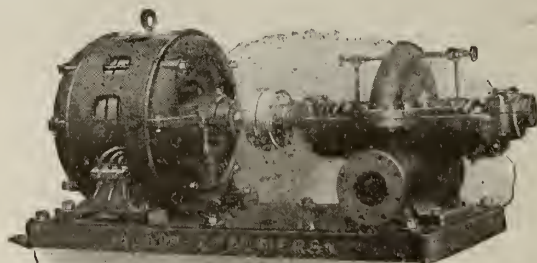
company manufactures, there is no danger of the drive being too large or too small for the pump, or similar difficulties which are possibilities when the pump and drive are furnished by different makers.

The economical and satisfactory service which these complete units are giving in service has impressed us with the value to the purchaser of our "*complete units of undivided responsibility.*"

Types of Pumps.

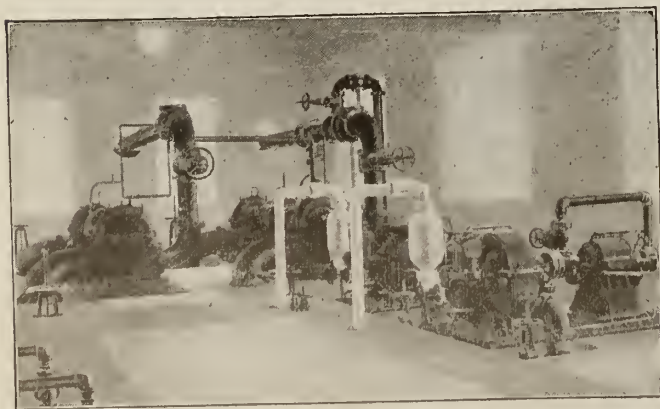
The types of pumps manufactured as standards are the single stage type "S" and the multistage, both horizontal; also horizontal and vertical types for special services.

TYPE "S"—This type, which is a horizontal split casing, single stage, double suction, enclosed runner, bronze fitted pump, has the most general application to all classes of pumping service. It is built as a standard and carried in stock in sizes from 2 to 20 ins. These pumps will operate against heads up to 200 ft. and are simple, reliable and economical in operation.

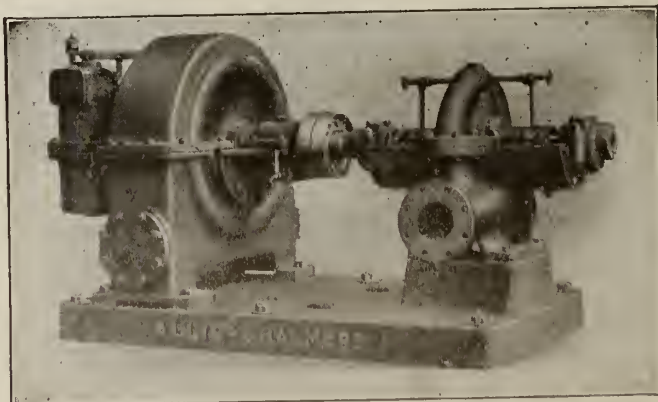


MOTOR DRIVEN TYPE "S" PUMP

Type "S" pump lends itself readily to direct connection to an electric motor or steam turbine; and these are the commonest methods of drive, although belt drive is often used when it is desirable to retain the advan-



ALLIS-CHALMERS COMBINED UNITS IN POWERHOUSE OF UNITED VERDE COPPER COMPANY



TURBINE DRIVEN TYPE "S" PUMP

tages of the type "S" pump operated at a relatively high speed but driven by a slower running driving agent.

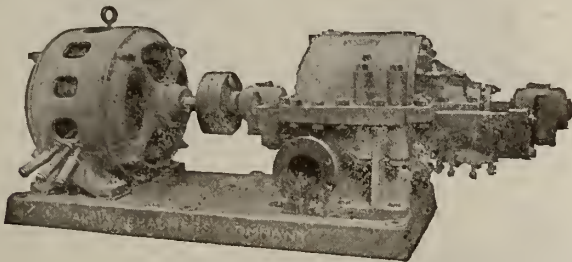
The design of the Allis-Chalmers type "S" pump was carefully worked out after an exhaustive series of tests and has been proved under all conditions of operation in a great many different services.

DATA, STANDARD TYPE "S"
Approximate Capacities of Standard Sizes

Size	Capacity in g. p. m.		Total head in feet		Speed, r. p. m.
	Norm.	Max.	Norm.	Max.	
2	125	225	85	95	1730
3	300	500	85	110	1740
4	450	750	130	145	1750
6	800	1400	120	160	1750
8	1500	2400	170	190	1750
10	2500	3750	175	200	1750
12	4500	6500	165	200	1450
14	5500	7500	170	200	1450
16	6500	9000	135	170	1160
18	9500	12000	90	100	860
20	12000	14500	80	90	690
24	15000	20000	110	140	690

Table is only approximate and for more detailed information the company's centrifugal pump catalogue will be sent on request.

MULTISTAGE PUMPS—For heads higher than can be developed in a single stage, this company recommends their standard horizontal split casing, bronze fitted, hydraulically balanced, multistage pumps. These pumps are built in sizes from 2½ to 14 ins. and for normal heads up to 500 ft. Special multistage pumps are also built for heads up to 1000 ft.



MOTOR DRIVEN MULTISTAGE PUMP

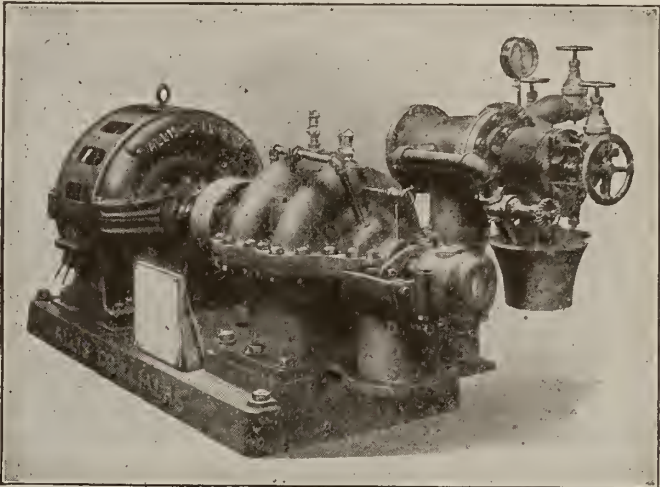
Multistage pumps have their widest application as boiler feed pumps, mine drainage pumps, fire pumps, etc., and in all of these services the features of the Allis-Chalmers multistage pumps are proving their practical usefulness in many installations.

Horizontally Divided Casings.

Allis-Chalmers type "S" and standard multistage pumps are all made with horizontally divided casings with the suction and discharge nozzles located in the lower half casing. This makes it possible to easily remove the top half casing without disturbing the piping connections.



18-INCH TYPE "S" PUMP IN IRRIGATION PUMPING STATION
Cover raised showing split casing feature



1000-GALLON UNDERWRITERS' FIRE PUMP
Built in four sizes: 500, 750, 1,000, 1,500 g. p. m.
750 AND 1,000 G. P. M. SIZES MOST COMMON

Size, g. p. m.	Total hd., lbs.	R. p. m.	H. p. motor required	Size of suction and disch., ins.	No. of 1½-in. streams	Weight with fittings, lbs.
750	100	1750	85	8	3	3800
1000	100	1750	100	8	4	4000

Catalogue.

There are a number of points to consider in selecting centrifugal pumps for industrial uses, and to assist those who contemplate installing centrifugal pumps the company will send without charge catalogue No. 1632-CX, which describes the standard pumps more in detail and gives other valuable information.



VIEWS SHOWING PUMPS UNDER CONSTRUCTION IN ALLIS-CHALMERS SHOPS

AMERICAN STEAM PUMP COMPANY

BATTLE CREEK, MICH.

NEW YORK OFFICE, 17 Battery Place

CHICAGO OFFICE, 1220 Monadnock Block

Products.

AMERICAN-MARSH VACUUM PUMPS; AMERICAN POWER PUMPS; AMERICAN-MARSH BOILER FEED PUMPS; AMERICAN-MARSH CENTRIFUGAL PUMPS; MARSH DEEP WELL ENGINES.

American Compound Pumps, Water Works Pumps, Elevator Pumps, Belt or Steam Driven Air Compressors.

American-Marsh Steam Pumps, Automatic Boiler Feed Pumps and Receivers, Hydraulic Pressure Pumps, Tank Pumps, Magma Pumps, Oil Pumps, Brine Pumps, Sinking Pumps, Air Compressors, Jet Condensers.

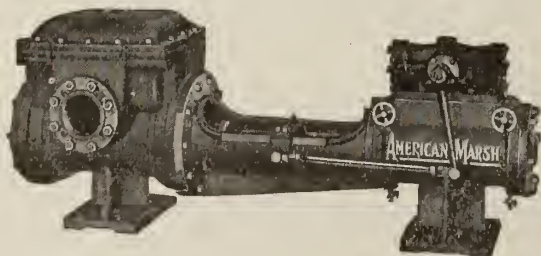
American-Marsh Pump.

Of the improved Marsh design. Consists of all the advantages and governing element of the well-known Marsh pump combined with the American simple, positive and reliable auxiliary valve which is mechanically actuated by a lever arm connected to the crosshead attached to piston rod. With this combination the inside trip tube and packing box formerly used in the Marsh design are eliminated. The American-Marsh is the very best pump ever produced; it is positive in action, possessing a perfect governing element and will not hang up under all the varying conditions.

Made of the best material and rugged and substantial in design. Steam and water cylinders joined by heavy cast iron yokes with ring and plug fit to insure perfect alignment of wearing parts. Special bronze fittings (not common brass) furnished regularly without extra charge, consisting of removable bronze liners, bronze piston rods, valve seats, valve bolts, springs; also either good grade hard or soft rubber valves or bronze valves, as the service may require, are furnished.

Pumps for Heating Service.

Due to the positive full stroke, self-governing element and special fitting, these pumps are particularly adapted for use in connection with heating systems of all descriptions. The American-Marsh is the very best pump made for extreme hot water service.

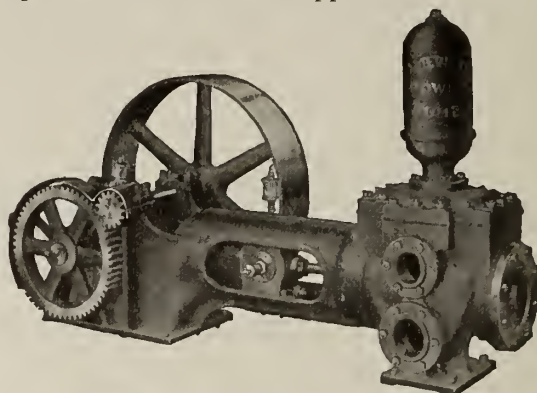


STYLE "S" AMERICAN-MARSH VACUUM PUMP
Side suction; double base; delivery opposite

American-Marsh Boiler Feed Pump.

Heavily constructed and bronze fitted; equipped with solid bronze piston rods, bronze valve seats, bolts and springs and heavy cast bronze removable water cylinder bushings, with the exception of the three smallest sizes, in which the bushing is pressed into place. Waterways large and direct, with ample valve area. Ample handhole plates, giving immediate access to all water valves, furnished in the larger size piston pumps and in all outside center packed plunger pumps.

In cases where the boiler pressure exceeds 150 lbs., the outside center packed plunger type is recommended. Description and other data on application.



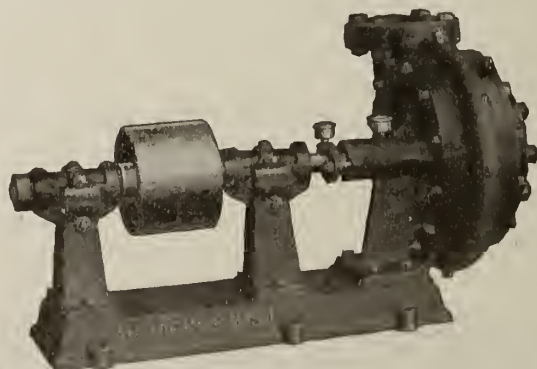
AMERICAN GEARED POWER PUMP



AMERICAN-MARSH BOILER FEED PUMP

American-Marsh Centrifugal Pump.

Very simply constructed; hence first cost is much less than any other style of pump. No valves used in construction and practically noiseless in operation. Occupy but little space; cost of foundation is small.



TYPE "B" AMERICAN-MARSH CENTRIFUGAL PUMP

Marsh Deep Well Engine.

Designed for pumping wells in which the water drops below suction reach of the regular horizontal pump. Steam head or steam cylinder is located at the surface of the ground, while the water cylinder is lowered to the water and operated by means of a well rod connecting the steam and water pistons.

THE AMERICAN WELL WORKS

Manufacturers of Centrifugal and Deep Well Plunger Pumps

GENERAL OFFICES AND WORKS
AURORA, ILL.

First National Bank Building
CHICAGO, ILL.

DISTRICT AND SALES AGENCIES

NEW YORK, N. Y.
(Domestic and Export)
PHILADELPHIA, PA.
PITTSBURGH, PA.
ST. PAUL, MINN.

SAN FRANCISCO, CAL.
LOS ANGELES, CAL.
ARTESIA, N. M.
SALT LAKE CITY, UTAH
DENVER, COLO.

KANSAS CITY, MO.
JOPLIN, MO.
ST. LOUIS, MO.
BIRMINGHAM, ALA.
DALLAS, TEX.

MONTREAL, QUE., CAN.
CHATHAM, ONT., CAN.
CALGARY, ALTA., CAN.
EDMONTON, ALTA., CAN.

Products.

CENTRIFUGAL PUMPS, for water works, irrigation, drainage, mine, fire protection, quarry, dredge, hydraulic, giant, caisson, foundation, sump, trench, bilge, boiler feed, condensing and general purpose pumping.

DEEP WELL TURBINE CENTRIFUGAL PUMPS for pumping wells 12 in. and larger in diameter.

DEEP WELL PLUNGER PUMPS, Single Acting, Double Acting, and 2-stroke.

"American" Centrifugal Pumps.

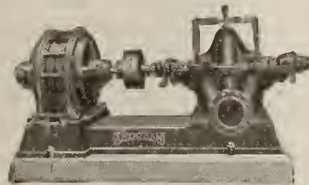
These pumps are built in about 50 standard types, each designated by a letter of the alphabet; and, in addition, a large number of special pumps are designed and built. Centrifugal pumps are made with either open type or enclosed type impellers, with or without diffusers and with either single suction or double suction in single stage pumps. Most of our double suction pumps and some single suction pumps are made with split casing, so designed

that the upper half of the casing can be removed to expose the internal working parts without disturbing the pipe connections.

IMPORTANT FEATURES—The important features of "American" centrifugals are skillful designing so that they attain high efficiencies with flat efficiency curves, thus being economical in use through a wide range of delivery; use of good material in their construction, careful machining and accurate adjustments. Bearings are ring or chain oiled. Impellers are given both rotative and end thrust balance. In single suction, open impeller type pumps, the sides and edges of impeller and interior of casing are carefully machined and closely adjusted at sides to prevent leakage. The split casing types are fitted with labyrinth rings around suction openings to reduce leakage to minimum. Multistage, enclosed impeller types are designed to have fewest points of leakage back to suction opening.

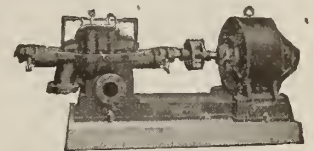
Water for water seal on high pressure side packing box is taken from first stage of the pump, thus reducing friction on shaft.

Multistage opposed im-



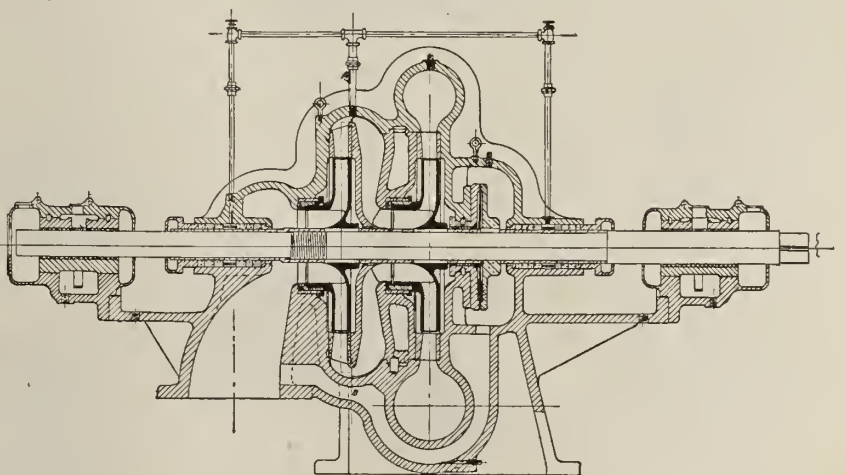
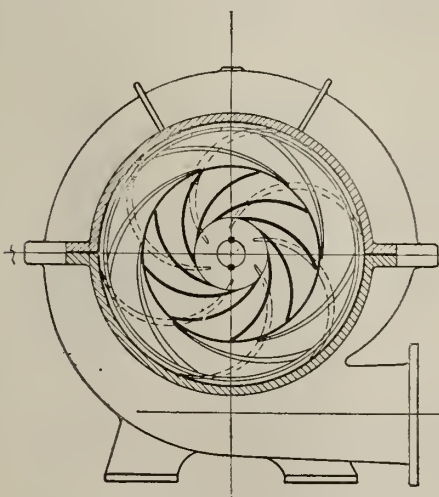
TYPE DSMD

High pressure, double suction, single stage, split volute, for total heads to 200 ft.



TYPE KTMD

High pressure, multistage, horizontally split casing, motor driven, for total heads up to 1000 ft.



CROSS SECTION OF TYPE KTMD "AMERICAN" CENTRIFUGAL PUMP
Illustrating hydraulic balancing device and also the diffuser vanes

PELLER types have long radius pipe bends connecting stages in pairs, so that end thrust in one stage is equalized by end thrust in opposite direction in the other stage.

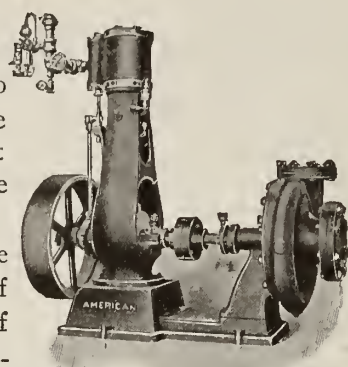
TESTING—Pumps made from each separate set of patterns in all sizes of stock pumps, and all specially designed pumps are carefully tested under working conditions and their characteristics plotted.

No pump is allowed to leave the works that does not show the efficiency guaranteed.

THRUST BALANCE—“American” multistage, single suction, split casing, centrifugal pumps, with enclosed impellers, are provided with hydraulic thrust bearings in which a rotating disk within pump casing is separated from a stationary disk by a film of water, the water within the enclosed space acting as a hydraulic cushion. This hydraulic balance has advantages over the mechanical thrust bearing, although both types can be furnished, depending on conditions.

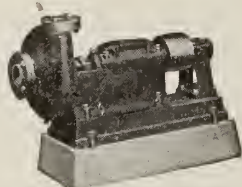
For pumping gritty water, we make a pump with very wide bearings entirely removed from the volute chamber. This pump is known as Type P. Between the bearings in this pump is placed a ball bearing for taking care of end thrust. This ball bearing is held in place by a threaded collar which is locked in position.

Many types of “American” vertical



TYPE AED

Low pressure, single stage, horizontal centrifugal pump, direct connected to steam engine, for total heads up to 30 ft.



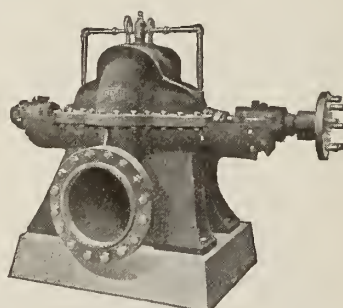
TYPE P

High pressure, horizontal, with gritproof bearing, for total heads to 125 ft.



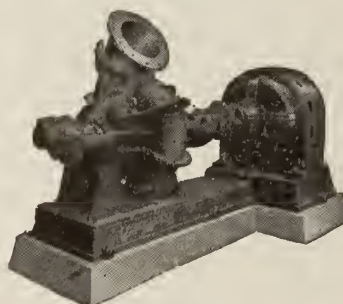
TYPE PMD

High pressure, single stage, horizontal centrifugal, with gritproof bearing. Motor driven, for total heads to 125 ft.



TYPE DS

Double suction, horizontal, split volute, single stage centrifugal, for total heads to 200 ft.



TYPE RMD

High pressure, single stage, double suction, vertical split volute, for total heads to 200 ft.

centrifugals and all “American” deep well turbine centrifugals are provided with roller or ball thrust bearings placed at top of the shaft and so designed that the entire weight of shaft and attached impeller, or impellers, is carried at the surface.

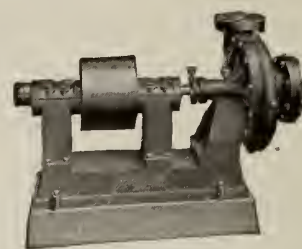
EFFICIENCY—Skillful designing and careful workmanship enable “American” centrifugal pumps to compete in point of efficiency with pumps of their kind made by any other manufacturer. The larger the pump and the higher the head, within certain limitations, the higher the efficiency.

Several standard types of these pumps are designed in larger sizes to maintain their highest efficiencies on total heads up to 200 ft. for each stage. Specially designed pumps that maintain highest efficiencies on total heads of over 400 ft. for each stage have been built by this company, and these pumps attain up to 80% efficiencies.

EQUIPMENT—“American” centrifugal pumps are equipped with plain pulley for belt drive, with grooved sheave for rope drive, steam engine, gasoline engine, electric motor, steam turbine, or with hydraulic turbine.

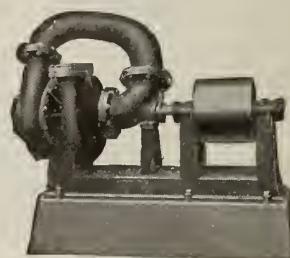
The pumps are also supplied unmounted, with flexible shaft coupling for any power, or mounted on a base, but without attached power.

MATERIAL—“American” centrifugal pumps are made of all-iron, of iron with bronze fittings



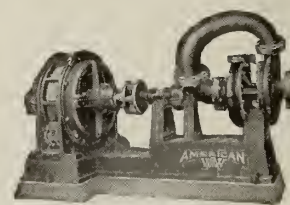
TYPE EE

Single stage, belt driven, high pressure, for heads to 125 ft.



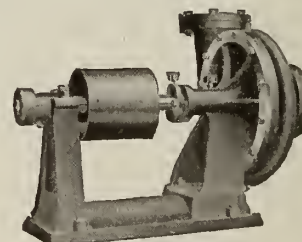
TYPE I

High pressure, 2-stage, belt driven, for total heads to 250 ft.



TYPE IMD

High pressure, 2-stage, motor driven, for total heads to 250 ft.



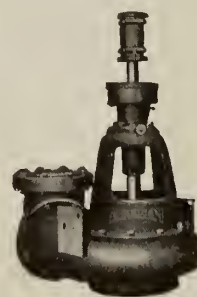
TYPE A OR TYPE E

Single stage, belt driven
Type A, low pressure.
Type E, high pressure, for heads to 125 ft.



TYPE C OR TYPE G

Type C, low pressure, single stage, vertical shaft, for total heads to 50 ft.
Type G, high pressure, single stage, vertical shaft, for total heads to 100 ft.



TYPE Q

High pressure, vertical type, single stage, with submerged water seal, for total heads to 100 ft.
Patented March 7 1916

or of all-bronze. For some conditions, special acid resisting metals are used.

SIZES AND CAPACITIES—
“American” centrifugal pumps are made in any size, from $\frac{3}{4}$ in. to the largest built. They are made in both horizontal and vertical types, and in any number of stages. For approximate capacities, see table on following page.

Mine Pumping.

“American” electrically driven centrifugals for mine pumping have the advantages of occupying small space; are so designed that they are least affected by water containing grit, or acid solutions; have all internal parts easily accessible in case repairs are needed; require little attention; and they obviate the use of steam pipes in shafts and underground chambers. The sinker pumps are designed to operate under variable heads, and are so constructed that they will not overload motors if total head is less than that for which pump is designed.

TYPE KTMD, SPECIAL—Illustration below shows a 6-stage high pressure, horizontally split shell, enclosed impeller, diffuser type, centrifugal pump, direct connected to electric motor.

This is a special type for mine service with marine type motor-thrust bearing and with flange coupling between bearing and motor, and flexible shaft coupling between thrust bearing and pump to provide for installing in an inclined shaft.

The 3-stage high pressure, horizontally split shell, enclosed impeller, diffuser type, centrifugal pump, direct connected to electric motor, is especially designed for mine service and equipped to operate in an inclined shaft.



TYPE H
High pressure, 2-stage, vertical shaft, for total heads to 150 ft.



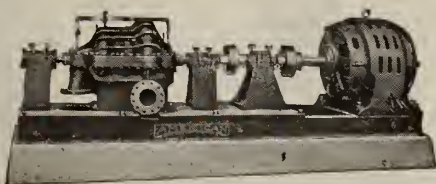
TYPE OKMD
Vertical plain centrifugal type mine-sinking pump, direct connected to vertical type motor



TYPE GMD
High pressure, single stage, vertical shaft, motor driven, for total heads to 100 ft.



TYPE KTMD, SPECIAL



TYPE KTMD, 3-STAGE

Deep Well Turbine Centrifugal Pumps.

The “American” deep well turbine centrifugal pump is designed to meet conditions which will not permit the use of plain centrifugals when mounted either horizontally or vertically. Made in sizes to operate in wells 12 ins. and larger in diameter, inside of casing. Special designs of this pump provide a combination of a deep well turbine, located in the well for elevating water to surface, and a single stage or multistage centrifugal mounted on same shaft at surface and driven by same power, to act as a booster pump for forcing water through mains or into an elevated tank or standpipe.

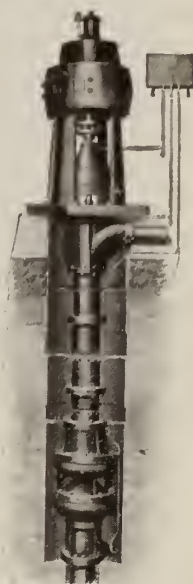
This pump has the shaft enclosed in an inner casing, so that water passage to surface is between inner and outer water casing. The pump is so constructed that any water passing up through packing gland above top impeller is drained out through an orifice into the well, preventing gritty water from getting into bearings. The entire weight of main shaft and attached impellers is carried on roller or ball bearings at surface, operating between large disks.

These pumps are designed to deliver from 200 to 3000 gals. of water per minute.

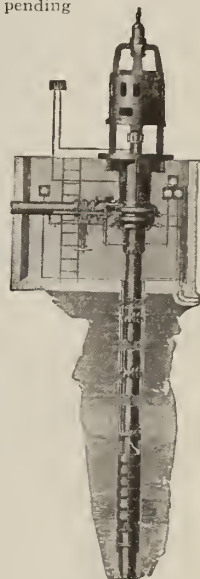
The turbine may be belt driven from any convenient power; but, where electric power is obtainable, electric motor can be mounted vertically on pump head and thus secure the most compact and economical drive. When electric motor is used, it is attached to turbine shaft by means of a flexible coupling. This equalizes any unequal alignment between motor and pump shaft, removes from pump all weight of motor and allows motor and pump to rotate together, the inequalities in either being balanced, saving friction common to other designs.

“American” Deep Well Plunger Pumps.

The latest practice in deep well plunger pumps is represented in



TYPE NMD
High pressure, 2-stage, motor driven, vertical turbine for operating in drill holes 12 to 30 ins. in diameter. Patented, and other patents pending



TYPE KNMD
Combination deep well turbine and booster pump. Patented and patents pending



TYPE CMD
Low pressure, single stage, vertical pump, direct connected to vertical type motor; for use in pits to 15 ft. in depth

the "American" line of this type. These pumps are built in types of power heads for operating single acting, double acting or 2-stroke cylinders. Each of these types of power heads can be adapted to be driven by belt, electric motor, gas or gasoline engine, or by steam engine. Power frame heads are substantially built to meet requirements of high lifts and large volumes of water from deep wells. The bearing boxes on frame, the wrist pin boxes, crank boxes, and the guide through which plunger travels are of large proportions. Bearing boxes are lined with babbitt metal, and run cool under maximum load. Crank shafts are made of steel, while gears and pinions are machine cut.

Compound steam heads are used when steam is delivered to pump at from 80 to 125 lbs. pressure. Special designs of large size deep well plunger pumps, not illustrated, are made with 36-in. stroke. Deep well plunger pumps are made in sizes to operate in wells 3 ins. and larger in diameter.

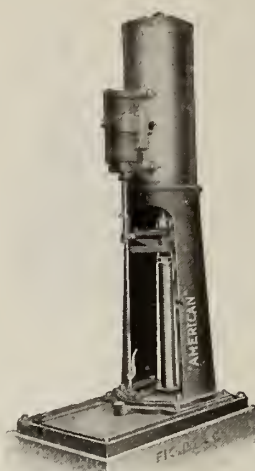
All water cylinders are made of bronze. The double acting cylinder delivers water on both down-stroke and up-stroke, and has about 60% greater capacity than a single acting cylinder of equal diameter and length of stroke. The 2-stroke cylinders are perfectly balanced and have practically double the displacement capacity of a single acting cylinder of equal diameter and length of stroke.

SIZES AND CAPACITIES OF "AMERICAN" CENTRIFUGAL PUMPS
TYPES A, AA, B, E, EE, L, P, C, G AND Q

Economical capacity per minute in U. S. gallons			Diam. of discharge, in ins.	Diam. of suction, in ins.	Weight iron*	
Low head	Medium head	High head			Domestic	Export
10	30	35	1	1 1/4	45	60
30	55	80	1 1/4	1 1/2	115	140
40	75	150	1 1/2	2	125	150
60	125	195	2	2 1/2	145	170
110	200	385	2 1/2	3	215	260
135	265	470	3	4	230	275
225	410	720	3 1/2	5	360	420
250	500	845	4	6	380	440
350	750	1200	5	7	680	790
400	900	1350	6	8	725	1440
600	1550	2200	7	9	950	1490
800	1600	2600	8	10	1280	1520
1100	2600	3950	10	12	2045	2400
1500	4000	5800	12	15	2420	2810
2900	6000	8800	15	15	3040	3500
4500	10000	14000	18	18	5320	6150
6100	13500	18500	20	20	7200	8280
7500	16500	22000	24	24	11400	13200

* Weights given apply only to Type A Pumps

TYPES DS, DSB AND DSMB				TYPES K, KMB, KT AND KTMB			
Diam. of discharge in ins.	Most economic capacities per minute in U. S. gallons, depending on total heads			Diam. of discharge in ins.	Most economic capacities per minute in U. S. gallons, depending on total heads		
1 1/2	65	75	85	1 1/2	65	75	85
2	105	125	145	2	105	125	145
2 1/2	160	185	210	2 1/2	160	185	210
3	225	265	305	3	225	265	305
3 1/2	315	370	425	3 1/2	315	370	425
4	410	480	550	4	410	480	550
5	640	750	860	5	640	750	860
6	935	1100	1265	6	935	1100	1265
7	1275	1500	1725	7	1275	1500	1725
8	1620	1900	2180	8	1620	1900	2180
10	2550	3000	3450	10	2550	3000	3450
12	3655	4300	4945	12	3655	4300	4945
15	5525	6500	7475	15	5525	6500	7475
18	8160	9600	11000	18	8160	9600	11000
20	10200	12000	13800	20	10200	12000	13800
24	14450	17000	19550	24	14450	17000	19550
30	22500	26500	30500				
36	32300	38000	43700				
42	44200	52000	59800				
48	57000	67000	77000				
60	85000	100000	115000				



"AMERICAN" HEAVY DEEP WELL STEAM PUMP HEAD
For operating with either single or double acting cylinders

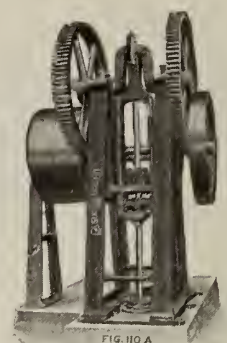


FIG. 110-A No. 3 1/2
"AMERICAN" HEAVY CONSTRUCTION, DEEP WELL, BELT DRIVEN PUMP HEAD
For operating double acting cylinders

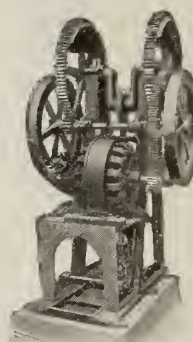


FIG. 110-AMS
"AMERICAN" MOTOR DRIVEN DEEP WELL POWER HEAD

For operating single or double acting cylinders

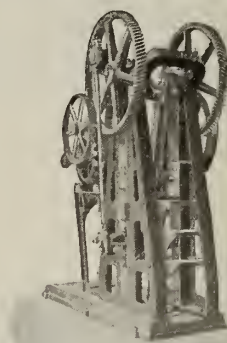


FIG. 483
"AMERICAN" MOTOR DRIVEN 2-STROKE DEEP WELL POWER HEAD



FIG. 382-A.
"AMERICAN" ALL-BRONZE BALL VALVE SINGLE ACTING WATER CYLINDER



FIG. 380-A. "AMERICAN" ALL-BRONZE DOUBLE ACTING WATER CYLINDER

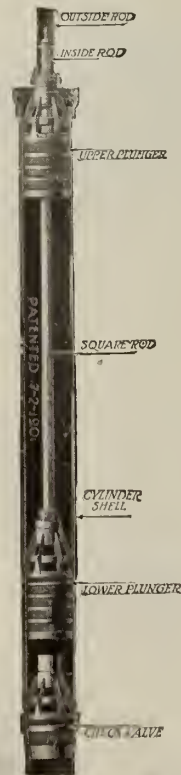


FIG. 195. "AMERICAN" ALL-BRONZE 2-STROKE WATER CYLINDER

Complete line of "American" deep well plunger pumps is illustrated and described in Catalogue No. 130.

Irrigation Pumping.

"American" centrifugal pumps have gained merited prominence in the irrigation field, because they are made in a large number of special designs for this purpose, to meet nearly every condition of service.

Bulletin 150 describing types of pumps adapted for irrigation work mailed on request.

Water Works Pumps.

"American" centrifugal pumps for water works installations have the advantage of being low in first cost, low in foundation cost, low in housing cost; require small expense for attendance and repairs; are not likely to get out of order or to rupture the mains by sudden changes of pressure; and are so designed that they produce a more flexible installation than plunger pumps.

By installing a water works system of "American" centrifugals of comparatively small units, and piping the pumps so that they can be operated separately, in parallel or in series, only a sufficient number of pumps need be operated at any time to supply desired quantity of water at required head, and these pumps can be operated at their maximum efficiency.

By manipulating a few valves, other pumps can be coupled-in to increase the quantity of delivery, or by coupling the pumps in series, to raise the pressure for fire service.

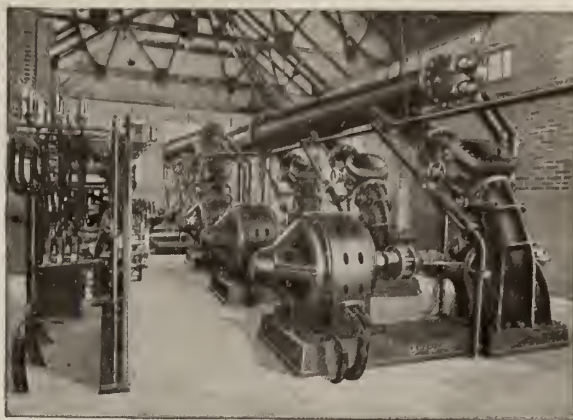
Catalogue 149 showing a number of water works designs will be sent on request to any one interested.

Fire Protection Pumping.

"American" centrifugal fire pumps conform to underwriters' specifications. They combine simplicity with reliability. A special feature of these pumps is that they are so designed that, in case of hose rupture, they will not overload motor, but will consume less power than when operating under standard fire pressure. Capacity, 500 to 1500 gals. per minute, or larger, as ordered. Discharge pressure, 100 lbs. or more per sq. in.

Information Required When Installing "American" Centrifugal Pumps

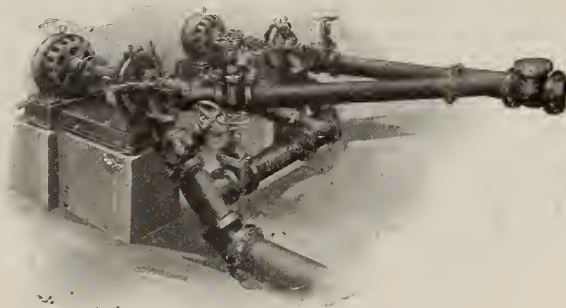
- State: (1) Quantity of water required.
 (2) Kind of pump suggested for economical results.
 (3) Static head, or total distance from fluid at rest to center of mouth of discharge pipe.
 (4) Velocity head, or energy required to set fluid in motion and raise it to velocity attained when passing through discharge opening of pump.
 (5) Friction head, or friction throughout piping, bends, valves, etc.



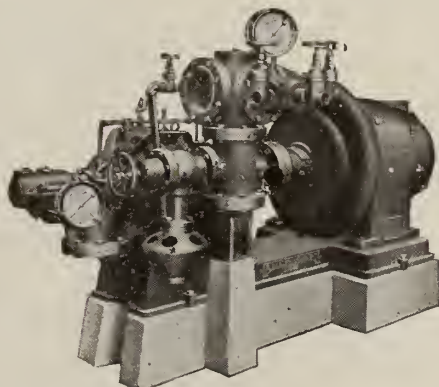
SIX 14-INCH "AMERICAN" CENTRIFUGALS INSTALLED FOR IRRIGATING 6,000 ACRES AND DELIVERING OVER 50,000,000 GALS. OF WATER PER DAY, ON LIFTS OF 84 TO 110 FT.



INSTALLATION OF "AMERICAN" CENTRIFUGALS, CITY WATER WORKS, HOLLAND, MICH.



INSTALLATION OF "AMERICAN" CENTRIFUGALS, CITY WATER WORKS, LINCOLN, NEBR.



TYPE KMD, UNDERWRITERS' FIRE PUMP
 High pressure, 2-stage, horizontal split shell; direct connected by flexible shaft coupling to high speed enclosed ventilated motor

BLACKMER ROTARY PUMP CO.

SALES OFFICES
1347 Book Building
DETROIT, MICH.

Product.

Sole manufacturers of the BLACKMER ROTARY PUMP.

Blackmer Rotary Pump (Patented).

The Blackmer rotary pump is a different and exclusive application of the rotary or centrifugal principle.

There is no other pump on the market like it. It has proved its greater efficiency and economy by its varied uses over a number of years.

Wide Variety of Uses.

Blackmer pumps are giving satisfactory service in breweries, tanneries, chemical works, oil stations, cotton oil mills, soap factories, distilleries and packing houses and refineries.

They act as bilge pumps on boats, large and small, in salt or fresh water.

They are used in water works, irrigation plants, quarries, sugar refineries, creameries and dairies.

It is thus evident that they are adapted to the widest variety of usages.

Improvements.

Gradual improvements have raised the early high standing of Blackmer efficiency to a point where it is generally accepted as one of the most efficient pumps now on the market.

The improved Blackmer rotary pump handles a surprisingly large volume of fluid.

Its action is continuous and dependable; it starts easily without priming.

Blackmer pumps are standardized throughout. The interchangeability of all its parts, whether of iron or bronze, is a highly important feature, as pumps cost at piecemeal no more than as a unit.

Construction.

The illustration shows the interior construction of the Blackmer rotary pump, which consists of cylinder, revolving piston and 4 buckets.

As the piston revolves with the shaft, the buckets are held out against the cylinder by centrifugal force and gravity. The air is thus exhausted from the extension or water chamber, and the fluid which is under atmospheric pressure flows into the pumps and fills the extension chamber.

The buckets drop into this extension chamber at the left and pass to the right, drawing liquid in at suction and pushing it out at discharge. The only fluid that will carry by the discharge port is that which fills the recesses in the piston. Here, it acts as a fluid packing, and keeps the pump at all times suction-tight.

The ports of the Blackmer pump run diagonally across the cylinder, which gives the bucket an even wear.

Friction everywhere is reduced to the lowest point.

Suction Lift.

The large extension chamber, found in the Black-

mer pump, enables these pumps with centrifugal force to make a good suction lift.

When properly installed with suction lift that is given for them in specification table, each pump will pick the liquid from the bottom without priming.

Slippage.

The Blackmer pump is protected against slippage losses by the fact that the buckets are hinged; this device allows freedom for the buckets to drop out against the wall of the cylinder by their own weight, as well as by centrifugal force.

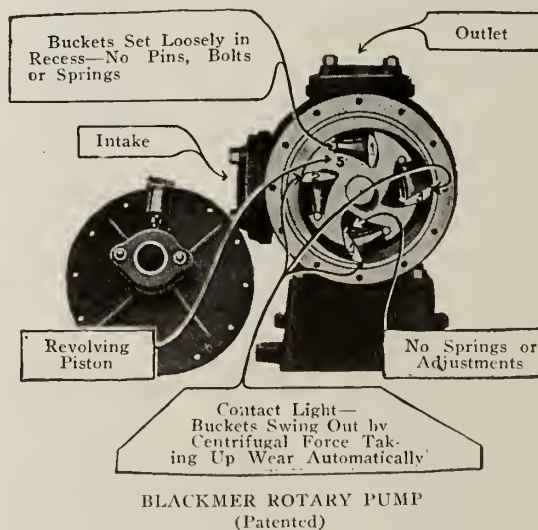
All wear is automatically taken up and the pump is kept at full efficiency until the buckets are used up. New buckets can be installed at small expense, so that the same pump is always ready for another long term of usefulness.

Renewable Linings.

Another remarkable and distinctive feature of the Blackmer pumps, as applied to rotary pumps, is the renewable linings. These can be taken out and replaced without special tools or experience, and without disturbing the connections, in 30 minutes' time. This is an important consideration—the independence from the machinshop's aid.

Nos. 2, 4, 6, 8, 10 and 12 are made with these replaceable linings. They prolong the life of the pump indefinitely.

For liquids containing acid, a special acid resisting bronze is furnished at the extra cost of the metal.



Belt Driven Regular Pumps.

Are made in the solid as well as lined type. The lined types have two heads. Specifications for the lined and solid are the same. The solid types are Nos. 0 to 8, inclusive. Nos. 2, 4, 6 and 8 are solid or lined. Nos. 10 and 12 are lined only.

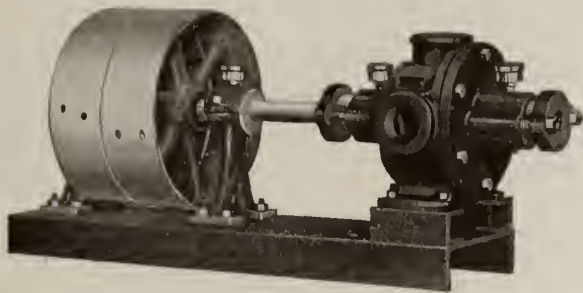
All belted pumps are furnished with tight and loose pulley.

All solid or lined iron pumps are fitted with bronze buckets and bronze glands, up to the No. 8. On the Nos. 8, 10 and 12 they are fitted with iron buckets and iron, bronze-bushed glands.

Each pump is provided with a friction clutch or slide gear, in the double, triple, four and six pump units, and can be used together or separately.

Furnish units with pumps of either 50, 100 or 200 gals. per minute.

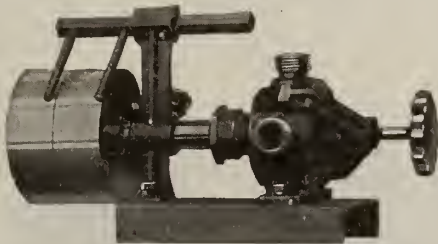
Engineers consider floor space when designing.



BELT DRIVEN PUMP

Sanitary Creamery and Food Pumps.

Nos. 11, 01, 02, 03 made in either iron or bronze, with tight and loose pulley. Similar to others except that shaft is in 2 pieces. Head is fastened to cylinder by bracket and screw, which enables one to take it apart, clean and put it together in a few minutes.



SANITARY CREAMERY AND FOOD PUMP

No. 9 Transfer Pump.

Used for transferring from barrels and tanks. Also made with gears, which doubles its capacity and doubles the suction life.



NO. 9 TRANSFER PUMP

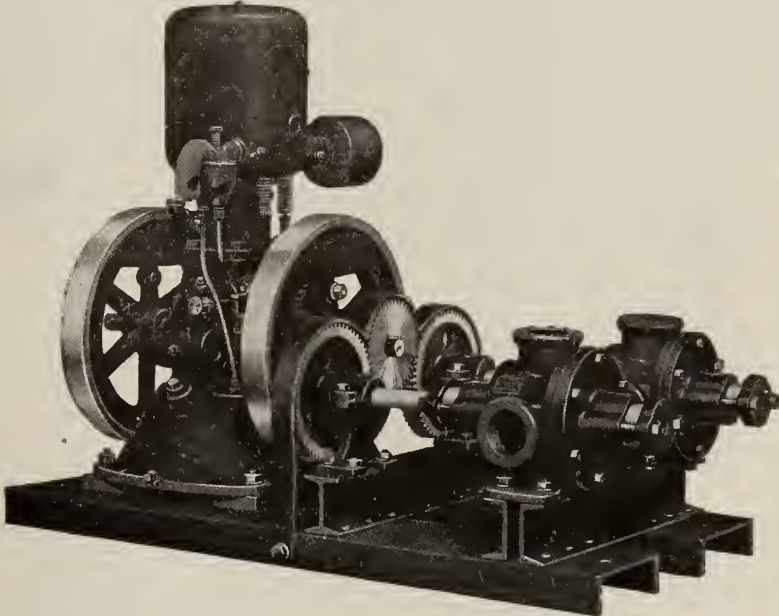
Single, Double, Triple, Four and Six Pump Units.

Extensively used by large oil companies, tanneries, chemical plants, heat treating plants, or any company who wishes to conserve space.

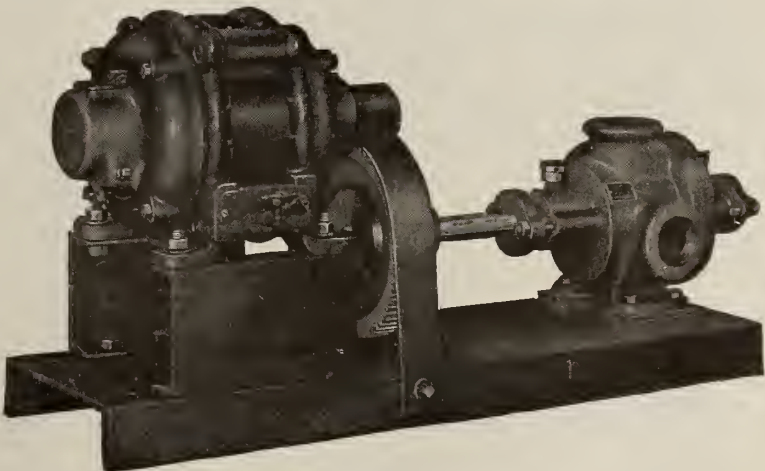
Connections are by gear and pinion to either engines or motors.

BLACKMER ROTARY PUMPS

Number of pump	Pipe connections, in.	Size of pulley, in.	R.p.m.	G.p.m.	Suction lift, ft.	Max. pressure, lbs.	Shipping weight, lbs.	Floor space, in.
0	1 1/2	4 x 1	600	6	2	75	40	4 x 12
1	3/4	6 x 2	500	12	10	75	45	10 x 21
2	1	6 x 2	500	20	10	75	55	10 x 21
3	1 1/2	10 x 3	400	35	12	75	120	12 x 31
4	2	10 x 3	430	50	12	75	130	12 x 31
6	2 1/2	16 x 4	250	100	15	75	350	16 x 40
8	3 1/2	18 x 6	220	200	18	75	500	18 x 52
10	5	30 x 7	175	350	20	75	1350	30 x 80
12	6	36 x 10	150	500	20	75	2500	36 x 90
6 Spec.	2	12 x 4	250	100	15	40	260	14 x 36
11	1	4 x 1	700	4 1/2	1 1/2	40	20	4 x 12
01	1	6 x 2	500	16	8	40	45	8 x 16
02	1 1/2	10 x 2	350	30	10	40	75	10 x 23
03	2	12 x 4	200	80	12	40	240	12 x 33
9	1	Hand		12	5		40	
5	1 1/2	Hand		15	5		65	
7	2	Hand		25	8		125	
9	1			Geared 25	Hand 12		45	
5	1 1/2			30	12		60	



DOUBLE UNIT PUMP CONNECTED BY GEAR TO GASOLINE ENGINE



SINGLE UNIT ROTARY PUMP CONNECTED TO MOTOR

BUFFALO STEAM PUMP COMPANY

BUFFALO, N. Y.

BRANCHES IN ALL PRINCIPAL CITIES

Products.

SINGLE STAGE and MULTISTAGE, DOUBLE SUCTION, CENTRIFUGAL PUMPS.

Specifications, Class "S" Single Stage, Double Suction, Centrifugal Pumps.

SHELL—Heavy gray cast iron, divided on horizontal center line, machined to gauge, drilling to template. Close clearances with runner preventing leakage.

WEARING RINGS—Brass. Furnished in shell.

RUNNER—Enclosed type, double suction, hard cast iron to withstand abrasion, finished to template.

SHAFT—Open hearth machine steel, accurately finished all over. Large size shafts are hammer forged. All rotating parts assembled on shaft and balanced before putting in pump.

BEARINGS—Ring oiling. Solid bearing bushings on 4-in. sizes and smaller. Split bearing bushings on 5-in. sizes and larger.

THRUST BEARING—Bearing surfaces water cooled on 5-in. sizes and larger, insuring perfect condition of lubricant. (Factory reserves discretion as to best type bearing to suit customer's requirements of head and running speed.)

STUFFING BOXES—Extra deep. Glands of cast iron, allowing ample packing space. Water seals and necessary connections furnished.

COMPANION FLANGES—Furnished on pumps 6-in. size and smaller, having flanged openings.

COUPLING—Flanged or flexible, as desired.

SUBBASE—Cast iron, ribbed and stiffened.

FINISH—All pumps painted, filled and rubbed down. Bright parts exposed to weather protected by slushing compound.

FITTINGS—Drain and air cocks, piping for water seal and water jacket on thrust bearing.

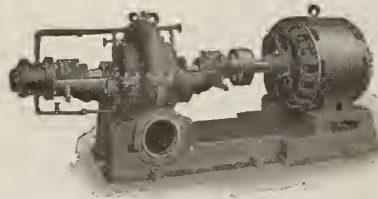


FIG. 1065. CLASS "S" SINGLE STAGE, DOUBLE SUCTION, CENTRIFUGAL PUMP
180 ft. maximum working head

Fig. No.	Size pump, in.	Pipe sizes, in.		Cap., gals. per min.		Diam. and face pulley, in.	Approx. floor space, pulley pump, in.	Code word, pulley pump
		Suc- tion	Dis- charge	Normal	Maximum			
1059	1	1½	1½	25	35	4 x 4	31 x 18	PABAG
1059	1½	2	2	55	75	5 x 5	31 x 18	PABEH
1059	1½A	2	2	55	75	5 x 5	31 x 18	PABEX
1059	2	2½	2½	100	140	6 x 5	31 x 18	PABFU
1059	2A	2½	2	100	140	6 x 5	31 x 18	PABFZ
1062-3	2½	3	2½	155	225	6 x 5	39 x 22	PABIJ
1062-3	2½A	3	2½	155	225	6 x 5	39 x 22	PABIR
1062-3	3	4	3	225	325	7 x 6	39 x 22	PABJY
1062-3	3A	4	3	225	325	7 x 6	39 x 22	PABLD
1062-3	4	5	4	400	550	8 x 8	45 x 25	PABNA
1065	5	6	5	620	850	10 x 8	69 x 28	PABOK
1065	6	8	6	900	1,300	10 x 10	70 x 30	PABSE
1065	8	10	8	1,600	2,000	12 x 12	83 x 35	PABUL
1065	10	12	10	2,500	3,100	15 x 12	92 x 42	PABWI
1065	12	14	12	3,600	4,500	18 x 12	100 x 44	PABYM
1065	15	18	15	5,500	7,000	30 x 20	108 x 51	PABZS
1065	18	20	18	8,000	10,500	40 x 24	128 x 69	PABZX

Add code words:
JCESF for brass runner.
JCHBY for brass glands.
JCFXD for brass covered shaft.
JCGMP for monel metal shaft.
JCWAF for motor base and flanged coupling.
JCXRS for motor base and flexible coupling.

Specifications, Class "RDS" Double Suction, Multi-stage Centrifugal Pumps.

CASING—Cast iron, divided on horizontal center line.
IMPELLERS—Cast iron. Double suction, enclosed type. Hydraulically balanced. Mounted on shaft by feather keys and lock nuts.

CLEARANCE RINGS—Bronze, "L" section, floating type.

SHAFT BEARINGS—Ring oiling, removal shells, babbitt lined.

THRUST BEARING—Multiple collar, marine type. Housing split horizontally, babbitted and water jacketed. Oil circulates continuously over thrust collars.

GLANDS—Cast iron, brass bushed.

WATER SEALS—Brass cage rings with suitable circulating holes. Provided at each stuffing box. Seal on suction end has water supply connection.

SHAFT—Steel, brass covered in pump and through glands.

SUBBASE—Cast iron, ribbed and stiffened.

PULLEY—Cast iron, one piece. Pedestal bearings cast iron, bearings similar to main pump bearings.

COUPLING—Flexible type.

FINISH—Painted, filled and rubbed down outside with final finishing coat. Bright parts exposed to weather protected by a slushing compound.

FITTINGS—Drain and air cocks. Piping for water jacket on thrust bearing and for water seal.

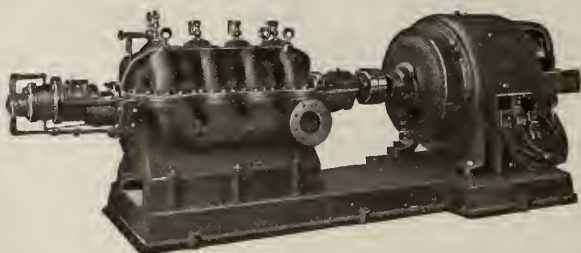


FIG. 1240. SECTIONAL VIEW, CLASS "RDS" MULTISTAGE, DOUBLE SUCTION, CENTRIFUGAL PUMP
300 lbs. maximum working pressure

Fig. No.	Size pump, in.	Pipe sizes, in.		Cap., gals. per min.		Diam. and face pulley, in.	Approx. floor space, pulley pump, in.	Code word, pulley pump
		Suc- tion	Dis- charge	Nor- mal	Maxi- mum			
TWO STAGE								
1248	2	2½	2	100	140	6 x 5	87 x 25	RSADM
1248	2½	3	2½	150	225	7 x 6	87 x 25	RSBER
1248	3	4	3	225	325	8 x 8	92 x 27	RSCUB
1248	4	5	4	400	550	10 x 10	111 x 31	ESDIL
1248	5A	6	5	620	750	10 x 12	111 x 31	RSEFX
1248	5B	6	5	620	850	10 x 12	116 x 38	RSFAD
1248	6	8	6	900	1300	12 x 16	120 x 38	RSFYK
1248	8	10	8	1600	2000	13 x 16	130 x 43	RSFZP
THREE STAGE								
1249	2	2½	2	100	140	On Application	94 x 25	RSGND
1249	2½	3	2½	150	225		94 x 25	RSHPZ
1249	3	4	3	225	325		99 x 27	RSJEO
1249	4	5	4	400	550		120 x 31	RSKAP
1249	5A	6	5	620	750	On Application	120 x 31	RSLOX
1249	5B	6	5	620	850		127 x 38	RSLOV
1249	6	8	6	900	1300		131 x 38	RSMTI
1249	8	10	8	1600	2000		143 x 43	RSMUX
FOUR STAGE								
1250	2	2½	2	100	140	On Application	100 x 25	RSNUC
1250	2½	3	2½	150	225		100 x 25	RSOBY
1250	3	4	3	225	325		106 x 27	RSPAL
1250	4	5	4	400	550		129 x 31	RSQEF
1250	5A	6	5	620	750	On Application	129 x 31	RSTIZ
1250	5B	6	5	620	850		138 x 38	RSTWD
1250	6	8	6	900	1300		142 x 38	RSWOL
1250	8	10	8	1600	2000		155 x 43	RSWRV

Add code words:
JCESF for brass runners.
JCHBY for brass glands.
JCXRS for motor base and flexible coupling.
Note: Brass runners are recommended for 2-in. and 2½-in. pumps, and are necessary on these sizes when speed is 2200 r.p.m. or over.

CHICAGO PUMP COMPANY

Electric Pumping Machinery

918 West Lake Street

CHICAGO, ILL.

REPRESENTATIVES

BOSTON, MASS., ALLEN ENGINEERING CO.
CINCINNATI, OHIO, C. R. LINGO
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MINNEAPOLIS, MINN., MORGAN GERRISH CO.

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PHILADELPHIA, PA., W. G. CULBERT
PITTSBURGH, PA., F. W. ROCKSTRAW
SAN FRANCISCO, CAL., GARNETT YOUNG & CO.

Products.

DUPLEX ELECTRIC SEWAGE EJECTORS, AUTOMATIC ELECTRIC BILGE PUMPS, MULTISTAGE TURBINE PUMPS, AUTOMATIC CONDENSATION PUMPS and RECEIVERS, TURBINE AIR LINE PUMPS.

Pneumatic Water Systems.

Pumping Machinery.

Pumping machinery is made a specialty and all this company's facilities are devoted to improving this class of equipment, thus enabling it to produce the finest line of pumps manufactured. A full description, including illustrations of various styles of pumps, furnished on request.

AUTOMATIC ELECTRIC BILGE PUMP

Type and No. of pump	Size of disch., in.	Cap. in g.p.m. per pump	H.p. per ft. head
S.L.G. 1	1	10-15	.016
S.L.G. 2	1 1/4	25-30	.025
S.L.G. 3	1 1/2	50-55	.045
S.L.G. 4	2	70-75	.065
S.L.G. 5	2 1/2	100	.085
S.L.G. 6	2 1/2	125	.1
S.L.G. 7	3	150	.13
S.L.G. 8	4	200	.16
S.L.G. 9	4	250	.2
S.L.G. 10	4	300	.25
S.L.G. 11	4	350	
S.L.G. 12	4	400	
S.L.G. 13	5	500	
S.L.G. 15	5	750	
S.L.G. 17	6	1000	
S.L.G. 18	6	1250	
S.L.G. 19	6	1500	

Diameter of basin accommodating duplex pumps is 4 ft. Single pump is 3 ft. Depth of basin should be 3 ft. deeper than lowest inlet.

Duplex Electric Sewage Ejector.

For pumping sewage from basements into sewer.

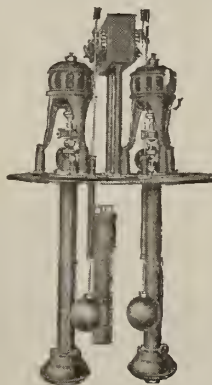
DUPLEX ELECTRIC SEWAGE EJECTOR

Type and size of disch., in.	Cap. in g.p.m. per pump	H.p. per ft. head
S.E. 2 1/4	50	.050
S.E. 2 1/2	75	.065
S.E. 3	100	.1
S.E. 3	125	.12
S.E. 3	150	.15
S.E. 3 1/2	200	.2
S.E. 4	250	.25
S.E. 4	350	.33
S.E. 4	400	
S.E. 5	500	

Diameter of basin accommodating duplex ejectors is 5 ft. Depth of basin should be 4 ft. deeper than lowest inlet.

TYPE S.L.G. AUTOMATIC ELECTRIC BILGE PUMP

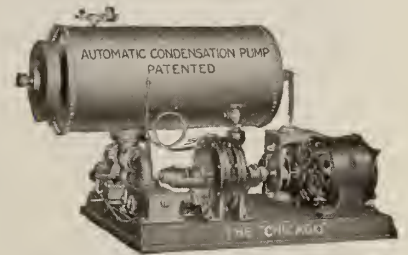
For pumping water out of basements into sewer



TYPE S.E. DUPLEX ELECTRIC SEWAGE EJECTOR

AUTOMATIC CONDENSATION PUMP AND RECEIVER

No. of pump	Max. sq. ft. direct rad.	H.p. motor	Approx. ship. wgt., lbs.	Boiler pres. pumps will disch. against at 1750 r.p.m.	Size of disch. in.	Approx. floor space required, in.	Highest water-level in receiver from floor line, in.
2	3000	1 1/4	400	10	3/4	30x53	21
3	6000	1 1/2	600	10	1	32x53	30
3A	10000	1 1/2	650	10	1	32x53	30
4	10000	1 3/4	700	15	1	32x64	30
4A	15000	1 3/4	700	10	1	32x70	34
5	15000	1	800	20	1 1/4	32x70	34
5A	20000	1	800	10	1 1/4	32x70	34
6	25000	2	900	20	1 1/2	36x76	37
6A	35000	2	900	10	1 1/2	36x76	37



AUTOMATIC CONDENSATION PUMP AND RECEIVER

For returning condensation water from heating systems into boilers. Controlled by tilting receiver—more positive than float control

TURBINE AIR LINE PUMPS

Size	Sq. ft. direct rad.	H.p. motor 1750 r.p.m.	Size of air return inlet, in.	Size of air exhaust and overflow, in.	Approx. ship. wgt., lbs.
1	5000	1 1/3	1 1/2	1	320
2	10000	1 1/2	1 1/2	1	350
3	15000	1 3/4	1 1/2	1	380
4	20000	1	1 1/2	1	420
5	30000	1 1/2	1	1 1/4	830
6	40000	2	1	1 1/4	900

Dimensions, Nos. 1 to 4: Receiver is 15 in. diameter; highest point of receiver from floor line, 15 in.; from floor line to highest point of motor, approximately 27 in.

Nos. 5 and 6: Receiver, 24 in. in diameter; 23 in. high; over all height 42 in.

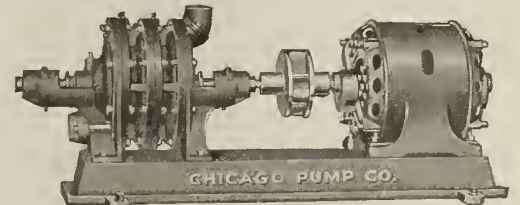
MULTISTAGE TURBINE PUMPS

Type and size of suc. and disch., in.	Cap. in g.p.m. per pump	Head in ft. per stage at 1750 r.p.m.
S.B. 1	5	15
S.B. 1	10	30
S.B. 1	15	27
S.B. 1 1/4	25	20
S.C. 1 1/4	35	50
S.C. 1 1/2	50	40
S.C. 2	75	40

HORIZONTAL SPLIT PUMPS

S.H.S. 2 1/2	100	145
S.H.S. 3	150	135
S.H.S. 3	200	125
S.H.S. 3	250	115
S.H.S. 4	300	
S.H.S. 4	350	

NOTE—To determine number of stages required to pump given quantity against given head, use number of stages that will develop head nearest to that required. If head developed by number of stages selected is less than that required, the capacity will be somewhat decreased; if head developed is greater, the capacity will be somewhat increased.



MULTISTAGE TURBINE PUMP



HORIZONTAL SPLIT PUMP

For supplying buildings with water, circulating hot and cold water and brine, and for boiler feed purposes

ESTABLISHED 1869

INCORPORATED 1900

COLUMBUS STEAM PUMP WORKS CO.

(JAMES G. PULLING & COMPANY)

COLUMBUS, OHIO

NEW YORK OFFICE, S. B. WHINERY, 95 Liberty Street

NEW ORLEANS OFFICE, HAUBTMAN & LOEB Co., LTD.

Products.

PUMPS for every service which include: Acid, Air, Ammonia, Boiler Feed, Brine, Centrifugal, Creamery, Filter Press, Deep Well, Duplex, Fire, Hydraulic, Oil, Plunger, Power, Reciprocating, Sewage, Slush, Sugar House, Tank, Tar, Vacuum.



TRADE-MARK

Experience and Services.

This company has been in the pump business for over fifty years, and during that time has accumulated a vast store of experience that is at the disposal of engineers who have pump problems to solve.

The company has made a specialty of pumps for handling heavy liquids of all description and can furnish the very best of references from the largest users in this country.

General Service Pumps, Single Cylinder Double Acting Pattern.

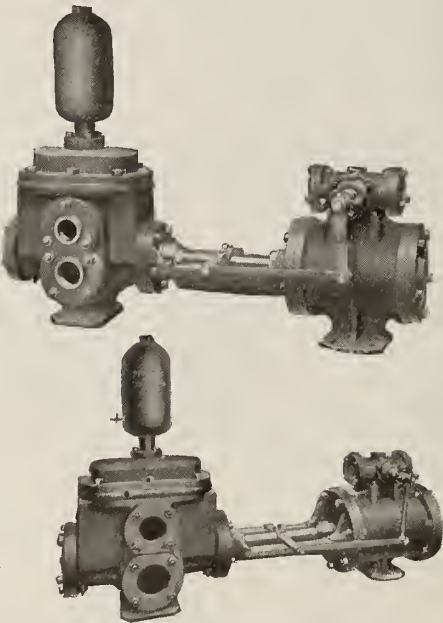
This type pump is designed for working pressure not to exceed 150 lbs.

Note the absence of outside working parts.

Pumps are absolutely guaranteed not to short stroke or hit heads when changing from full load to no load.

Furnished plain iron fitted unless otherwise specified.

However same can be brass fitted at small additional expense.



PULLING GENERAL SERVICE, SINGLE CYLINDER DOUBLE ACTING PUMPS

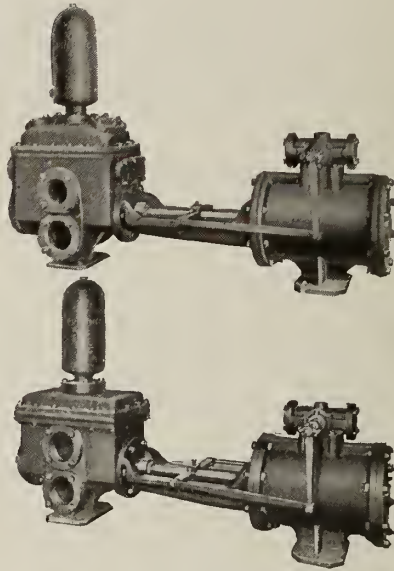
exceed 150 lbs. Where boiler pressure exceeds this, the use of outside packed plunger pumps is recommended.

These pumps are fitted with either brass or rubber valves. When pumping cold water, soft or medium valves are preferable, but when pumping hot water the valves should be hard rubber or brass. Note the absence of outside working parts.

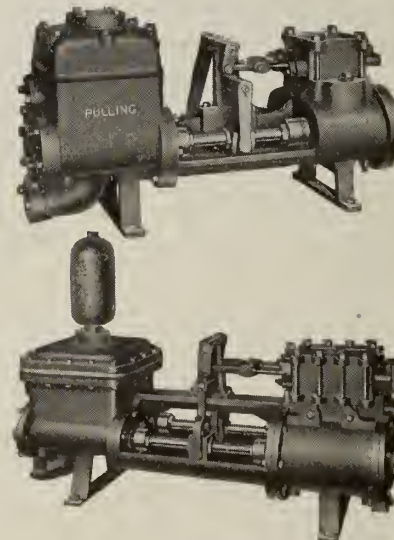
Duplex Boiler Feed Pumps.

Although this type is designed especially for boiler feeding service, all of the pumps listed are adapted for general service or the pumping of liquids substantially free from grit, aciduous or foreign matter that would tend to obstruct the water passages, or effect the proper seating of valves.

Pumps can be furnished plain iron or brass fitted as desired.



PULLING BOILER FEED PUMPS, SINGLE CYLINDER DOUBLE ACTING PATTERN



PULLING DUPLEX BOILER FEED PUMPS

DATA, PULLING REGULAR PATTERN PISTON PUMPS FOR GENERAL SERVICE

Size No.	Diam. steam cyl. in.	Diam. water cyl. in.	Piston stroke, in.	Cap. per stroke, gal.	Cap. ordinary speed, gal.	Steam pipe, in.	Exhaust pipe, in.	Suction pipe, in.	Disch. pipe, in.	Wt., lbs.
1	4 1/2	2 1/2	6	.13	11	3/4	1	1 1/2	3/4	265
2	4 1/2	2 3/4	6	.16	16	3/4	1 1/4	1 1/4	1 1/2	300
3	5	3	7	.25	31	3/4	1 1/4	1 1/2	1 1/4	330
4	6	3 3/4	8	.40	42	3/4	1 1/2	2	1 1/2	500
5	7	4 1/2	8	.55	69	1	1 1/2	2 1/2	2	560
6	9	5	10	.89	103	1 1/4	2	3	2 1/2	925
7	10	6	12	1.43	143	1 1/2	2	4	3	1,200
8	12	7	12	2.	200	1 3/4	2	5	4	1,560
8 1/2	14	8	16	3.50	350	1 1/2	2 1/2	5	4 1/2	2,150
9	16	8	24	5.20	522	2	3 1/2	6	5	2,650
10	16	10	24	8.16	690	2	3 1/2	6	5	4,150
11	18	12	24	11.80	750	2 1/2	3 1/2	8	6	4,660
12	20	14	24	16	900	3	4	10	8	6,000

Boiler Feed Pumps, Single Cylinder Double Acting Pattern.

This type is designed for working pressures not to

DATA, DUPLEX BOILER FEED PUMPS

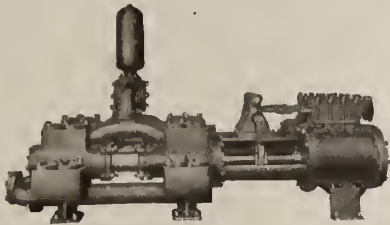
Diam. steam cyl. in.	Diam. water cyl. in.	Piston stroke, in.	Cap. per stroke, gal.	H.p. boilers pump will feed	Steam pipe, in.	Exhaust pipe, in.	Suc. pipe, in.	Disch. pipe, in.	Weight, lbs.
3	2	3	.08	50	3/8	1/2	1 1/4	1	240
4 1/2	2 3/4	4	.205	125	1	1 1/4	2	1 1/2	540
5 1/4	3 1/2	5	.416	300	1	1 1/4	2 1/2	2	650
6	4	6	.652	400	1	1 1/2	3	2 1/2	755
7 1/2	4 1/2	6	.826	500	1 1/2	2	4	3	1,100
7 1/2	4 1/2	10	1.37	700	1 1/2	2	4	3	2,000
9	5	10	1.70	800	1 1/2	2	4	3	2,100
10	6	12	2.44	1,200	2	2 1/2	5	4	2,700
10	7	12	3.99	2,000	2	2 1/2	6	5	2,900
12	7	12	3.99	2,000	2	2 1/2	6	5	3,000
*12	8	12	5.00	2,750	2 1/2	3	6	5	3,800
*12	8 1/2	12	5.80	3,000	2 1/2	3	7	6	3,850
*12	10	12	8.16		2 1/2	3	8	7	5,850
*14	10	12	8.16		2 1/2	3	8	7	6,050
*14	10	20	10.09		3	3 1/2	8	7	9,650
*20	12	16	10.09		3	3 1/2	8	7	14,000

*Sizes 12 x 8 x 12 to 20 x 12 x 16 inclusive, are of the separate water cylinder type. Any of the above pumps can be furnished brass fitted at slight additional cost.

Duplex Outside Center Packed Plunger Pumps.

This type is especially adapted for situations where the liquid to be pumped contains considerable grit or sand, or where the pressure to be pumped against is high. It is well adapted for hot water. In this type of pump, the plungers, being externally packed, are always in sight of the attendant engineer, so that any leakage can be readily detected and the stuffing boxes adjusted or repacked.

The pump ends, on the machines listed below, will stand a constant working pressure of 300 lbs.



PULLING DUPLEX PLUNGER PUMP

DATA, DUPLEX OUTSIDE CENTER PACKED PLUNGER PUMP

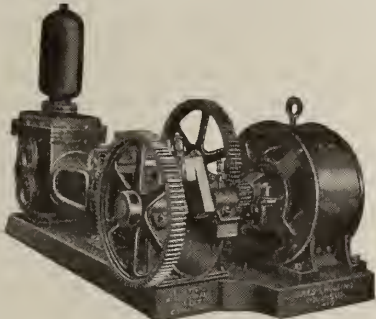
Diam. steam cyl., in.	Diam. water plungers, in.	Stroke length, in.	Cap. per stroke 1 plunger, gals.	Strokes per min. ea. plunger	Gals. per min. both plungers	Steam pipe, in.	Exhaust pipe, in.	Suc. pipe, in.	Disch. pipe, in.
7½	4½	10	.65	50 to 100	75 to 125	1½	2	4	3
9	4½	10	.65	50 to 100	75 to 125	1½	2	4	3
9	5	10	1.00	50 to 100	100 to 200	1½	2	4	3
10	6	12	1.47	50 to 100	145 to 290	2	2½	5	4
12	6	12	1.47	50 to 100	145 to 290	2	2½	5	4
12	7	12	2.00	50 to 100	200 to 400	2	2½	6	5
14	7	12	2.00	50 to 100	200 to 400	2½	3	6	5

Any of the above pumps will be fitted with composition plungers, lined glands and bronze rods at a slight additional cost.

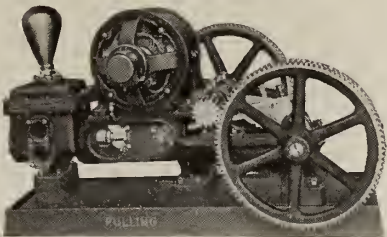
Power Pumps, Horizontal Single Cylinder Double Acting Type.

This type is used extensively in connection with water systems in small village water works, water stations, office buildings, factories, refineries, refrigerating plants and mines, where water to be pumped does not contain a large proportion of solid matter and for general pumping where the working pressure does not exceed 150 lbs.

Motor driven pumps are generally used because of the ease and efficiency with which power may be transmitted to them. However, all sizes of belt driven machines can be furnished, if desired.



DRIVE FORM "A"

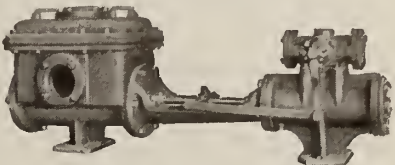


DRIVE FORM "C"

DATA, POWER PUMPS								
Diam. water cyl., in.	Stroke length, in.	Max. water press., lbs.	R.p.m.	Gals. per rev.	Gals. per min.	Suc. in.	Disch., in.	Form, mounting motor
3	8	150	50	.42	25	2	1½	B or C
3½	8	150	50	.56	30	2	1½	B or C
3¾	8	150	50	.66	35	2	1½	B or C
4½	8	125	50	1.10	55	2½	2	B or C
5	8	125	50	1.35	68	3	2½	B or C
6	8	100	45	1.95	88	3½	3	B or C
7	8	100	40	2.66	106	4	3	A or B
8	8	100	40	3.41	136	5	4	A or B
5	12	150	40	2.04	82	3	2½	A or B
6	12	150	40	2.94	117	4	3	A or B
7	12	140	40	3.99	160	4	3	A or B
8	12	125	40	5.22	209	5	4	A or B
10	12	100	30	8.16	245	6	5	A or B
12	12	100	30	11.75	353	7	6	A or B

Low Vacuum Pumps, Single Cylinder Double Acting Pattern.

This type is designed for elevating water, or other liquids to a moderate height with small consumption of steam. They have water cylinders as large or larger than the steam cylinders, therefore they can not feed their own boilers, but when desired an auxiliary boiler feed pump may be supplied for this purpose. Furnished either iron or brass fitted as desired.



PULLING LOW VACUUM PUMP

DATA, LOW VACUUM PUMPS

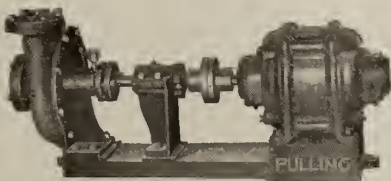
Diam. steam cyl., in.	Diam. water cyl., in.	Piston stroke, in.	Cap. per stroke, gals.	Cap. per min., gals.	Steam pipe, in.	Exhaust pipe, in.	Suc. pipe, in.	Disch. pipe, in.	Weight, lbs.
3	3	7	.21	28	¾	1	1	¾	290
3	3½	7	.29	38	¾	1	1½	1	300
3½	3½	7	.29	38	¾	1	1½	1	320
4½	4	8	.39	50	¾	1	2	1½	415
4½	4½	8	.55	70	¾	1	2	1½	500
4½	5	8	.60	80	¾	1	2½	2	630
4½	6	8	.86	115	¾	1	3	2½	700
6	6	8	.86	115	1	1¼	3	2½	875
6	7	8	1.33	133	1	1¼	4	4	925
6	8	8	1.80	200	1	1¼	5	4	1,000
6	6	12	1.47	150	1¼	2	3½	3	1,150
6	10	12	2.60	260	1¼	2	5	4	1,400
8	8	12	4.08	400	1¼	2	6	5	1,300
8	10	12	2.60	260	1¼	2	5	4	1,375
8	12	12	4.03	400	1¼	2	6	5	1,400
10	10	12	5.87	530	1¼	2	7	6	2,150
10	12	12	4.03	400	1¼	2	6	5	1,500
10	14	16	5.87	530	1¼	2	7	6	2,300
12	14	16	10.66	900	1¼	2	8	7	3,400
12	16	16	12.00	900	1¼	2	8	7	3,525
14	14	16	10.66	900	1½	2½	10	8	3,675
14	16	16	12.00	1050	1½	2½	10	8	3,700
16	16	16	12.00	1050	1½	2½	10	8	3,875
					1½	2½	10	8	4,050

Other sizes than those listed can be furnished for other requirements when desired.

Tests and Guarantees.

The policy of this company, from the inception of the business, has been to build the very best pump that accurate designing and skilled workmanship applied to the best material can produce. Over fifty years of successful pump manufacturing has demonstrated the wisdom of this course.

Every pump is thoroughly tested before leaving the factory and is fully guaranteed to be exempt from any defects arising due to faulty workmanship or material. Its satisfactory operation is also guaranteed on condition that it is properly set up, reasonably cared for and used for the service and capacity of its proportion and design.



DIRECT CONNECTED CENTRIFUGAL PUMP

Made in all sizes for any head



POWER DRIVEN MAGMA PUMP

Made in all sizes



SINGLE CYLINDER MAGMA PUMP

Made in all sizes

COPPUS ENGINEERING & EQUIPMENT CO.

Manufacturers of Turbo Boiler Feed Pumps

340-350 Park Avenue
WORCESTER, MASS.

BRANCH OFFICES AND AGENCIES

CHICAGO, ILL.
CLEVELAND, OHIO
DENVER, COLO.
HAZELTON, PA.

MINNEAPOLIS, MINN.
MONTGOMERY, ALA.
MONTREAL, CANADA
NEW ORLEANS, LA.

NEW YORK, N. Y.
PHILADELPHIA, PA.
PITTSBURGH, PA.
SALT LAKE CITY, UTAH

SAN FRANCISCO, CAL.
WINNIPEG, MAN.
VANCOUVER, B. C.

Products.

CENTRIFUGAL TURBO BOILER FEED PUMPS.
STEAM TURBINES.

For Turbo Undergrate Blowers, see page 976.

Coppus Centrifugal Turbo Boiler Feed Pump, Type CCC.

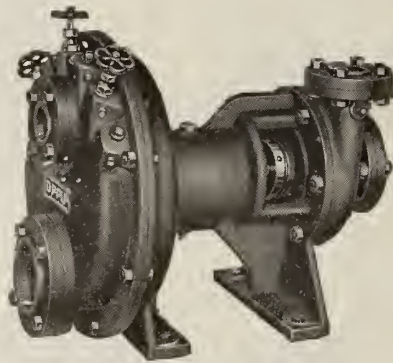
This pump is a complete unit in itself, having one shaft common to pump and steam turbine.

On the turbine end, mechanical packing of the labyrinth type is employed, which is steamtight for ordinary back pressures, can not and does not need to be adjusted and is not subject to wear. On the pump end is the only stuffing box of the unit, with high grade plastic metallic packing.

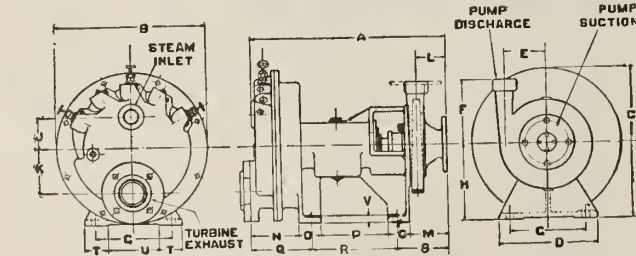
One oil reservoir serves both bearings and on account of the very ingenious oiling system, the oil level for the ball bearings is maintained regardless of the amount of oil in the oil chamber.

Excess pressure pump governor and safety stop valve are furnished with every pump, making possible positive and instant control of feed water and protection should water supply give out.

ADVANTAGES—
Simplicity of Construction and Low Upkeep—Very few working parts. No valves to be reground or to cause back leakage. Only one stuffing box, easily re-packed. Oiling sys-



COPPUS CENTRIFUGAL TURBO BOILER FEED PUMP, TYPE CCC



DIMENSION DIAGRAM, COPPUS CENTRIFUGAL TURBO BOILER FEED PUMP, TYPE CCC

SIZES, CAPACITIES, DIMENSIONS, ETC., OF TYPE CCC TURBO BOILER FEED PUMPS

Size	Capacity, b.h.p.	Max. discharge pressure, lbs.	Steam consumption, lbs., per h.p.h.	All dimensions are in inches																	Discharge *	Suction *	Exhaust *	Inlet *	Size founda- tion bolts			
				A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R						S	T	U	V
1	50-250	135	75-80	19 1/2	13 3/4	14 1/2	9 3/4	5 1/2	7	7 1/4	3	4 1/2	2 1/2	3 1/2	4 1/2	1 3/8	7 3/8	6	8 3/4	5	2	5	3 1/2	1 (p. tap)	1 1/2 (p. tap)	2	1 (p. tap)	5/8
1 1/4	250-500	165	65-70	22	16 3/4	16 7/8	11 1/4	6	8 1/2	8 1/2	3 1/2	4 1/2	3	4 1/2	5 1/4	2 1/2	7 3/8	6 3/4	9 3/4	5 3/8	2 3/4	5 3/4	3 1/2	1 1/4 (p. tap)	2	3	3 1/2	3/4
1 1/2	500-1000	175	60-65	22	16 3/4	16 7/8	11 1/4	6 1/2	8 1/2	8 1/2	3 1/2	4 1/2	3	4 1/2	5 1/4	2 1/2	7 3/8	6 3/4	9 3/4	5 3/8	2 3/4	5 3/4	3 1/2	1 1/2 (p. tap)	3	3	1 1/2 (p. tap)	3/4
2	1000-1600	200	55-60	24 3/4	20 3/4	20 7/8	13 5/8	7	10	10 1/2	4 1/2	6 1/4	3 1/2	5 1/2	5 1/2	3	8	7 1/4	10 1/2	6 7/8	3	7	7 1/2	2	3	4	2	1
2 1/2	1600-3500	200	52-55	25	24 3/4	25 1/8	16 6 1/4	8	11 3/8	12 5/8	5 1/2	7 1/4	3 1/2	5 1/2	5 1/2	3	8	7 3/8	10 1/2	6 7/8	3	10	7 3/8	3	3	4	1 1/4	1

*All flanged pump and turbine connections are furnished with companion flanges.

tem requires filling only a few times each year, compared with the daily oiling necessary for reciprocating pumps. No complicated governing devices and no sliding valves. Needs very little attention.

Continuous, Steady Flow of Water without Pulsation—Insures longer life to pipe lines, valves and fittings.

Great Flexibility, Constant and Easy Control of Feed Capacity—After excess pressure governor has once been set to a certain pressure, feed water capacity is regulated by simply throttling or opening hand feed valve at boiler. Constant water level is easily maintained. Water can be cut off at the boiler, for a short period of time, without stopping the pump, as is the case with a reciprocating pump.

Exhaust Steam Free From Oil—Steam in turbine does not come in contact with any oil, thus exhaust steam can be used directly for heating purposes.

Longer Life and Less Depreciation—The high grade of materials used, superior workmanship, few moving parts, absence of cylinders requiring reboring and re-bushing, elimination of minor repairs such as is the case with reciprocating pumps, also careful inspections and tests, insure long life and continuous operation.

Higher Steam Economy—Efficiency remains practically constant through years of use. Steam economy should not drop more than 3% to 5% during the life of the pump.

Less Floor Space Required—Requires but a fraction of the floor space necessary for a reciprocating pump or a "two-unit" turbine driven centrifugal pump of corresponding capacity.

DATA REQUIRED WHEN MAKING INQUIRIES—

Name and location of plant. Total rated capacity in boiler horsepower of boilers to be fed by pump. Capacity developed by boiler. Steam pressure. Degree superheat, if any. Temperature of feed water. Positive suction head (in feet) or pressure (in lbs.) under which water flows to pump. Back pressure against which steam is exhausted, in pounds. Approximate length and size of feed line from pump to boiler. State if there is a big drop in steam pressure from boiler to pump. Advise if an open or closed heater is used or any other special arrangement.

Coppus Steam Turbines.

This company builds steam turbines in 12, 16 and 20-in. sizes up to 50 h.p., suitable for direct connection to centrifugal pumps, electric generators, blowers, etc. They are built only as double-stage turbines with speed controlling governors.

DAYTON-DOWD COMPANY

Manufacturers of Centrifugal Pumps

345 York Street
QUINCY, ILL.

Products.

DAYTON-DOWD TYPE "CS" SPLIT CASE SINGLE-STAGE and MULTISTAGE CENTRIFUGAL PUMPS, both horizontal and vertical styles, belted and direct connected; TYPE "SS" SINGLE-STAGE PUMPS, horizontal and vertical styles, belt driven and direct connected; UNDERWRITERS' FIRE PUMPS.

Automatic Sump or Ejector Pumps, and Contractors' Portable Gasoline Engine Driven Pumping Outfits, direct connected and belt driven, mounted on truck or skids.

Uses.

Dayton-Dowd centrifugal pumps are adapted to every class of service where centrifugal pumps can be used: city water works, filtration plants, boiler feed, sewage pumping, irrigation, reclamation, sluicing, fire service, contractors' service, mine drainage, dry dock and marine pumping, brine circulation, hot water circulation; pumping oil, acids, chemicals, and numerous other applications.

Every pump is especially designed and built to meet the particular requirements of each installation. All pumps thoroughly tested, and must meet the exact conditions of service before leaving the works.

Dayton-Dowd Type "CS" Single-stage Double Suction, Centrifugal Pumps.

Built in sizes from 1¼-in. discharge to 36-in. discharge.

Casing split horizontally, which permits access to working parts by merely lifting top half of the casing, making it unnecessary to disturb pipe connections or alignment of the pump. Impellers are of "non-overloading" design, which effectually protects the motive power from being overloaded in case head is varied from normal.

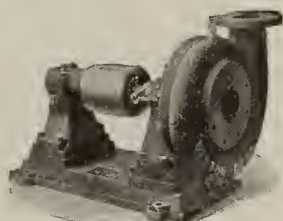


DAYTON-DOWD 10-IN. TYPE "CS" SINGLE-STAGE TURBINE DRIVEN PUMP

Dayton-Dowd Type "SS" Single-stage Pumps.

Adapted to any general pumping service where the head does not exceed 130 ft., as contractors' service, irrigation, drainage, sewage pumping, etc.

Furnished belt driven, and arranged for direct connection to motor or gas engine. Built in both horizontal and vertical styles.

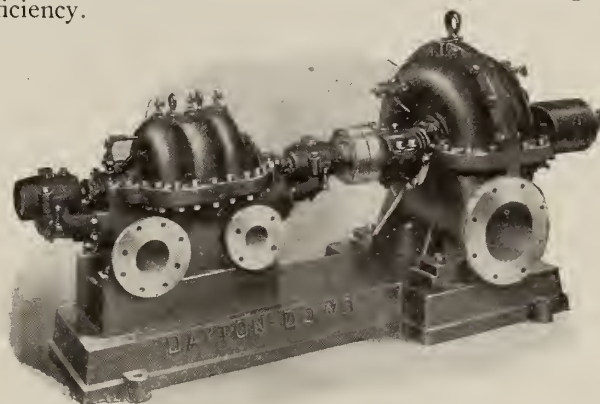


DAYTON-DOWD TYPE "SS" SINGLE-STAGE PUMP

Dayton-Dowd Type "CSU" Multistage Pumps.

For high pressure service, such as boiler feed, fire pressure systems, mine pumping, and in fact any pumping conditions where a high head is encountered. Furnished in the multistage construction, with pulley for belt drive, or with extended base and flexible coupling for direct connection to motor, turbine, etc.

Full advantage is taken of the old turbine principle in a new way to increase efficiency and obtain diffusion vane effect without intricate construction. Axial thrust entirely eliminated by means of an automatic balancing device of the disk type, which effectually keeps the rotating elements in their proper place of rotation. Simple and rugged, reliable in operation, up to the minute in design and construction, and developing the highest efficiency.

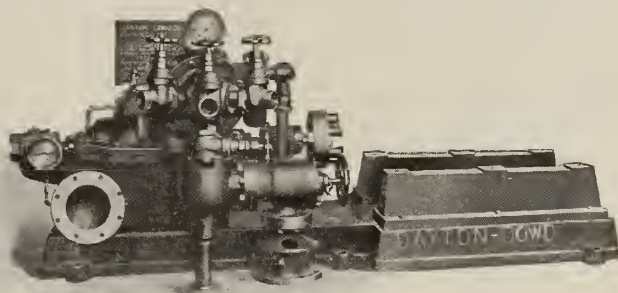


TYPE "CSU" 3-IN. 3-STAGE AUTOMATICALLY BALANCED TURBINE DRIVEN BOILER FEEDER

Dayton-Dowd Underwriters' Approved Fire Pumps.

Dayton-Dowd fire pumps are built in 500-gal., 750-gal., 1000-gal. and 1500-gal. sizes in the multistage construction to work against any desired pressure.

Dayton-Dowd fire pumps are built to conform to the underwriters' specifications, and are approved by both the National Board of Fire Underwriters and the Associated Factory Mutual Fire Insurance Association.



DAYTON-DOWD 1000-GAL. UNDERWRITERS' CENTRIFUGAL FIRE PUMP

THE DEMING COMPANY

Manufacturers of Pumping Machinery

SALEM, OHIO

GENERAL AGENCIES FOR DEMING POWER PUMPS

ATLANTA, THE DUNN MACHINERY Co., 522 South Pryor Street
 BIRMINGHAM, MOORE-HANDLEY HARDWARE Co.
 BOSTON, CHARLES J. JAGER Co., 13-15 Custom House Street
 BUFFALO, ROOT, NEAL & Co., 178-80 Main Street
 CHICAGO, HENION & HUBBELL, 223-31 North Jefferson Street
 DENVER, HENDRIE & BOLTHOFF MFG. & SUPPLY Co.
 DETROIT, KERR MACHINERY CORPORATION, Kerr Building
 KANSAS CITY, ENGLISH TOOL & SUPPLY Co.
 LOS ANGELES, R. W. SPARLING, 945 North Main Street

CANADA: MONTREAL, TORONTO, WINNIPEG, DARLING BROS., LTD.

NEW ORLEANS, GIBBENS-FINNEY-GORDON Co., 213 Canal Street
 NEW YORK, RALPH B. CARTER Co., 152 Chambers Street
 PHILADELPHIA, W. P. DALLETT Co., 922-24 Sansom Street
 PITTSBURGH, HARRIS PUMP & SUPPLY Co., 320-22 Second Avenue
 RICHMOND, SYDNOR PUMP & WELL Co., 1310 East Main Street
 SAN FRANCISCO, CRANE COMPANY, 301 Brannan Street

Products.

DEMING PUMPING MACHINERY for operation by any power: TRIPLEX POWER PUMPS; DEEP WELL POWER WORKING HEADS; ARTESIAN WELL CYLINDERS; HORIZONTAL POWER PISTON PUMPS; DIAPHRAGM PUMPS.

Deming Hydro-pneumatic Water Systems, operated by hand or windmill, gasoline engine, or electric motor.

Also, Rotary Pumps, Hydraulic Pressure Test Pumps; Deep Well Power Pumps; Trench Pumps; Air, Ammonia, Creamery, Bilge, Sewage and Sump Pumps; Pumping Outfits, stationary and portable.

Agencies for Deming Pumps.

Many agencies, not mentioned above, carry in stock Deming hand and windmill pumps and cylinders, spray pumps, hydraulic rams, etc. The above agencies, however, specialize on Deming power pumps.

Co-operative Engineering Service.

Manufacturers, engineers, and others are invited to refer pumping and water system problems to the engineering department of this company. On receipt of layout of conditions and statement of requirements, an estimate for the pumping equipment will be submitted. Blue prints, also photographs showing typical installations on request.

Information Required for Estimate Basis.

(1) For what purpose pump is to be used; (2) maximum quantity to be pumped per minute, hour or day of 24 hours; (3) to what height liquid is to be lifted by suction, and diameter and length of suction pipe; (4) height or pressure against which liquid is to be discharged; (5) diameter and length of discharge pipe; (6) whether liquid to be pumped is hot or cold, salt or fresh, acid or clear, thick or gritty; (7) power available for driving pump; (8) if electric motor, state whether current is direct or alternating; if direct, give voltage; if alternating, state voltage, cycle and phase; (9) advise if pump is to be driven by belt from motor, or to have same direct connected by gearing or otherwise.

Triplex Power Pumps.

The application of Deming pumps, due to variety of styles and sizes, is practically unlimited where belts, water wheels, electric motors, or steam, gas, or gasoline engines are available for power. Efficiency is higher than direct acting steam pumps.

BELT DRIVEN—For water works, boiler feeding, paper and pulp mills, and all kinds of factory pumping.

ELECTRIC DRIVEN—For water works, compression and open tank pumping; for private water supply, fire service, boiler feeding, brine circulating, hydraulic ele-

vators, hydraulic pressure accumulators, mine pumping, irrigating, etc.

GAS OR GASOLINE DRIVEN—For water works, railway tank service, private water supply, mine pumping, irrigating, etc.

Triplex Power Pump, Fig. 50.

Standard design, single acting; designed for suction lift of 25 ft. or less.

FRAME—Of large sizes, made in one casting with guides and crank shaft bearings lined with antifriction metal. In sizes 4 by 4 in. and smaller, frame and cylinder cast in one piece.

CRANK SHAFT—Of best open hearth steel casting in one piece.

GEARING—Machine cut, and is double in sizes 9 by 10 in. and larger. Gear ratios 5 to 1.

PINION SHAFT—Of steel, running in antifriction metal, and bolted to main housings.

CONNECTING RODS—In sizes 4 by 6 in. and larger, have bronze boxes with wedge and screw adjustment at crosshead end, and marine type babbitted boxes at crank end. Smaller sizes have bronze bushings at crosshead ends.

CROSSHEADS—Run in bored guides. Sizes 4 by 6 in. and larger have bronze adjustable shoes.

PLUNGERS—Of best cast iron, finished true and smooth; packing of ample depth.

CYLINDERS AND BASE—In one casting in sizes 10 by 10 in. and smaller; in larger sizes, the cylinders are in separate castings.

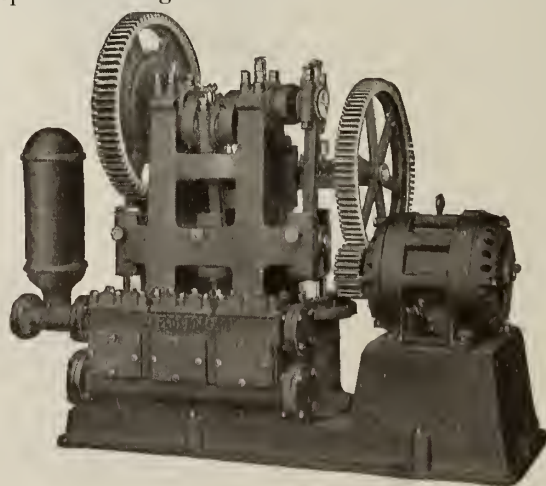


FIG. 50. TRIPLEX POWER PUMP
 Sizes $5\frac{1}{2} \times 8$ with Type "B" drive

VALVE CHAMBERS—In sizes 3½ by 4 in. and larger, separate castings bolted to cylinders.

VALVES—Of large area and readily accessible—for cold water are rubber disks, protected on top from cylindrically wound springs by brass plates; for hot water are either special hard composition or bronze valves.

VALVE SEATS—Bronze, of grid type, screwed into decks. Iron seats and valves furnished, if required.

GREASE CUPS—Furnished with all pumps.
Pumps furnished with bronze plungers, and varying otherwise from standard construction, at extra price.

Many other power pumps, also different types of drive are shown in Power Pump Bulletins

SIZES AND CAPACITIES, FIG. 50. TRIPLEX POWER PUMPS

Plungers		Capacity		Maximum working pressure, lbs.	Diam. pipes		*Tight and loose pulleys, in.	Cipher
Diam., in.	Stroke, in.	Usual r. p. m.	Gals. per min.		Suction, in.	Discharge, in.		
2	2	70	5.67	150	1½	1	8x 2	Obese
2½	2	70	8.89	150	1½	1	10x 2	Obelize
2½	3	60	11.4	150	2	1½	12x 3	Oaken
3	3	60	16.2	150	2	1½	14x 3	Oath
3½	3	60	22.	150	2	1½	16x 3	Oakling
3½	4	60	30.	150	2½	2	16x 4	Obelus
4	4	60	39.	150	2½	2	18x 4	Oakum
4	6	60	59.	160	2½	2	20x 5	Oarsman
4½	6	60	74.	150	3	2½	20x 5	Oaky
5	6	60	91.	150	3	2½	24x 5	Oasis
5½	8	60	147.	150	4	3	28x 6	Oatmeal
6	8	55	161.	140	4	3	30x 6	Obduration
7	8	55	220.	150	5	4	30x 8	Obdurate
8	8	55	287.	150	5	4	36x 8	Obiter
8½	8	55	324.	140	6	5	36x 8	Obdure
9	10	50	413.	160	8	6	42x10	Obloquy
10	10	45	459.	150	8	6	42x12	Obsignate
11	12	42	622.	160	10	8	48x14	Obduct
12	12	42	740.	150	10	8	48x16	Obduction
12	14	40	820.	150	12	10	48x18	Observance
13	14	40	964.	140	12	10	48x20	Observant

*Note—Sizes 9 by 10 and larger regularly furnished with tight pulley only

Horizontal Power Piston Pump, Fig. 708.

Pumps of this type are much used at present in construction work of all kinds. Especially suited for long distance pumping, in many cases forcing water horizontally a mile or more from source of supply. Fig. 708 illustrates a typical horizontal power pump. Adapted for suction lift of 24 ft. and is good for 200 lbs. working pressure. Made in 3 sizes, with capacities of 490, 750 and 1100 gals. per hour, respectively. Several other types of piston pump are made, with capacities from 450 to 18,000 gals. per hour.

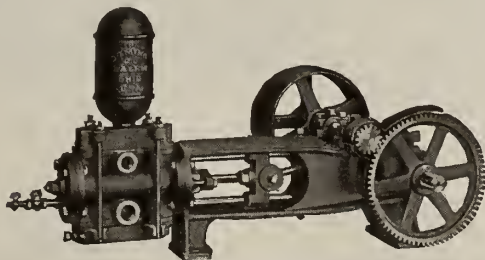


FIG. 708. HORIZONTAL POWER PISTON PUMP

Diaphragm Pump, Fig. 1473.

Fig. 1473 power diaphragm pump is recommended for handling large quantities of muddy and gritty water quickly and economically. The diaphragm is 12½ in. diameter, of best quality rubber, and valves are of metal, rubber faced, both being easily renewable. Waterways are large and practically non-chokable. Furnished with 1 or 1½ h.p. engine as desired. Gears of jack are machine cut, from solid blanks to reduce friction and noise. Pump may also be had without engine and jack for hand operation.

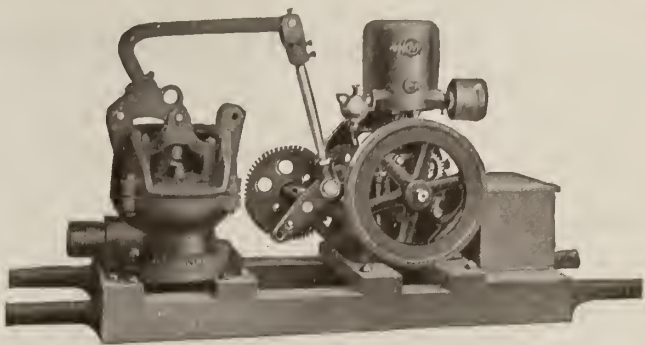


FIG. 1473. DIAPHRAGM PUMP
SIZES, CAPACITIES AND PRICES

Outfit No.	Pump diaphragm, in.	Suction, in.	Cap. per hour, gals.	H. p. engine	Approx. weight, lbs.	Price	Extras *
1	12½	3	3500	1	535	\$155.00	\$30.00
2	12½	3	3500	1½	585	175.00	30.00

*Extra for 15-ft. of suction hose, including coupling and galvanized strainer

Deep Well Power Working Head, Fig. 80.

This pump, with differential plunger, is designed for operation of deep well cylinders, and contains many desirable features which extensive experience in this line of pumping machinery indicates as the best.

BEARINGS—Lined with best antifriction metal, the pinion shaft bearings being bolted to main housings.

GEARING—Machine cut, the main gear (or gears) being bolted to a large flange (or flanges) integral with the crank shaft.

CONNECTING ROD—Of steel with marine type box at crank end, and bronze bushing at crosshead end.

CROSSHEAD—Has bronze shoe adjustable for wear, and runs in polished guides.

DIFFERENTIAL PLUNGER—Equalizes flow of water, with consequent greater economy and ease of operation.

AIR CHAMBER—Supplied; also grease cups, or oil cups and wrenches furnished with all pumps.

DISCHARGE—Can be connected at either front or back of pump.

When electric motor or steam engine is to be direct connected, we can furnish these working heads with different types of drive, for which see Power Pump Bulletins.



FIG. 324. BRASS ARTESIAN WELL CYLINDER

SIZES AND CAPACITIES, FIG. 80

Stroke, in.	Max. diam. of pipes		Gear ratio	Tight and loose pulley, in.	Hght, in.	Cipher
	Suction, in.	Dischg., in.				
16	9	4	6 to 1	28 x 6	76	Orient
24	9	4	5¼ to 1	36 x 6	98½	Oriental

MAXIMUM SPEED AND CAPACITY PER MINUTE WITH FIG. 324 SINGLE ACTING CYLINDER

Diam. cylinder, in.	16-in stroke		24-in stroke		†Maximum depth of well, ft.
	Revs.	Gals.	Revs.	Gals.	
4¼	35	34	28	41	540
4¾	35	42	28	51	450
5¼	35	52	28	63	360
5¾	35	62	28	75	300
6¼	35	74	28	89	250
6¾	35	86	28	104	210
7¼	35	114	28	137	150
8¾	35	137	28	164	130

†From lowest surface of water in well to highest point of delivery.



FIG. 80. DEEP WELL POWER WORKING HEAD

ECONOMY PUMPING MACHINERY CO.

120-122 North Curtis Street
CHICAGO, ILL.

Products.

Manufacturers of SEWAGE EJECTORS, BILGE PUMPS, ELECTRIC CELLAR DRAINERS, CONDENSATION PUMPS and RECEIVERS, RETURN LINE and AIR LINE VACUUM PUMPS.

Also, Automatic Water Systems, electrically operated.

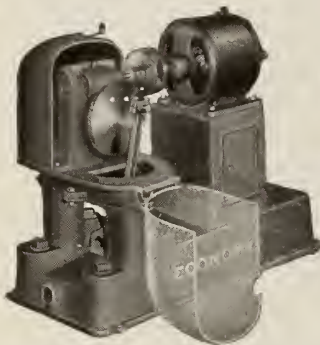


FIG. 2150. AIR LINE VACUUM PUMP

DATA, FIG. 2150

Unit No.	Max. cap., sq. ft.	Suction, ins.
1	4000	3/4
2	7500	1
3	12000	1 1/4
4	17000	2
5	25000	2 1/2

DATA, FIG. 2150 (CONTINUED)

Unit No.	Discharge, ins.	H. p.
1	3/4	1 1/4
2	1	1 1/2
3	1 1/4	1 3/4
4	2	2
5	2 1/2	2 1/2

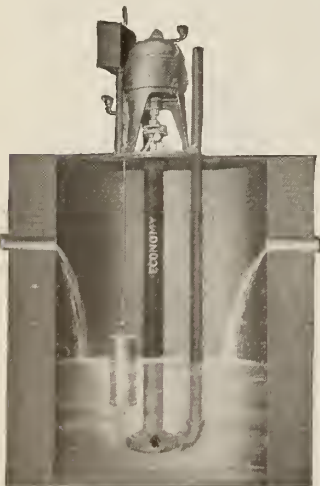


FIG. 2104. TYPES B AND C ECONOMY SUBMERGED BILGE AND SEWAGE PUMP

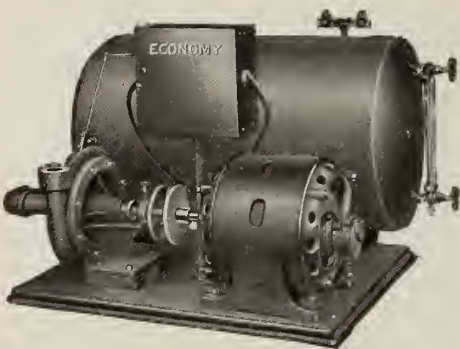


FIG. 2176. CONDENSATION PUMP AND RECEIVER

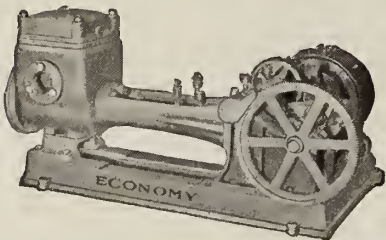


FIG. 2149. ECONOMY MOTOR DRIVEN RETURN LINE VACUUM PUMP, DOUBLE ACTING TYPE

DATA, FIG. 2149

Unit No.	Diam. cyl., ins.	Length stroke, ins.	R. p. m.	Cap. sq. ft. direct radiation	Suction, ins.	Discharge, ins.	H. p.
3	3	5	50	2500	1 1/2	1 1/4	1
4	4	6	45	4000	2	1 1/2	1 1/2
5	5	6	45	6000	2	1 1/2	1 1/2
6	6	6	45	8000	2 1/2	2	2
7	5	10	40	10000	2 1/2	2	2
8	6	10	40	20000	3	2 1/2	3
9	7	10	40	30000	3	2 1/2	3
10	8	12	30	40000	4	3	5
11	9	12	30	47500	5	3 1/2	5
12	10	12	30	55000	6	4	7 1/2

DIMENSIONS FIG. 2104, TYPES B AND C

Gals. per min. per pump	7 to 12	10 to 15	15 to 20	20 to 30	35 to 50	60 to 75	80 to 100	125 to 150	200 to 250	300 to 400	500 to 725	800 to 1200
To pump against ft. head	8 to 12	10 to 14	12 to 20	15 to 30	15 to 30	15 to 35	15 to 35	15 to 35	15 to 40	15 to 40	15 to 40	15 to 40
H. p.	1/2	1/4	1/3	1/3 to 3/4	1/2 to 1	1 to 1 1/2	1 to 2	2 to 3	3 to 5	5 to 7 1/2	7 1/2 to 10	7 1/2 to 15
Discharge pipe, ins.	3/4	1	1	1 1/2	1 1/2	1 1/2	2	2 to 2 1/2	2 1/2 to 3	3 1/2 to 4	5 to 6	7 to 8
Diam., ins., of basin, either B or C	20, 24, 30	20, 24, 30	20, 24, 30	24, 30, 42	24, 30, 48	24, 30, 42	24, 30, 36, 42	36, 42, 48	36, 42, 48	48, 54, 60	48, 54, 60	54, 60, 72
Depth of basin	Optional to suit requirements											

NOTE—Type B, duplex. Type C, single pump
Speed of all units up to 100 g.p.m., 1750 r.p.m.
Speed of all units above 100 g.p.m., 1200 r.p.m.



FIG. 2175. UNDERGROUND CONDENSATION PUMP AND RECEIVER

DATA, FIGS. 2175 AND 2176

Unit No.	Sq. ft. direct radiation will drain
5	1000
6	2000
6 1/2	3500
7	5000
7 1/2	7500
8	10000
9	25000
10	35000 to 50000 as specified

DATA, FIGS. 2175 AND 2176 (CONTINUED)

Unit No.	Boiler pressure, lbs.	H. p.
5	5	1/6
6	10	1/4
6 1/2	10	1/3
7	10	1/2
7 1/2	10	3/4
8	15	1
9	15	2
10	15 to 30	3 to 5

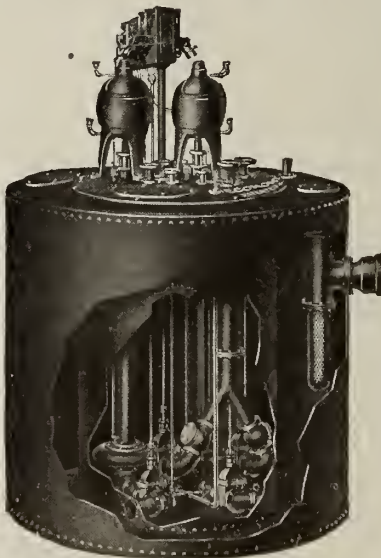


FIG. 2119. TYPE A ECONOMY DRY PUMP CHAMBER AUTOMATIC SEWAGE EJECTOR

Unit No.	4	5	6	7	8	9
Cap. each pump, gals.	50 to 75	100 to 125	150 to 175	200 to 250	300 to 400	450 to 600
H. p.	1 to 1 1/2	1 1/2 to 2	2 to 3	3 to 4	4 to 5	5 to 10
Standard speeds	1000 to 1200	1000 to 1200	850 to 1200	850 to 1200	550 to 1000	550 to 1000
Discharge pipe, ins.	3	4	4	5	6	8
Diam. pump chamber, ins.	48	48	48	54	54	60
Diam. sewage recept., ins.	78	78	78	84	84	90
Ejector depth, ft.	As conditions require					
Size sewer inlets	No. and size required					

FAIRBANKS, MORSE & CO.

Manufacturers of Pumps

CHICAGO, ILL.

Products.

CENTRIFUGAL, POWER and STEAM PUMPS.

For Oil Engines, see page 699; for Electric Motors, see page 1113.

Fairbanks-Morse Pumps.

Fairbanks-Morse pump installations are giving continuous service and satisfaction in municipal plants, mines, oil fields, railroads, rice fields, irrigation projects, canneries, bleacheries, smelteries and in manufacturing plants in all sorts of industry.

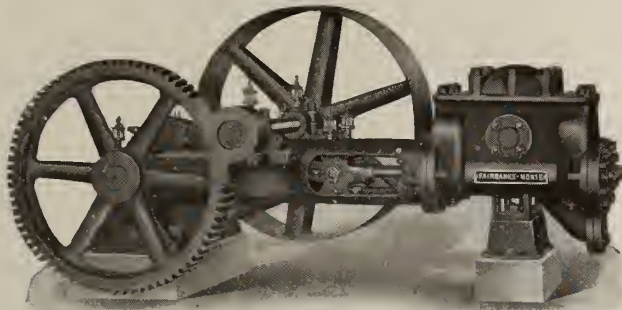
Fairbanks-Morse pumps are constructed and finished in a manner insuring durability, efficiency, reliability,

ease of operation and low cost of maintenance. Guaranteed by Fairbanks-Morse quality.

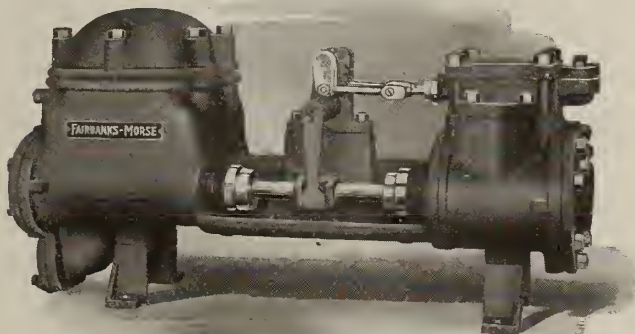
Owing to the wide variety of pumping equipment required to supply the diversified needs of various industries and projects, an attempt has been made to show but a few installations, the purpose of which is to give a general idea of the adaptability of Fairbanks-Morse pumps to various lines of work.



FIG. 1000. 5-INCH, 3-STAGE, HORIZONTALLY SPLIT CASING CENTRIFUGAL PUMP, DIRECT CONNECTED TO 75 H.P. FAIRBANKS-MORSE INDUCTION MOTOR

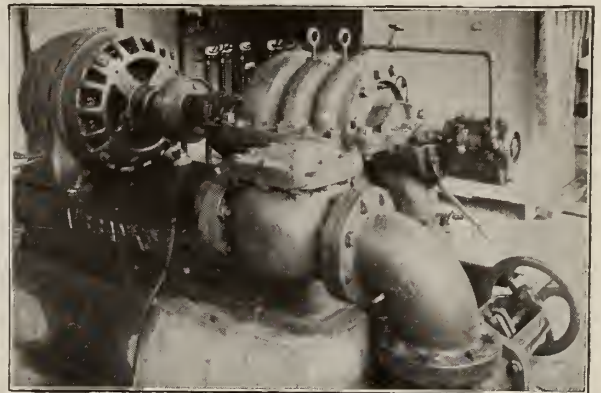


"MID-CONTINENT" DUPLEX PISTON PATTERN POWER PUMP



BOILER FEED PUMP, DUPLEX RAM PATTERN

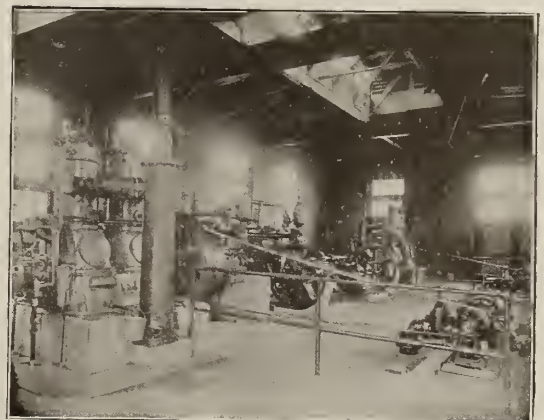
SWEET'S CATALOGUE



PUMPING EQUIPMENT, MUNICIPAL PLANT, PORTLAND, ORE.



RICE PLANT INSTALLATION AT LA BELLE, TEX.



PUMPING PLANT, SOUTHERN RAILROAD, MONROE, VA.

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Manufacturers of Centrifugal, Power and Hand Pumps for Every Service

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SALES AGENCIES IN ALL PRINCIPAL CITIES

Products.

SINGLE CYLINDER, DUPLEX and TRIPLEX POWER PUMPS, SINGLE and DOUBLE ACTING; SINGLE STAGE and MULTISTAGE, HORIZONTAL and VERTICAL CENTRIFUGAL PUMPS; DEEP WELL TRIPLEX PUMPS; DEEP WELL WORKING HEADS and CYLINDERS; VACUUM PUMPS; HYDRAULIC RAMS.

Air Compressors; Rotary and Diaphragm Pumps; Boiler Testing Pumps; Bilge, Quarry, Spray and Windmill Pumps; Turbo Driven Pumps; Hydraulic Pressure Pumps; House or Tank Pumps; Force and Lift Pumps; Pumps for Private House Water Systems; Pumping Outfits; Turbo Pumping Outfits; Special Pumps for all services.

Uses and Service.

The Goulds line includes types and capacities for all pumping services. Some of the more common of these are:

General water supply; boiler feeding, hydraulic elevator and pressure machinery service; condenser service; fire protection; vacuum service on heating systems; circulating cooling water for gas engines; pumping brine, ammonia, tar, soap, clay, sewage, chemicals, wine, acids, etc.; stuff pumping in paper mills, vacuum service in paper mills, refineries, etc.; pumping oils and gasoline; mine pumping; pumping out excavations, etc.

For service with pneumatic tanks, they can be furnished to pump both air and water.

These pumps can be furnished for belt, chain, gear or direct drive from all types of drivers.

The Goulds line also includes all types of hand pumps for all services.

The pumps illustrated and described here are only a few of a very complete line. A set of bulletins, describing all the Gould types made, will be sent on request.

Single Acting Triplex Plunger Pumps (Bulletin 101).

For general water supply, municipal water works, boiler feeding, hydraulic elevators, mine pumping, etc. Furnished for any standard form of drive.

FRAME—Close grained iron, cast in one piece with cross-head guides and cylinders, forming exceptionally rigid construction and accurate alignment of all working parts.

CRANK SHAFT—High carbon open hearth steel, accurately machined to gauge.

BEARINGS—Crank shaft and pinion shaft bearings are of babbit metal.

GEARING—Gear and pinion charcoal iron, machine cut from the solid. A gear guard covers the pinion and adjacent teeth of the gear. Gear ratio 5 to 1.

CROSSHEADS—Sizes 4 by 6 in. and larger, fitted with adjustable bronze shoes which run in bored guides. Sizes 3½ by 4



TRADE-MARK

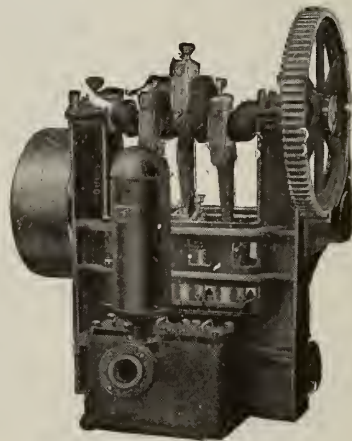
in. and smaller; the crossheads are cylindrical in form, made of bronze, and run in bored guides.

CONNECTING RODS—Sizes 4 by 6 in. and larger, strap head and wedge adjustment with bronze boxes at crank end and adjustable bronze boxes, marine type, at cross-

head end. Sizes 3½ by 4 in. and smaller have adjustable boxes babbitted at crank end and bronze bushings at crosshead end.

CYLINDERS—Close grained iron, cast in one piece, with standards.

PLUNGERS—Sizes 2½ by 4 in. and larger are fitted with hard cast iron plungers. Sizes 2 by 3 in. and smaller have bronze plungers accurately machined and ground true and smooth.

GOULDS SINGLE ACTING
TRIPLEX PLUNGER PUMP

Made in various types, for working pressures from 100 to 300 lbs., and for elevations from 231 to 293 ft. Capacities ranging from 120 to 21,000 gals. per hour

DATA, SINGLE ACTING TRIPLEX PLUNGER PUMP
FIG. 1696 TYPE

Displacement, gals. per minute	Size of pump		Displacement 1 revolution of crank shaft, gals.	Revolutions per minute	Horsepower at catalogue rating	Size of suction and discharge, in.	Tight and loose pulleys, in.
	Diam., in.	Stroke, in.					
2	1¼	2	0.031	67	.35	¾	12x1½
4	1¾	2½	0.078	52	.64	1	12x2½
6	2	3	0.122	50	.96	1¼	12x2½
6	1¾	2½	0.078	77	.89	1	12x2½
9	2	3	0.122	75	1.33	1¼	12x2½
12	2½	4	0.255	48	1.71	1½	15x3
18	2½	4	0.255	71	2.46	1½	15x3
18	3	4	0.367	50	2.29	1½	15x3
25	3	4	0.367	79	3.07	1½	15x3
25	3½	4	0.501	50	3.07	2	15x3
40	4	6	0.978	42	4.60	2	20x3
50	4	6	0.978	52	5.65	2	20x3
60	4	6	0.978	62	6.72	2	20x3
100	5	8	2.041	50	10.60	3	30x5
125	5	8	2.041	62	13.00	3	30x5
125	6	8	2.938	43	13.20	4	30x6
150	6	8	2.938	52	15.80	4	30x6
175	6	8	2.938	60	18.30	4	30x6
175	7	8	4.000	44	19.00	4	36x6
200	7	8	4.000	50	21.30	4	36x6
250	7	8	4.000	63	26.00	4	36x6
250	7	10	5.000	50	26.60	5	36x6
300	7	10	5.000	60	31.30	5	36x6
300	8	10	6.520	46	32.00	5	42x6
350	8	10	6.520	54	36.50	5	42x6

Ratings based on pumping cold water.

For high suction lifts select pumps to run at slow speeds.

GLANDS—Sizes 2½ by 4 in. and larger have iron glands. Sizes 2 by 3 in. and smaller have bronze glands.

BASE AND VALVE BOXES—Charcoal iron, in one casting, of liberal proportion, affording large valve area.

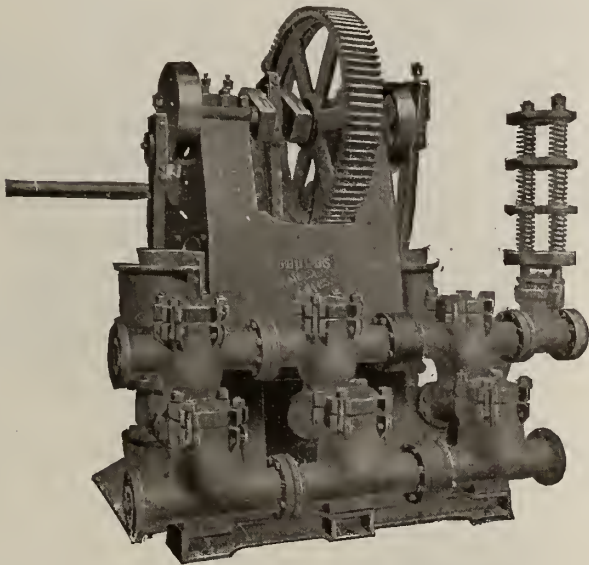
VALVES—3 by 4 in. and smaller bronze valves. 3½ by 4 in. and larger, for cold water, rubber disks on bronze grid seats with cylindrically wound springs. For hot water, the grid seat valve with special disk is recommended.

AIR CHAMBERS—Supplied with pump. Vacuum chamber to order.

SPECIAL CONSTRUCTION—Phosphor bronze plungers, lined cylinders and glands, rawhide pinion, etc.; to order.

Single Acting Triplex Plunger Pumps (Bulletin 103).

For general water supply, municipal water works, boiler feeding, hydraulic elevators, mine pumping, oil pipe lines, accumulators, hydraulic presses, etc. Furnished for any standard form of drive.



SINGLE ACTING TRIPLEX PLUNGER PUMP

Made for working pressures from 100 to 1,500 lbs. and for elevations from 230 to 3,500 ft. Capacities ranging from 3,060 to 69,060 gals. per hour

FIG. 1585 TYPE

Displacement, gals. per minute	For working pressure, lbs.		Plungers		Displacement 1 revolution of crank shaft, gals.	Revolutions per minute	Horsepower at catalogue rating	Size of pipe		Geared	Pulley
	Pattern		Diam., in.	Stroke, in.				Suction, in.	Discharge, in.		
587	200	B	10	16	16.32	36	80.5	12	10	5.06 to 1	Pulley extra according to size. Always specify dimensions and speed of motor pulley and required number of gals. per min.
648	185	B	10½	16	18.00	36	82.3	12	10	5.06 to 1	
711	165	B	11	16	19.74	36	80.5	12	10	5.06 to 1	
846	130	B	12	16	23.49	36	75.5	12	10	5.06 to 1	
916	120	B	12½	16	25.46	36	75.5	12	10	5.06 to 1	
992	112	B	13	16	27.57	36	76.4	12	10	5.06 to 1	
1151	100	B	14	16	31.93	36	79.0	12	10	5.06 to 1	
587	225	A	10	16	16.32	36	90.5	12	10	5.06 to 1	
648	200	A	10½	16	18.00	36	89.0	12	10	5.06 to 1	
711	185	A	11	16	19.74	36	90.3	12	10	5.06 to 1	
846	150	A	12	16	23.49	36	87.2	12	10	5.06 to 1	
916	140	A	12½	16	25.46	36	88.0	12	10	5.06 to 1	
177	900	LA	5½	16	4.93	36	105.0	6	6	5.43 to 1	
211	800	LA	6	16	5.87	36	115.0	6	6	5.43 to 1	
220	775	LA	6½	16	6.12	36	113.0	6	6	5.43 to 1	
229	750	LA	6¾	16	6.37	36	117.7	6	6	5.43 to 1	
618	250	LA	10¾	16	17.18	36	106.0	12	10	5.43 to 1	

Ratings based on pumping cold water.

FRAME—Consists of two standards which carry the main bearings, the seats for the two outside cylinders and the out-

side crosshead guides. Standards are held together by the center crosshead guide and the seat for the center cylinder.

CRANK SHAFT—High carbon open hearth steel, accurately machined to gauge. Fitted with crank disks at the ends of the crank shaft.

BEARINGS—Crank shaft bearings are phosphor bronze and pinion shaft bearings are of babbitt metal.

GEARING—Gear, charcoal iron, machine cut from the solid. Pinion, forged steel. Gear guard covers the pinion and adjacent teeth of the gear.

CROSSHEADS—Fitted with adjustable bronze shoes which run in bored guides.

CONNECTING RODS—Cast steel, strap head and wedge adjustment with bronze boxes at crank end and adjustable bronze boxes, marine type, at crosshead end.

CYLINDERS—Separate charcoal iron castings, bronze lined.

PLUNGERS—Hard cast iron, accurately machined, ground true and smooth.

GLANDS—Iron, and of easy access for adjustment and re-packing.

VALVE BOXES—Separate charcoal iron castings, each containing a set of suction and discharge valves.

VALVES—Special to meet requirements.

AIR CHAMBER—Supplied on all pumps for pressures up to 400 lbs. On pumps for pressures above 400 lbs., a spring alleviator can be furnished at extra price.

PINION SHAFT AND PULLEY—For belt drive an extended pinion shaft is regularly furnished; but the pulley and outboard bearing required are extra.

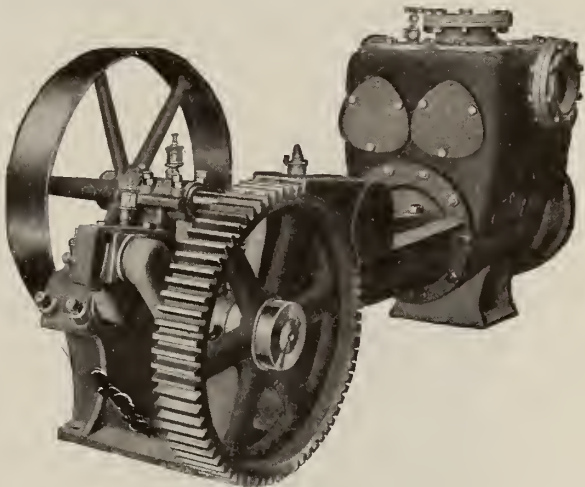
PIPE CONNECTIONS—At either end of pump.

SPECIAL CONSTRUCTION—Phosphor bronze plungers, bronze lined glands, etc., to order.

Horizontal Double Acting Piston Vacuum Pumps (Bulletin 106).

For vacuum heating systems, suction box on paper machines, vacuum pans and surface condensers.

FRAME—Cast iron in one piece bolted to the cylinder, supporting the bearings and crosshead guides.



HORIZONTAL DOUBLE ACTING PISTON VACUUM PUMP

Displacements of 10,200 to 81,000 gals. per hour

FIG. 1049 TYPE

Displacement, gals. per minute	Pistons		Displacement 1 revolution of crank shaft, gals.	Revolutions per minute	Size of pipe		Geared	Single pulley, in.
	Diam., in.	Stroke, in.			Suction, in.	Discharge, in.		
170	8	10	4.28	40	5	5	4 to 1	30x4
265	10	10	6.73	40	5	5	4 to 1	30x5
385	12	10	9.72	40	5	5	4 to 1	30x5
525	14	10	13.22	40	6	6	4 to 1	30x5
700	14	14	18.51	38	6	6	4 to 1	36x6
1000	16	16	27.62	37	8	8	4 to 1	36x6
1350	18	18	39.31	35	10	10	4 to 1	42x8

CRANK SHAFT—High carbon open hearth steel, accurately machined to gauge.

BEARINGS—Crank shaft and pinion shaft bearings are of babbit metal.

GEARING—Gear and pinion charcoal iron, machine cut from the solid. A gear guard covers the pinion and adjacent teeth of the gear.

CROSSHEADS—Cast iron, with adjustable planed crosshead guides.

CONNECTING RODS—Steel, and fitted with phosphor bronze boxes, strap heads and wedge adjustment at crank end and gib and key at crosshead end.

CYLINDER—Charcoal iron, fitted with removable cast bronze lining, bolted in. This lining can be turned to distribute the wear.

PISTON—Bronze, with a bronze follower and fitted with fibrous packing.

PISTON ROD—Tobin bronze.

STUFFING BOX AND GLAND—Bronze, fitted with fibrous packing.

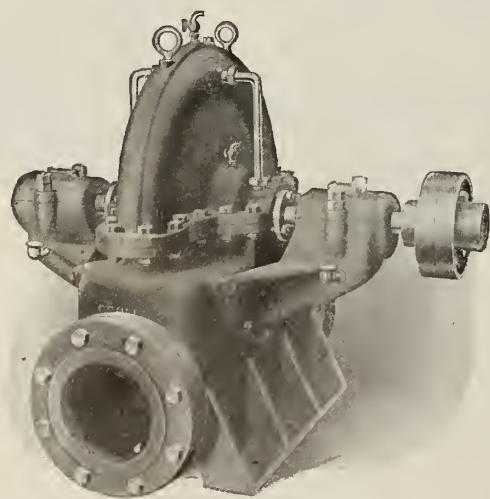
VALVES—Rubber disks on bronze grid seats with cylindrically wound springs.

PIPE CONNECTIONS—Suction at top and one side of cylinder, discharge at the other side, except 8 by 10-in. and 10 by 10-in. sizes, which have side suction only.

Single Stage, Double Suction Centrifugal Pumps (Bulletin 110).

For general water supply, hot water circulating in heating systems, for irrigating, booster or mine service, where the total net head does not exceed 150 ft., this pump is superior, due to the high efficiency obtained.

The prominent features of this type of pump are: Simple construction, single moving element; can be cared for by unskilled labor; no valves to get out of order, and with electricity will operate noiselessly. It is possible to close valve in discharge pipe without serious injury to the pump or driving mechanism. Built for all standard forms of drive.



GOULDS SINGLE STAGE DOUBLE SUCTION CENTRIFUGAL PUMP

Capacities from 4,800 to 480,000 gals. per hour

IMPELLER—Close grained iron, accurately machined to a smooth finish. It is of the enclosed type, so designed as to give high efficiency and make it impossible to seriously overload the motive power under any conditions at the specified speed.

SHAFT—Special alloy steel, heat treated, accurately machined to gauge.

BEARINGS—Removable shells lined with best quality anti-friction metal. They are of the ring oiling type, provided with large oil reservoirs.

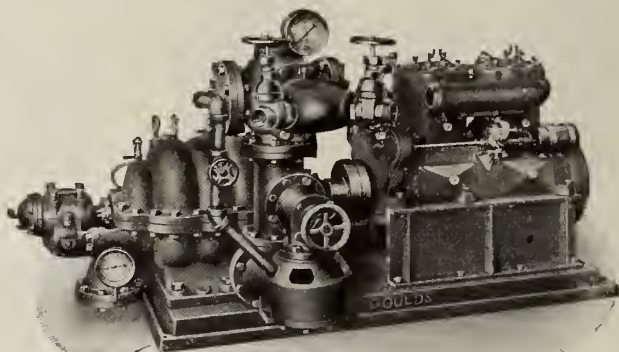
STUFFING BOX—Provided with brass water sealing rings, which prevent air entering the pump.

CASING—Close grained iron, divided horizontally, the two halves bolted together, giving easy access to the interior.

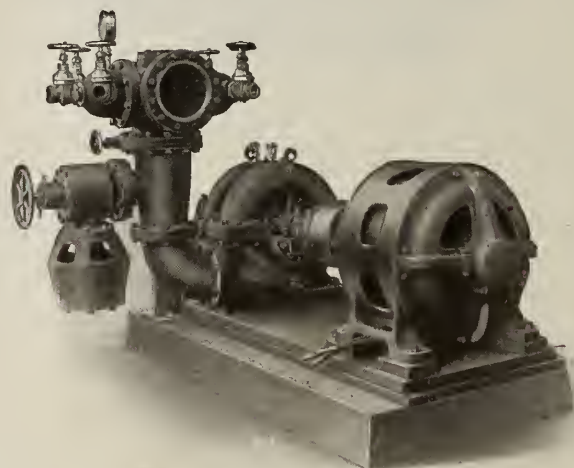
HOUSING—Bearings of ring oiling type, mounted in housings bolted to lower half of pump casing. Housings are provided with removable shells, lined with the best genuine bab-bitt which is bored and scraped to fit the shaft.

Centrifugal Fire Pumps (Bulletin 118).

These pumps have all the characteristics that are desirable for fire protection service. They have the indorsement of the Associated Factory Mutual Fire Insurance Companies, Underwriters' Laboratories, Inc., the National Board of Fire Underwriters and the National Fire Protection Association, and have proved by the rigid tests given them to be up to standard in every respect.



ENGINE DRIVEN CENTRIFUGAL FIRE PUMP FOR STAND-BY SERVICE



2-STAGE, NO. 8, 1500-GALLON CENTRIFUGAL FIRE PUMP, ELECTRIC MOTOR DRIVEN

FIG. 3014 TYPE

Pump number	Gals. per minute	Number of 1 1/4-in. streams	†Total head, lbs.	†Approximate speed, revolutions per minute	Horsepower of motor required	Size of suction and discharge, in.	*Approximate weight, lbs., without motor
4	500	2	100	1700	50	6	2800
5	750	3	100	1700	75	8	3600
6	1000	4	100	1700	100	8	4000
8S	1500	6	100	1700	150	10	4500

†Can be arranged for other pressures and speeds.

*Weight includes pump mounted upon extended bed plate and flexible coupling. Does not include weight of motor or other driver.

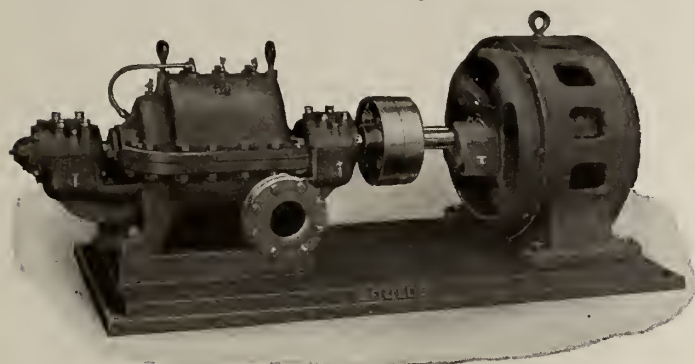
Multistage Centrifugal Pumps (Bulletin 120).

For pumping installations where the head is greater than can be efficiently dealt with in a single stage, we offer the multistage.

These pumps embody all the latest features, the value of which experience has fully demonstrated.

Where the size of the pump has permitted, the casing is horizontally divided, with the suction and discharge nozzles cast upon the lower half of the casing. This applies to sizes Nos. 4, 5, 6 and 8. The small sizes, Nos. 2-S, 2-L and 3, have vertically divided casings of the sectional type, which are held together by horizontal bolts in accordance with the best practice.

These pumps can be furnished in 2 to 5 stages. The small sizes can be built up to 6 stages.



MULTISTAGE CENTRIFUGAL PUMP

FIG. 3300 TYPE

Pump number	Size of pipe		Range of capacity, gals. per minute	Maximum head
	Discharge, in.	Suction, in.		
2S and 2L	2	2	50 to 100	250 lbs. or 580 ft.
3	3	3	100 to 200	
4	4	4	175 to 325	
5	5	5	250 to 700	
6	6	6	600 to 1200	
8	8	8	1200 to 1500	

Deep Well Working Heads (Bulletin 108).

For operating single and double acting deep well cylinders.

FRAME—Consists of two cast iron standards bolted to the base, strongly braced and fastened together with center guide and tie pieces, forming a very rigid construction.

CRANK SHAFT—High carbon open hearth steel, accurately machined to gauge.

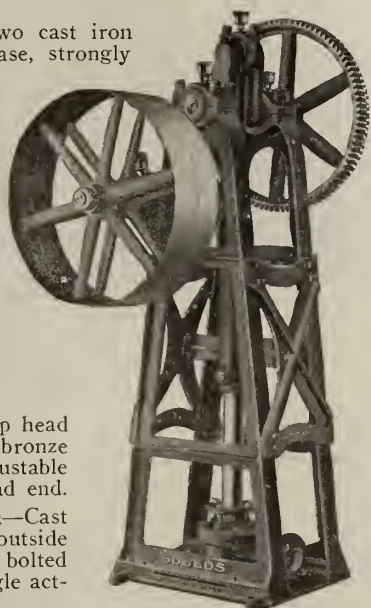
BEARINGS—Crank and pinion shaft bearings, babbitt metal.

GEARING—Charcoal iron, machine cut from the solid.

CONNECTING ROD—Strap head with wedge adjustment and bronze box at crank end, and adjustable babbitted boxes at crosshead end.

DIFFERENTIAL PLUNGER—Cast iron, working through an outside packed stuffing box with bolted gland. Furnished with single acting cylinders only.

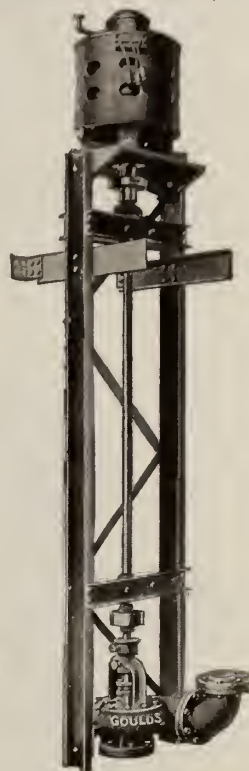
AIR CHAMBER—Regularly furnished.



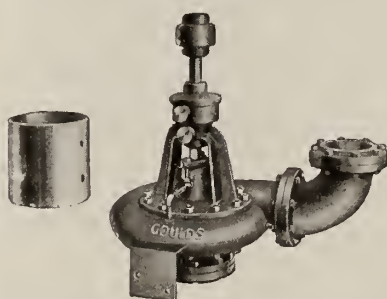
GOULDS DEEP WELL WORKING HEADS

Vertical Single Stage Centrifugal Pump (Bulletin 114).

The Goulds new vertical centrifugal pump is made for service in a pit where the water level is at such a depth below the surface of the ground that the ordinary horizontal shaft pump can not be used. The pump is installed in the pit above or below the water level. A steel shaft is extended to the surface, where a pulley is mounted upon it for belt drive. The shaft can also be direct connected to a vertical electric motor at this point.



PUMP MOUNTED IN STEEL FRAME, DIRECT CONNECTED TO AN ELECTRIC MOTOR



GOULDS VERTICAL, SINGLE STAGE CENTRIFUGAL PUMP

Co-operative Service.

Parties contemplating the installation of pumping equipment are invited to present their problems to this organization, which is prepared to assist in selecting the proper and most economical pump for their purposes.

Guarantee.

Every Goulds pump is guaranteed to satisfactorily perform the specific work for which it is sold.

Bulletins.

The following bulletins, any of which will be sent on request, give complete specifications on the various standard types of Goulds Power Pumps:

- No. 100. Double Acting, Single Cylinder Piston Pumps.
- No. 101. Single Acting Triplex Plunger Pumps, Outside Guided Type.
- No. 103. Single Acting Triplex Plunger Pumps, Large Capacity and High Pressure Types.
- No. 104. Double Acting Triplex Piston Pumps, Vertical Type.
- No. 105. Single Stage, Single Side Suction Centrifugal Pumps.
- No. 106. Vacuum and Stuff Pumps.
- No. 107. Deep Well Triplex Pumps.
- No. 108. Deep Well Working Heads and Cylinders.
- No. 109. Portable Mine Pumps.
- No. 110. Single Stage, Double Suction Centrifugal Pumps.
- No. 111. Centrifugal Sump Pumps.
- No. 112. Handy Data on Power Pumping.
- No. 113. Rotary Pumps.
- No. 114. Vertical, Single Stage Centrifugal Pumps.
- No. 115. Double Acting Plunger Pumps, Horizontal Type.
- No. 116. Single Acting Triplex Pressure Pumps.
- No. 117. Air Pressure and Vacuum Pumps.
- No. 118. Centrifugal Fire Pumps.
- No. 119. Single Stage, Single Suction Centrifugal Pumps.
- No. 120. Multistage Centrifugal Pumps.
- No. 122. Centrifugal Pump Sales Service Data.

THE KINNEY MANUFACTURING CO.

Manufacturers of Pumps

3529-3541 Washington Street
BOSTON, MASS.

BRANCH OFFICES

NEW YORK, N. Y. — PHILADELPHIA, PA. CHICAGO, ILL. KANSAS CITY, MO. SAN FRANCISCO, CAL.

Products.

ROTATING PLUNGER TYPE STEAM JACKETED PUMPS; TURBINE DRIVEN PUMPS; GASOLINE ENGINE DRIVEN PUMPS; ELECTRICALLY DRIVEN PUMPS; BELT DRIVEN PUMPS; STRAINERS.

For Road Oiling Equipment, see page 128; for Friction Clutch Pulleys and Cut-off Couplings, see page 834.

Rotating Plunger Type Steam Jacketed Pumps.

Kinney rotating plunger type steam jacketed pump direct connected by flexible coupling through a turbo type speed reducer to a steam turbine and controlled by emergency pump governor. See Fig. 191.

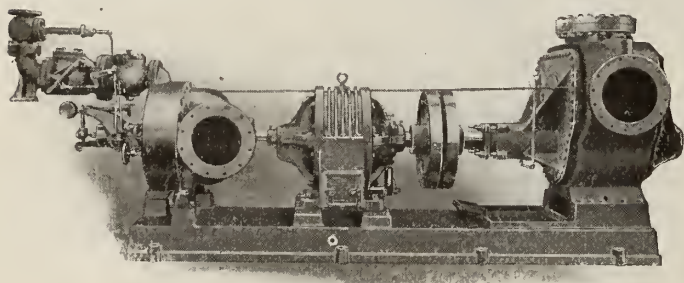


FIG. 191

KINNEY ROTATING PLUNGER TYPE STEAM JACKETED PUMP

This type of pump and drive is designed for handling all classes of heavy viscous materials, such as asphaltic oils, asphalts, paving pitches, glucose, molasses, tar and tar products. It is equally well adapted for handling materials of a much lighter specific gravity. These pumps are furnished in any size. Prices on application.

Turbine Driven Pumping Unit.

The Kinney marine unit, direct connected to a steam turbine and controlled by an automatic pressure pump governor. See Fig. 181. Both pump and turbine are manufactured by THE KINNEY

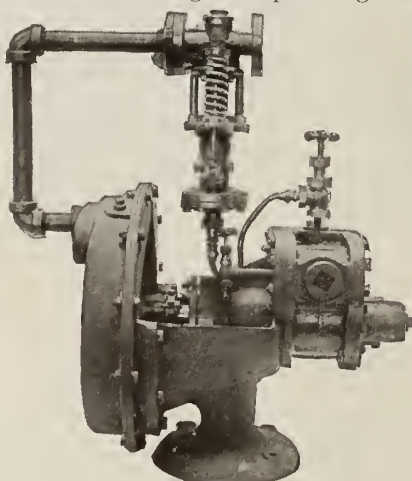


FIG. 181

KINNEY TURBINE DRIVEN PUMPING UNIT

MANUFACTURING Co. for use in marine work and are designed for fuel oil and lubricating oil. This pump is built in capacities from 10 gals. per minute at 300 lbs. pressure to 45 gals. per minute at 50 lbs. pressure. The unit is very compact, being self-contained. It is fitted with a lantern type of stuffing box which prevents all packing trouble.

The discharge from this pump is uniform and without pulsation. This feature is of great value in pumping fuel oil to burners for firing marine boilers. Its freedom from pulsation and smooth, uniform delivery insure long life to baffle plates and bridge walls of fire chambers.

Illustration, Fig. 182, shows another type of Kinney turbine driven pumping unit.

A high pressure unit with gear and pinion reduction and pump governor. It is particularly adapted for fuel oil burner systems of any capacity, at a working pressure up to 300 lbs. per sq. in. Prices on application.

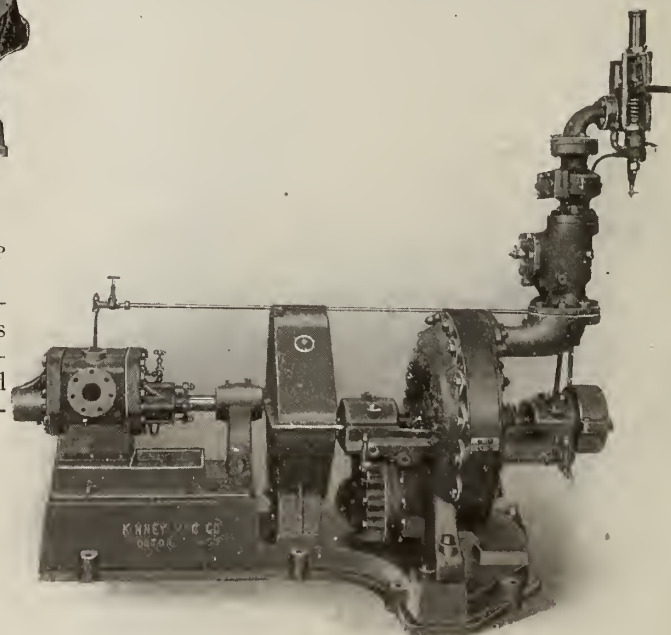


FIG. 182

KINNEY TURBINE DRIVEN PUMPING UNIT

Gasoline Engine Driven Pumping Unit.

This gasoline engine driven pump is direct connected through gear and pinion and friction oil bath clutch to the Kinney 100 h. p. 6-cylinder gas engine. It is designed for handling heavy crude oil. See Fig. 192. These units are furnished in any size and capacity and for all kinds of heavy viscous materials as well as lighter fluids. Prices on application.

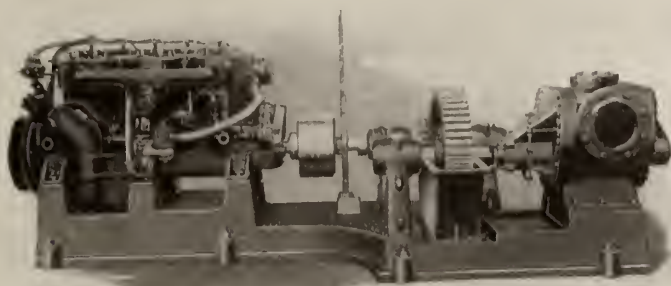


FIG. 192
KINNEY GASOLINE ENGINE DRIVEN PUMPING UNIT

Electric Driven Pumping Unit.

Pump is connected to a motor by a silent chain. See Fig. 194. It is also furnished gear driven and is adapted for pumping all kinds of heavy viscous materials as well as liquids of a lighter gravity. Prices on application.



FIG. 194
KINNEY ELECTRIC DRIVEN PUMPING UNIT

Steam Jacketed Pumping Unit.

This type is furnished in any size and capacity. The

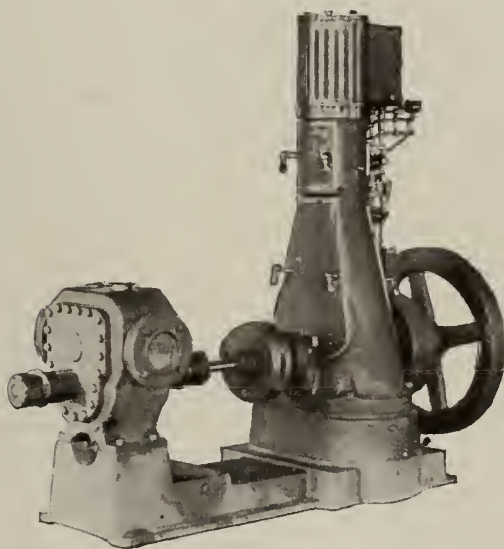


FIG. 184
KINNEY STEAM JACKETED PUMPING UNIT

illustration, Fig. 184, shows the pump connected through flexible coupling to a vertical, all enclosed type of engine with pump lubrication. This unit has the advantage of great flexibility of speed and variation of capacity. Prices on application.

Belt Driven Pump with Tight and Loose Pulleys.

This type of pump, Fig. 195, is furnished in any size and of any capacity, and is adapted for handling all heavy viscous materials as well as liquids of lighter gravity.

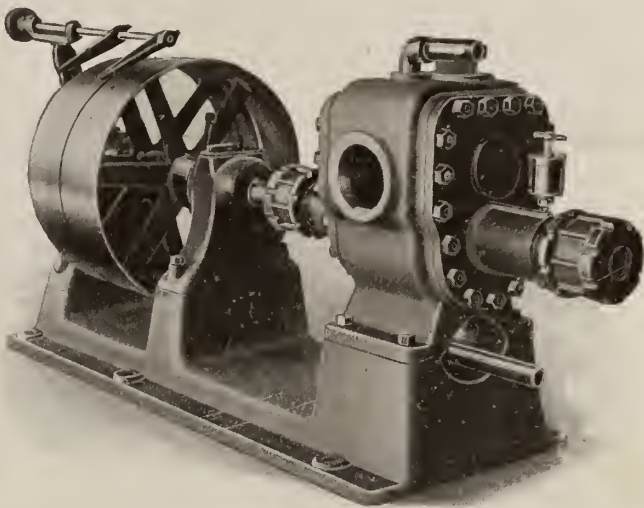


FIG. 195
KINNEY BELT DRIVEN PUMP WITH TIGHT AND LOOSE PULLEYS

Strainers.

Both the plain and steam jacketed strainers are furnished in any size.

The steam jacketed type is particularly adapted for use in connection with the pumping of heavy viscous materials where heat is required to keep the material in a fluid state.

These strainers are of the basket type. When the basket is removed, all insoluble matter is removed with it.

Prices on application.

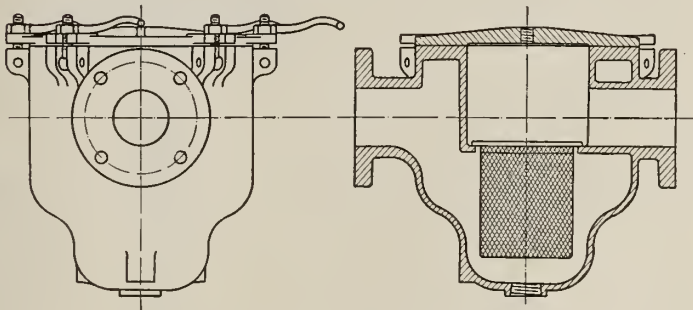


FIG. 164
DETAILS OF KINNEY STRAINER

LAYNE & BOWLER COMPANY

Manufacturers of Turbine Pumps and Well Screens

GENERAL OFFICES AND MAIN WORKS
MEMPHIS, TENN.

BRANCH FACTORIES
HOUSTON, TEX.

LOS ANGELES, CAL.

HOUSTON, TEX., Sixth and Gerard Streets
LOS ANGELES, CAL., 910 Santa Fe Avenue

BRANCH OFFICES
CHICAGO, ILL., 1440 Old Colony Building
WELSH, LA.

STUTTGART, ARK.
CROWLEY, LA.

Products.

LAYNE VERTICAL TURBINE PUMPS;
LAYNE SHUTTER SCREENS; KEYSTONE WIRE
WRAPPED SCREENS; GRAVEL WALL WELLS.

Development and construction of Ground
Water Supply Systems for Railroad, Mining,
Industrial, Municipal and Irrigation Service.

Layne Vertical Turbine Pump.

The value of a well lies in the economical delivery
of its yield to the desired height or pressure and depends
chiefly upon a pump of known and positive performance.

After much experimenting, LAYNE & BOWLER COM-
PANY perfected a vertical turbine pump suitable for wells
of various depths, the simplicity of design and superior
construction of which have won a marked recognition
from pump authorities.

The Layne vertical turbine pump consists of 3 gen-
eral parts: discharge head, discharge column and bowls
or stages.

The discharge head contains
the power connection, thrust
bearings, adjusting screws, lubri-
cating device, discharge nipples
and base plate.

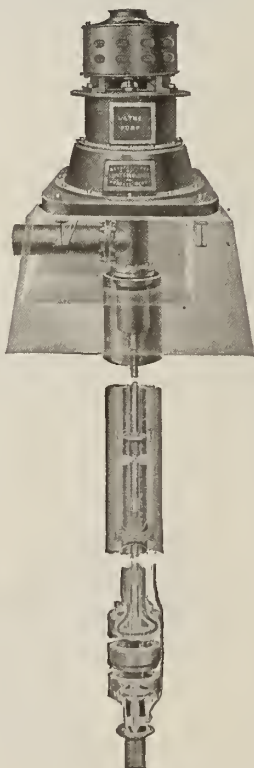
The discharge column con-
sists of line shaft, shaft bearings,
shaft casing and discharge cas-
ing. The shaft casing and dis-
charge casing together, transmit
to the base plate all the dead load
or weight of the bowls or stages,
where the weight hangs sus-
pended.

The bowls or stages contain
the impellers, diffusion rings,
guide passages and suction. The
weight of the water in motion
through the bowls is transmitted
to the thrust bearings in the dis-
charge head by the line shaft.

In order that the line shaft
may operate under tension, the
Layne vertical turbine pump is
purposely designed to produce
some down thrust.

DISCHARGE HEAD TYPES—

The Layne vertical turbine pump
can be furnished in the following
discharge heads. Oil balance,
for lifts of 300 ft. and over.



LAYNE VERTICAL TUR-
BINE PUMP
Direct connected motor,
high pressure head



TRADE-MARK

Special twin bearing, for lifts not exceeding
350 ft. Standard ball bearing, for lifts not
exceeding 150 ft.

Oil Balance Head—The oil balance head
has made possible the lifting of water from
depths of 400 to 500 ft. without undue fric-
tion and resultant wear on bearings. In this
design the entire weight of shafting, impellers
and water discharge is carried on a film of oil.
The design is very simple with all parts located

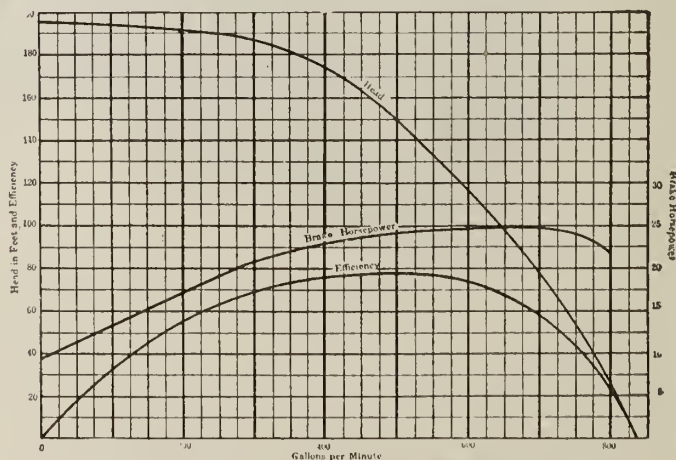
above the surface and readily accessible. It can be
adapted to any lift regardless of depth or quantity of
water to be handled.

The head is constructed with a series of pistons or
pressure plates rigidly attached to the pump shaft at re-
quired intervals, which rotate with the shaft. An oil
pump is also connected to the pump shaft by means of
rawhide and steel gears. As the main pump shaft
revolves, the oil pump forces oil to the underside of the
rotating pistons and there builds up a pressure inside the
piston casing sufficient to lift the shaft with its entire
load a fraction of an inch in height and forms an oil
cushion or film underneath each piston, upon which they
float.

A thrust collar at top of shaft operates on ball
bearings; is adjustable by thumbscrews, and fixes the
height to which the shaft may be raised for proper
clearance of the impellers in the bowls.

A pressure gauge and regulating valve are provided
in the oil line, so that, by means of a thumbscrew, the oil
pressure may be regulated to any amount necessary to
carry all or a part of the load or weight.

An oil tank or reservoir is located in one or more of



CHARACTERISTIC CURVES OF 15-INCH TURBINE PUMP OPER-
ATING AT CONSTANT SPEED OF 1125 R.P.M.

the arch legs, cast hollow, with circulation from the bearings provided by means of an overflow valve from pressure regulator. The upper thrust collar bearing is lubricated by sight feed cup. Overflow from bearings is connected with oil reservoir. In a belted head, two annular ball bearings are placed one above and one below the pulley, to reduce the friction on bearings due to the belt tension.

Special Twin Bearing Head—This type head designed for lifts not exceeding 350 ft. Consists of two separate, self-aligning ball thrust bearings, so arranged as to equalize on each the entire weight of the shafting, impellers and pump discharge. An adjusting device near the top of shaft takes care of impeller clearance in the bowls.

Forced lubrication to all bearings is provided by means of centrifugal circulating oiler connected to main shaft with oil flow indicator near top of head. In belt driven type, special provision is made for the thrust due to the belt tension.

This is a neat, compact assembly with all parts readily accessible at the ground surface, well proportioned and with ample bearing area to support the entire load without undue friction and wear.

Standard Ball Bearing Head—Furnished for all high pressure work on lifts not exceeding 150 ft. and standard for average conditions. It consists of a self-aligning ball thrust bearing to carry the entire weight of all moving parts, as well as weight of water discharged. An adjustable collar at top of shaft provides for impeller adjustment.

Lubrication is furnished by sight feed oil cups at top of pump. Bearing is housed, with overflow chamber provided to prevent leakage and waste of oil.

Heads for Special Conditions—Where the pumping problem presents unusual conditions the LAYNE & BOWLER COMPANY are prepared to design and build special types of heads to meet such conditions.

Power Connection—Any type head manufactured by this company can be fitted for direct connected motor, direct connected steam turbine or belt drive. Direct connection for motors and turbines are made with flexible couplings of the Layne & Bowler manufacture.

Angle of Discharge—All style discharge heads can be fitted with any of the following angles of discharge without extra charge.

Open Surface: Angle of discharge nipple 60° or 90° off the vertical.

Above Ground: For working against medium pressures. Angle of discharge nipple 60° or 90° off vertical.

Below Ground: For working against high pressures. Angle of discharge nipple 90° only.

DISCHARGE COLUMN—The patented enclosed line shaft embodied in the discharge column is distinctly a Layne feature and is covered by valid patents already upheld by court decisions.

The main pump or drive shaft is surrounded or enclosed with a standard steel casing, which extends from the discharge head to the bowl. The shaft casing is in sections 6 ft. 8 in. in length, connected by threaded bronze bushings which serve the two-fold purpose of casing couplings and lateral shaft bearings.

At the discharge head the shaft casing is connected to the base plate by means of an increaser nipple, which provides annular space around the shaft. The increaser nipple is packed against internal pressure at the surface and bored for oil pump connection.

Lubricating oil is forced into the shaft casing and completely fills the annular space between the shaft and casing for its entire length from discharge head to the bowl. The lower end of shaft casing is sealed against leakage of oil and admission of sand, grit or other matter by a reducer nipple connected to the guide bell in the initial bowl of stage.

In this manner the shaft for its entire length, with all shaft bearings, is thoroughly lubricated by immersion. In fact, the shaft operates in oil at all times, preventing the bearings from becoming heated.

Shaft diameters range from 1½ in. to 3½ in., and shaft casing diameters from 2½ in. to 6 in.

By its connection with the base plate, the shaft casing is made to carry a portion of the weight of the bowls. This weight keeps the shaft casing under tension and adds stiffness to it, which operates to overcome any lateral vibration in the main shaft.

The enclosed line shaft feature prevents any water or sand coming in contact with the shaft or shaft bearings and makes it possible for the pump to operate where grit and sand must be handled.

Water leaves the bowls in the Layne turbine pump with uniform stream line motion and passes to the surface without the creation of eddies at shaft couplings or shaft bearings, as these are all enclosed in the shaft casing, which presents a smooth exterior at each joint. This is important, as it materially reduces the frictional losses in the discharge column.

Discharge Casing—It is made up of standard lap welded casing and standard pipe sizes from 7 to 16 in., dependent upon capacity. Casing couplings are threaded in the 12-in. pump, but flanged in all larger sizes.

The discharge casing is connected at its upper end with base plate and at lower end with pump bowls. In this manner all dead weight in the well is suspended from the base plate, the shaft casing carrying a part, but the discharge casing the greater amount.

Additional protection against shaft vibration is afforded by setting light weight brass spiders in the discharge casing at each joint.

All surfaces in contact with water are reduced to a minimum, consistent with strength, and are carefully machined and hand finished.

BOWLS OR STAGES—Layne vertical turbine pumps are manufactured in standard bowl sizes, having outside diameters, including oil line, from 11⅝ in. to 28½ in., and in larger diameters on special order. Bowls in all sizes are made of best grade cast iron and hand finished. Diffusion rings and guide passages are carefully smoothed to cut down friction losses.

Multistages—Layne turbine pumps, in all sizes, can be furnished in any number of stages to meet any capacity against any head. All bowls or stages nest together and are suspended from the base plate by means of discharge casing and shaft casing.

The weight of main shaft, impeller shaft, impellers and part of the down thrust of the water discharged is carried by the thrust bearings in discharge head. No



DISCHARGE COLUMN
Showing enclosed line shaft (patented)

support is derived through any attachment to the well or pit casing.

Suction—All Layne turbine pump bowls are manufactured with bottom suction, made by bolting a tapered flange nipple onto the bottom of last stage. They are guaranteed to operate under 20-ft. suction lift below bottom of lower stage, and it is the Layne & Bowler practice to fit them with a perforated suction pipe 20 ft. in length. The perforations act as a strainer to exclude the entry into the pump of any debris which might possibly choke the impeller or guide passages.

Impellers—They range in capacity from 250 to 6000 g.p.m. and are made both in gray iron and bronze, the former being preferred on account of longer life, although the bronze impeller develops slightly better efficiencies.

The closed type bottom suction impeller is used in all high efficiency pumps. All water passages are hand finished and polished to cut down skin friction. Extreme care is exercised in the balancing of the weight of all impellers, as in that feature rests the life of the installation. A slight adjustment in impeller clearance is all that is required, and this is made in all discharge heads at top of shaft by an adjusting nut.

The impeller or runner shaft has two bearings, one in the initial stage and the other in the suction nipple which bolts on to the lower stage. Lubrication for the upper bearing comes from the enclosed line shaft; while the bottom bearing is supplied from the surface by a separate oil line made of $\frac{1}{4}$ -in. pipe, placed on outside of bowls and discharge column and tapped into suction nipple.

PUMP SPEEDS—Layne turbine pumps are designed to operate at speeds from 800 to 1200 r. p. m. in direct connected motor and steam turbine driven units. Where 25 cycle current is encountered, the smaller size pumps may be operated at 1455 r.p.m. For belt driven units, speeds range from 600 to not exceeding 1000 r.p.m.

Direction of rotation in all pumps is left-handed or anticlockwise.

Layne Patent Shutter Screen.

This water screen is designed especially for large bore wells or for installations where large supplies of water are required. It is made of non-corrosive copper bearing steel plate, perforated in staggered louver form with $\frac{1}{2}$ -in. blank spaces left between vertical rows of openings, which gives unusual strength against collapse.

The shape of the perforations with the overhanging lip or shield prevents water from passing horizontally from the water bearing strata into the well tube and causes an upward flow at a much lower velocity than found in any other type of screen. With properly proportioned gauge of screen openings a velocity is obtained through the screen which is so slow as not to carry in suspension any of the sand or gravel from the surrounding medium. Matter that is in suspension is dropped at the screen as the water flows upward through the opening and is deflected downward outside the walls by the shape of the screen opening.

The Layne patent shutter screen is made in diameters from 8 to 36 in. in No. 10-gauge plate and 10 to 40 in. in No. 8-gauge plate, and in 5-ft. sections, unless otherwise specially ordered. It may be riveted together in continuous lengths to fit any thickness of strata. The size or gauge of openings range from .018-in. to $\frac{3}{16}$ -in.

VERTICAL CONE BOTTOM—To facilitate the setting of

the shutter screen, a vertical cone bottom is furnished with it, perforated in the same manner and constructed of same gauge metal. The cone has a cylindrical cutting edge at its lower end, which serves to guide the screen vertically downward through the water bearing material and prevents the tendency to deflect when an uneven formation is encountered.

Vertical cones are furnished with top diameter to correspond to diameter of shutter screen and bottom diameters from 6 to 12 in. larger.

SHUTTER SEAL—Where the vertical cone can not be sealed against a hard stratum so as to prevent the entry into the well tube of sand, gravel or other material, a shutter seal with either solid or perforated bottom is inserted through the well tube into the shutter strainer, driven into position at bottom of same and locked against upward movement by pressure. The shutter seal is perforated in same manner as the shutter screen to admit the free flow of water, but all the sand or gravel from the bottom is excluded.

The shutter seal is furnished in diameters to correspond to shutter screen sizes and in 5-ft. lengths.

RIVETED PIT OR WELL CASING—This company manufactures riveted pit or well casing in all diameters from 8 to 40 in. It is made from Nos. 6-, 8- and 10-gauge plate of ingot iron, open hearth, charcoal or copper bearing steel, in 5-ft. lengths, and with single, double or butt lap riveted joints.

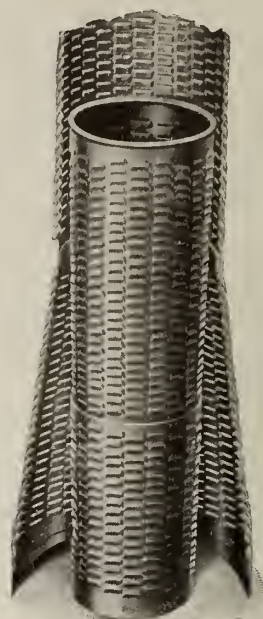
The anticorrosive quality of the steel selected for the manufacture of this well casing insures longevity for wells constructed by this company.

Gravel Wall Wells.

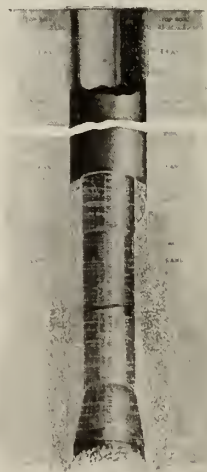
Actual tests have proved that many wells would produce from 3 to 4 times their yield if a scientifically designed screen were installed. It is now firmly established that the value of the well is in the screen. Gravel wall wells equipped with shutter screens are far superior to any other type in yield, in durability, and in low maintenance cost.

CONSTRUCTION AND OPERATION—A circular hole of diameter 16 in. or larger is drilled with rotary machine through the top formation to water bearing stratum. In this is set the pit or riveted casing, built up of 5-ft. sections riveted together, which extends from ground surface into the water bearing stratum any distance found desirable.

The thickness of the water bearing stratum having



SHUTTER SCREEN
Showing vertical cone
bottom



GRAVEL WALL
WELL
Composite view showing
method of construction

been predetermined from test hole, the shutter screen with vertical cone bottom, of required length, is riveted together into one continuous section. The bottom diameter of vertical cone is proportioned to fit the inside of the pit, the top diameter to fit the shutter screen, and the diameter of and opening in shutter screen to meet the character of material found in water stratum, as well as the demand to be made on the well.

The screening section is placed in the well with vertical cone resting at top of water stratum, the intervening distance between top of screen and ground surface being filled out with false or temporary casing. Gravel is fed into the annular space between screen and pit and the screen bailed to final position in water stratum. The next operation is to continue simultaneously the feeding of gravel and the pumping out of loose sand, gravel or other material, which operation is continued until well takes no further gravel and until water clears of sand. Then the false casing connecting the screen with the surface is removed, the shutter seal driven into position through cone and well tube sealed against any upward flow of material from the bottom.

Keystone Wire Wrapped Screen.

This type screen is especially adapted for deep oil or water well work where several water bearing strata may be encountered but at widely separated intervals. The quality of water in some of these may be found satisfactory, while in others it may be highly mineralized and unfit for use. The Keystone screen can be connected at any point in the well casing by special coupling devices manufactured by this company, so that the flow from any number of strata may be combined or excluded, as conditions may warrant.

CONSTRUCTION—Keystone wire wrapping screen is manufactured of perforated pipe wrapped spirally with brass or heavily galvanized tempered steel wire, rolled in shape of a keystone, the narrow edge of the keystone being wound next the pipe so that a smooth exterior is presented.

The pipe is perforated in special drill presses, in such a manner as not to cause an appreciable weakening in the material. The perforations are $\frac{3}{8}$ in. in diameter and in vertical, staggered rows $\frac{3}{4}$ -in. center to center.

The wire is wound and spaced accurately to form openings between successive turns from 5/1000 of an inch to any width which conditions may call for. The wire is attached to the pipe by vertical rows of solder $\frac{1}{2}$ in. in width and is finished off at start and finish with

a steel collar shrunk over each end of the wire. By the use of the electric weld, the ends of the wire are welded to the part already wound on the perforated pipe and forms a continuous wire from one end of the screen to the other.

Intake area in any screen is paramount. Keystone screen offers a maximum separating area which admits water at lower velocities than other types of screens. The spiral winding of the keystone shaped wire connects laterally all perforations in the pipe core, so that water must travel only a minimum distance to enter the well tube.

Keystone screen will not sand, jam or clog. Anything passing the space formed by the knife edges at the outer surface of the screen will pass through the perforations in the pipe and be pumped out. Any incrustation or lodgment does not totally exclude inflow, as water passes around and under the obstruction to some perforation, through the continuous "V"-shaped space formed by the successive windings of the keystone shaped wire. Keystone screen may be removed, cleaned and replaced in the well without injury to the screen.

It is regularly made in all standard well casing and pipe sizes ranging from 2 to 12 in., and in larger diameters on special order. Pipe stock is either standard black or galvanized finish. Screen lengths conform to random pipe lengths, but may be cut to any intermediate length before winding, if desired. All attachments, such as lead packer, ratchet lead packer, threaded top connection, threaded coupling, open ring bottom, back pressure valve, bottom bail, etc., can be furnished for Keystone screen. Other and special attachments to meet unusual conditions can be designed and furnished on application.

Construction Contracts.

In the contracting field, LAYNE & BOWLER COMPANY has built up an enviable reputation as one of the largest and foremost developers and constructors of ground water supply systems. Since the founding of the company the fixed policy of "no water no pay" has been the basis of all well construction contracts entered into by this company.

LAYNE & BOWLER COMPANY has a most efficient line of well products, modern well drilling machinery in charge of expert drillers, and experienced civil, hydraulic and mechanical engineers to examine into and pass upon soil conditions.

LAYNE & BOWLER COMPANY proposals, which are thorough engineering reports, not mere price quotations, cover fully the clients' requirements. They treat of all the engineering, operating and maintenance problems involved and include plans and estimates of the types of installations best suited to requirements, also comparative costs of operation and maintenance under variable service conditions. Such reports are the result of care and study by expert engineers whose designs and conclusions are in accord with approved practice.

Guaranteed Results.

The reputation and future prestige of the company are behind every undertaking and an additional security of a surety bond to the amount of the contract is offered to substantiate the company's guarantee to deliver the maximum possible amount of water per 24 hours. This confidence is due to the scientific precision of design and masterly execution that constitutes LAYNE & BOWLER COMPANY's service. Mistakes and the element of chance are eliminated, because the company investigates first and drills last.



KEYSTONE WIRE WRAPPED SCREEN
Showing method of winding



PERFORATIONS THROUGH WIRE

LEA-COURTENAY COMPANY

Manufacturers of Centrifugal Pumping Machinery

15 Maine Street
NEWARK, N. J.

BRANCHES IN PRINCIPAL CITIES

Products and Services.

CENTRIFUGAL PUMPS which include: Double Suction Single Stage Pumps; Single Suction Multistage Pumps; Underwriters' Fire Pumps.

LEA-COURTENAY COMPANY maintains a corps of engineers who are experts in their line. Their services are available, without obligation, for the solution of pumping machinery problems and for the selection of pumps which will properly fulfill requirements. Lea-Courtenay pumps are manufactured in standard sizes, all parts being practically interchangeable. Impellers, however, are always made to suit individual conditions.

Description.

Lea-Courtenay pumps are furnished with motor, turbine and gasolene engine drive; with capacities from 100 to 7500 gals. per minute, at any head up to a total head of 1000 ft. They handle hot and cold liquids of any consistency; are made of cast iron and of special bronze mixtures for mine water.

Tests.

To prove their ability to perform the service for which they are intended, all pumps made by this company are subjected to severe and rigid tests in a separate test plant, equipped with the most modern appliances, including a complete set of Venturi meters. Pumps are tested under actual service conditions; i. e. for boiler feed work, the pumps are tested with hot water at the temperature for which the pump has been ordered, and with a total head on the suction side to correspond exactly with that the pump is to work against.



FIG. 325. TESTING A LEA-COURTENAY 8-IN., 5-STAGE, ALL-BRONZE PUMP—ONE OF TWO FURNISHED A LARGE PENNSYLVANIA COAL COMPANY

Note the variable speed turbine, special reduction gear set and the Swiss torsion dynamometer

In testing all pumps a Swiss torsion dynamometer is used, which this company considers the only accurate means of measuring brake horsepower. It is more definite than a curve made by a motor manufacturer which is correct for one speed and load only and which requires

allowances for different conditions. By the Lea-Courtenay method of testing, the actual brake horsepower is secured on every individual pump that is shipped from the plant.

Lea-Courtenay Single Stage Pumps—known as Double Suction Volute.

Designed with and without diffusion vanes. The main case consists of only two parts and is horizontally split, with the suction and discharge always in the bottom half so that the top half may be easily removed without disturbing the suction and discharge pipe connections. All parts are easily accessible and pumps are bronze fitted throughout. On account of the double suction type of impeller taking water from both sides, this type of pump works in almost perfect hydraulic balance and is free from end thrust.

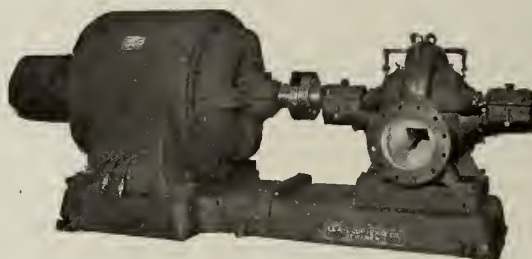


FIG. 474. LEA-COURTENAY 12-IN. DOUBLE SUCTION VOLUTE PUMP DIRECT CONNECTED TO 400 H. P. MOTOR
Delivering 4500 gals. per minute against 241-ft. head at 1750 r.p.m.

Double suction volute pumps are adaptable for a large range of uses. For irrigation and reclamation service, where large quantities of water are to be raised to moderate heads, they give excellent service. In power plants, they are used to advantage with steam turbine drive for general service against moderate pressures. Large packing houses are also using both steam turbine and motor driven single stage pumps for circulating brine. In large hot water heating plants the single stage pump fulfills all requirements for circulating water.

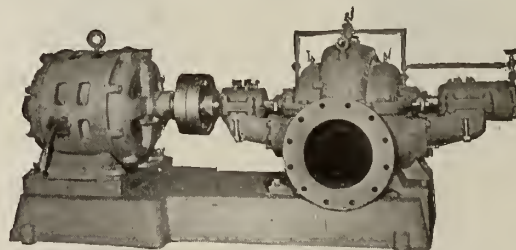


FIG. 431. LEA-COURTENAY 12-IN. PUMP WITH WATER COOLED MARINE THRUST BEARING AND WITHOUT DIFFUSION VANES
Desirable for heads up to 200 ft.

Single stage pumps have been built by this company for heads as high as 250 ft.; without diffusion vanes; running at 1750 r.p.m. This makes a very desirable pump for water works where motor drive is the chief form of power.

Lea-Courtenay Single Suction Uniflow Pumps.

These single suction multi-stage pumps (without diffusion vanes) made by this Company differ from Lea-Courtenay single suction turbine pumps in that they have well defined volutes at each and every stage.

Intake up to impeller is almost identical with other types of single suction pumps made by this company, but when the water leaves the impeller, instead of being guided into the second impeller by return passages constructed with vanes of various types, it is simply discharged into a volute, practically the same as in the double suction volute pump, and is led into the second wheel without shock loss. Velocity head is transformed into pressure head in such a manner that an extremely high efficiency is obtained.

The hydraulic balancing features of Uniflow pumps are fully described in a special bulletin, H-4.

Lea-Courtenay Single Suction Turbine Pumps.

These pumps consist of a series of side suction impellers mounted on one shaft, the oldest and best known type of multi-stage pumps.

The design has been perfected to such a point that pumps can be built with practically no end thrust and give perfect satisfaction without a marine thrust bearing.



FIG. 516. LEA-COURTENAY 4-STAGE BOILER FEED PUMP, DIRECT CONNECTED TO STEAM TURBINE
Designed to deliver 400 gals. per minute against an 800-ft. head

Lea-Courtenay Centrifugal Fire Pumps.

Built in accordance with specifications of the Associated Factory Mutual Fire Insurance Companies, National Board of Fire Underwriters and National Fire Protective Association, covering requirements for a simple and absolutely dependable fire pump, operated by means of power secured from outside sources.

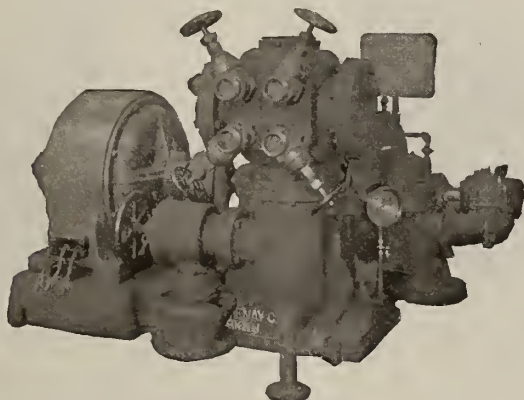


FIG. 786. LEA-COURTENAY STANDARD 1000-GAL. MOTOR DRIVEN UNDERWRITERS' FIRE PUMP
Designed for all pressures and built on National standard specifications. Has been approved by all Underwriter Boards

In addition to the standard pump shown, special designs have been developed and are in service, meeting requirements of local ordinances.

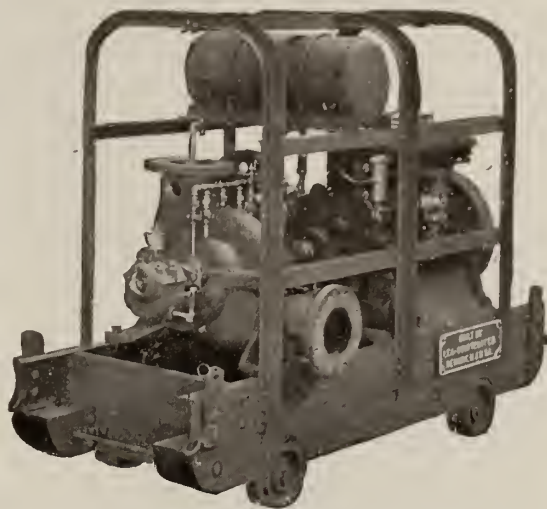


FIG. 473. LEA-COURTENAY SPECIAL SELF-CONTAINED GAS-OLINE ENGINE DRIVEN PUMP UNIT

One of a number furnished to the United States Government for salvaging ships. Very desirable for emergency pumping of various kinds. Two of these units are now in use in Norfolk, Va., pumping 11,000 gals. of water a minute to meet temporary needs of the city water supply

Fire pumps installed, if desired, and advice given as to requirements which must be met in any part of the country and any auxiliary apparatus to meet requirements of installation.

A specially designed fire pump unit, gasoline engine driven, has been perfected for isolated conditions where only one source of power is available, either electric or steam turbine, and where it is necessary to have a standby unit. This unit is accepted by the underwriters for special requirements.

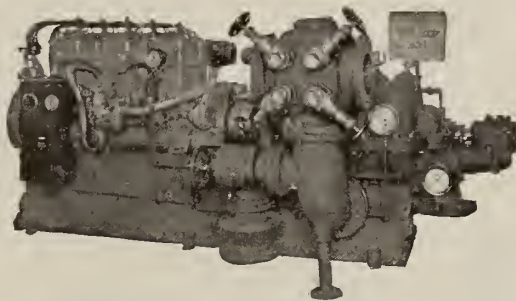


FIG. 789. LEA-COURTENAY SELF-CONTAINED GASOLINE ENGINE DRIVEN FIRE PUMP UNIT

Delivering 1000 gals. under 100 lbs. pressure at 1200 r.p.m. Complete with self-starting equipment

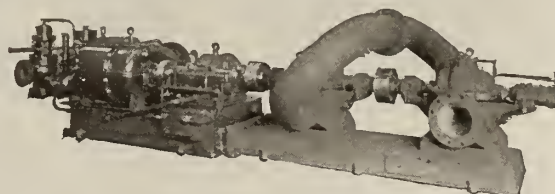


FIG. 476. LEA-COURTENAY 10-IN. PUMPS ARRANGED IN SERIES

Delivering 3000 gals. per minute against 180 lbs. pressure. This arrangement is very desirable where gritty water is handled at extremely high heads or under conditions where a hydraulically balanced pump could not be used, yet where a pumping unit of very high efficiency is required

LAMMERT & MANN CO.

Manufacturers of Rotary Vacuum Pumps; Engineers and Machinists

TELEPHONE:
WEST 4918

Wood and Walnut Streets
CHICAGO, ILL.

Products.

LAMMERT ROTARY VACUUM PUMPS, Air and Water Cooled for any high, dry vacuum service and pressure up to 25 lbs.

LAMMERT PRESSURE PUMPS.
Water Cooled Rotary Blowers.



TRADE-MARK

Lammert Pumps.

Lammert rotary dry vacuum and pressure pumps are made in a variety of types and sizes to meet the numerous service requirements.

For the past twenty years LAMMERT & MANN Co. have been making vacuum pumps and some of the largest concerns in America are using them with absolute satisfaction. They have demonstrated by actual on-the-job performance their superior adaptability in meeting the exacting requirements of the work for which they were designed.

Wide Range of Uses.

LAMMERT VACUUM PUMPS—Used for canning, preserving, milking, in chemical laboratories and for many varied special purposes where high, dry vacuum is required.

They are also adapted to the priming of centrifugal pumps, for which we have our automatic control.

LAMMERT PRESSURE PUMPS—Used for agitating liquids, cleaning generators, for machinestops and any service where pressure up to 25 lbs. can be used.

Distinctive Features.

Lammert pumps are dependable, economical and require the absolute minimum of attention. The oiling systems are flawless. The air cooled and small water cooled pumps are equipped with the capillary type of oiling—oil fed to the bearings and all moving parts by capillary attraction—very economical and efficient. The

large pumps are equipped with automatic oilers which deliver a constant flow of oil to the internal mechanism through the bearings, after which the oil is separated from the exhaust air and returned to the oil chamber to be used over and over again. This feature not only reduces the operating cost, but also cuts the attention required to the mini-

mum.

The smaller pumps may also be equipped with the automatic oiling feature, if desired.

Advantages.

There are no valves to stick, no pistons to wear, no cranks or connecting rods to complicate the working parts and consume power.

Lammert pumps are simple, compact and require little floor space.

They are quiet running without vibration. All parts are standard and interchangeable and each part is rigidly inspected and every pump is tested to its full rated capacity.

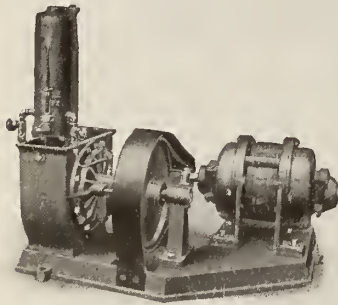
Every Lammert pump carries a full guarantee against faulty workmanship or material.

Types and Relative Vacuum Ratings.

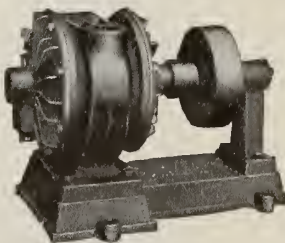
Lammert pumps may be had air or water cooled, belt or motor driven. The air cooled pumps are designed for intermittent service and will develop a 26-in. vacuum at sea level. The water cooled types are for continuous duty and will easily maintain a 27½-in. vacuum at sea level.

The two-stage, high duty vacuum pumps are guaranteed to maintain a vacuum within ½ in. of the barometer and can be made to do within 1/10 in.

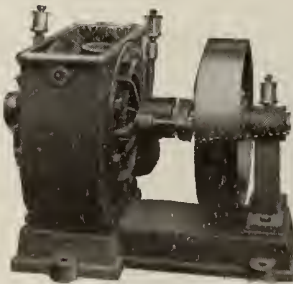
For special requirements various arrangements can be made to accomplish the desired result, such as "unit combination vacuum and pressure," etc.



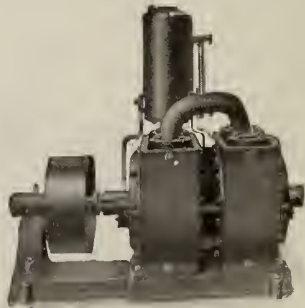
Motor Driven Type
For continuous duty. Equipped with automatic oiler



Air Cooled Belted Type
For intermittent service. Capillary oiling



Water Cooled Belted Type
For continuous service. Capillary oiling



Two-stage Belted Type
Equipped with automatic oiler. Highest vacuum

LAMMERT PUMPS

WATER COOLED, SINGLE-STAGE, BELT DRIVEN
For 27-in. vacuum at sea level

AIR COOLED, SINGLE-STAGE, BELT DRIVEN

WATER COOLED, SINGLE-STAGE, BELT DRIVEN, CAPILLARY OILING

WATER COOLED, DOUBLE-STAGE, BELT DRIVEN, HIGH DUTY

No.	5	5½	6	7	8	9	10	1	2	3	4	1	2	3	4	1A	4A	5½A	6A
Capacity cu. ft., per min.	55	67	90	180	275	425	700	3½	7	14	24½	3½	7	14	24½	3½	24½	67	90
R. p. m.	300	300	230	185	150	120	95	500	450	400	350	500	450	400	350	500	350	300	230
Pulley, in.	14x4	14x4½	16x6	24x7	28x10	34x12	46x14	4x2	6x2	8x2	10x3	4x2	6x2	8x2	10x3	4x1½	10x3	14x4½	16x6
Inlet and outlet, pipe size, in.	2	2	2½	3	3½	4	5	1½	3¼	1	1½	3¼	1	1½	1½	1½	1½	2	2½
Horsepower	4½	5¼	6½	12	18	28	40	¾	¾	1¼	2	¾	¾	1¼	2	1½	1½	7	9½
Floor space, in.	17x28	17x30	22x37	26x48	35x61	43x76	55x97	6x11	10x15	11x17	12x20	6x11	10x15	11x17	12x20	6x14	12x27	17x42	22x50
Shipping weight, domestic, lbs.	525	575	1000	1600	3500	6500	10800	26	80	90	170	26	80	90	170	45	245	975	1650
Shipping weight, export, lbs.	650	725	1250	1950	3950	7050	11450	36	100	120	200	36	100	120	200	60	280	1200	2000

LUITWIELER PUMPING ENGINE CO.

123 Ames Street
ROCHESTER, N. Y.

PACIFIC COAST BRANCH, 707 North Main Street; LOS ANGELES, CAL.

Products.

The LUITWIELER SYSTEM of NON-PULSATING PUMPING MACHINERY: DEEP WELL and TRIPLEX POWER PUMPS; HYDRO-PNEUMATIC PRESSURE SYSTEMS.

Scope of Use.

The Luitwieler system of non-pulsating pumping machinery is in use by city, village and corporate water works, private water supply, railroad tank service, cotton mills, chemical works, mines, manufacturing plants, irrigation, and all general and special purposes for which pumps are used, and particularly where it is desired to entirely eliminate pulsation, noise, jar, pound, vibration, etc.

Pumping Deep Wells With Electric Power.

Where electric energy is obtainable it is economically used as a driving power. Luitwieler pumping machinery consumes very little current; and the evenness and steadiness of load adapts it particularly to drive direct connected to motor by gearing.

Electrically operated pumps can be controlled automatically by float switch or pressure control so that little attention is required.

A large percentage of Luitwieler pumps are driven direct connected to electric motors.

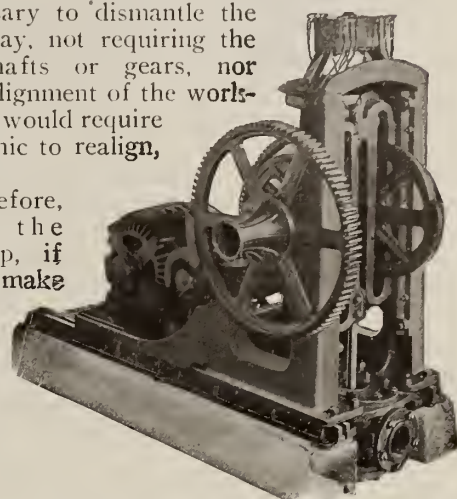
PISTONS—The two pistons in the single working barrel are operated by pump rods which are balanced and of equal weight. One piston rod is hollow, and the other piston rod is solid. Each rod is attached to a yoke having an upper and lower roller. The cams, rotating against these rollers, move the yokes and pump rods up and down uniformly. The shape of the cams is such that before one cam stops lifting, the other cam takes the load. This makes the water movement continuous, without the pulsating action found in crank and steam pumps. No check valves are required, as the pistons keep the water moving continuously in a solid stream.

SIMPLICITY—The Luitwieler non-pulsating pump

has few parts, only about one-third the number found in the average pulsating pump on the market.

Unlike most deep well systems, it is not necessary to dismantle the pump in any way, not requiring the removal of shafts or gears, nor changes to the alignment of the working parts, which would require a skilled mechanic to realign, when installing.

It is therefore, possible with the Luitwieler pump, if necessary to make repairs, to disconnect the rods, slide the head back on the sliding rails, and begin the operation of pulling out the rods in a few minutes.



ELECTRICALLY DRIVEN DEEP WELL PUMP

The illustration herewith shows the method of connecting pistons and rods to pumping engine. The solid rod is connected to right-hand cross head at top and the hollow rod is connected to left-hand cross head at bottom. Rods are in line with center of well.

Working barrel may be located at any desired point at which the pistons are submerged when pumping. Such submergence should be not less than 5 ft., and sometimes 20 ft. is desirable. The self-contained feature is highly desirable and a satisfactory one.

Automatic Pumps.

The Luitwieler automatic system of water supply is particularly desirable for the farm, suburban home, hotel, asylum, industrial plant, municipality, etc. Special attention has been given both to the open tank and to the closed tank (hydro-pneumatic) systems.

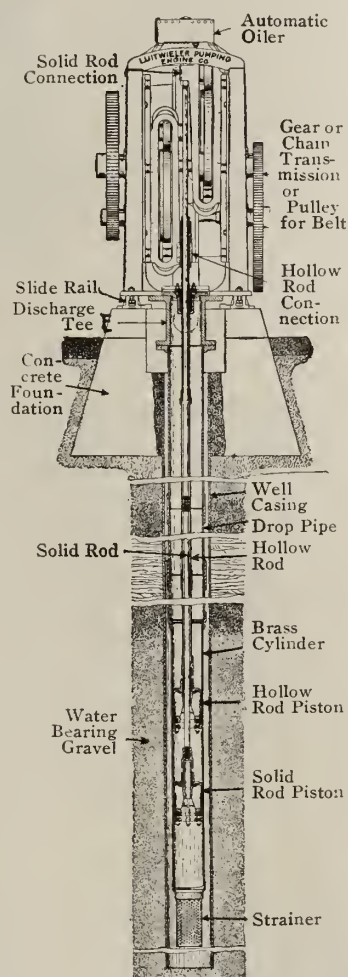
The system is equipped with self-starters for both A.C. and D.C. motors; diaphragm pressure regulator or gage type pressure regulator; float switch in either closed or open type, and other necessary devices for the automatic operation of these pumps.

SIZES, DIMENSIONS AND WEIGHTS OF DEEP WELL PUMPING ENGINES WITH EXTENDED BASES

Number	Stroke, in.	Width, in.	Length over slide rails, in.	Height, in.	Shipping weight, lbs.	
					Without motor or motor base	With motor base and reduction gear
401	4	19	24	23	350	435
702	7	25	35	32	750	870
1004	10	29	50	41	1300	1480
1205	12	42	76	53	2300	2600
1510	15	51	79	60	3300	3650
1815	18	63	92	70	5200	5900
1822	18	65	91	71	6200	6100
1830	18	68	91	72	7500	8400
1840	18	68	91	72	8200	9200
1850	18	92	118	81	12000	13500

Guarantee.

All machinery is guaranteed to be well made of first class material, and if proved defective within one year from date of sale, defective parts will be replaced free of charge, f.o.b. cars at factory.



DETAILS OF LUITWIELER PUMP
Arrangement on foundation and rod and column section

THE JOHN H. McGOWAN COMPANY

Steam and Power Driven Duplex Pumps for all Uses

CINCINNATI, OHIO.

Products.

DUPLEX STEAM and POWER DRIVEN PUMPS for all uses; DEEP WELL POWER HEADS.

Elevator and Water Works Pumping Engines; Electric Pumps furnished with all customary forms of drives in Mounted Motor and Extension Base Types.



TRADE-MARK

Specifications.

Complete specifications covering detailed construction will be furnished with all proposals for special equipment and for standard steam and power driven pumps when requested.

Installation Diagrams.

All bulletins relating to McGowan duplex steam or power driven pumps have the installation diagrams incorporated for the convenience of the buyer in planning their location.

Duplicate Parts

All McGowan duplex pumps are built on the interchangeable system, through the use of modern jigs and templates, except with regard to the final fitting necessary in the installation of large duplicate parts of pumping units, because of the variations in castings due to usual foundry practice.

McGowan Duplex Steam Pumps.

The valve plate design of duplex steam pump is built in the packed piston and outside center packed plunger patterns in all commercial sizes having fluid ends $8\frac{1}{2}$ by 12 in. and smaller. They represent a high standard of pump construction, which insures a decided reduction in the cost of maintenance and improvement in pump service, due to the following special features of construction:

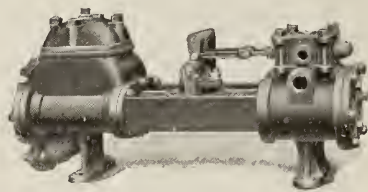


FIG. 295
MCGOWAN DUPLEX STEAM PUMP

SPECIAL FEATURES OF CONSTRUCTION—(a) Steam piston—one-piece box type.

(b) Cross head—spool form, permitting rotating of pistons.

(c) Renewable cross head wipers, which avoid expense of the replacement or the refitting of the cross head end of rocker arms, as required in the solid rocker arm construction.

(d) Piston rod packing nuts fitted with brass swiveled glands, which prevent corrosion and permit of the adjustment of the packing nuts without disturbing the packing as in the fixed gland type.



FIG. 331
MCGOWAN DUPLEX STEAM PUMP

(e) Threaded packing boxes screwed into the inner heads of pump cylinders, obviate the necessity of housing gaskets on the pump end.

(f) Adjustable packed pistons in all pumps of the packed piston pattern, which permit the adjustment of the piston follower to compensate for wear of packing.

(g) Brass bushed plunger packing box neck rings in all outside center packed plunger pumps, which obviate the reboring of the packing boxes when repairs to the plungers are necessary. These repairs may be made without removing the pump from foundation.

BULLETINS—

No. 601 relates to packed piston boiler feed and general service pumps.

No. 602 relates to packed piston tank or lower service pumps.

No. 603 relates to outside center packed boiler feed or general service pumps.

No. 604 relates to packed piston automatic feed pumps and receivers.

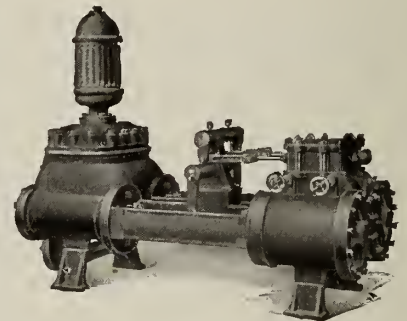


FIG. 439
MCGOWAN DUPLEX STEAM PUMP

McGowan Duplex Power Pumps.

The valve plate design of the duplex power pump is built in the packed piston and outside center packed plunger patterns, the sizes corresponding to the pump ends used in the McGowan duplex steam pumps of the same design, and are interchangeable with them. They represent a line of commercial duplex power pumps adapted for all modern types of drives and have incorporated in their construction the following special features:

SPECIAL FEATURES—(1) The frame combines the packing box yokes, cross head guides, main and pinion shaft bearings and pedestal. The main and pinion shaft bearings are jig babbitted with high grade babbitt metal, which process assures perfect alignment of bearings with respect to each other and with respect to the cross head guides.

(2) Cross head, plunger or sleeve type, which over-travels the cross head guides at each end of the stroke and overcomes the pressure and wear indispensable with the use of the adjustable cross head. The bearing pressure per square inch is less than half that on the adjustable cross head due to the fact that the sleeve or plunger type of cross head furnishes a complete and uniform bearing throughout its entire length.

(3) Crank shafts, center crank type, made of high carbon cast steel and of such proportions as to adapt them for the maximum plunger loads with minimum strain on the main bearing caps.

(4) Connecting rods made of high carbon cast steel, equipped with the babbitted marine type of bearing at the crank end and brass bushed box at the cross head end. A lubricating channel is cast in the connecting

rods for lubricating both the cross head and crank bearings by means of compression grease cups communicating with the lubricating channel at the crank end.

(5) Gearing machine cut from the solid castings and provided with rear guards at meshing points of such form as may be readily removed for inspection or renewal of gears.

(6) Bed plates are supplied for all self-contained side or end motor mounted units.

BULLETINS—No. 801 relates to packed piston general service pumps.

No. 802 relates to packed piston tank or low service pumps.

No. 803 relates to outside center packed general service pumps.

No. 804 relates to packed piston automatic feed pumps and receivers.

McGowan Deep Well Power Heads.

For service in connection with single or double acting working barrels for tubular wells, or for service in connection with independent pump cylinders in open wells; adapted for the use of either the plunger rod or the displacement plunger. The former is used invariably in connection with double acting working barrels, and frequently in connection with single acting working barrels for surface discharge; the latter is used only in connection with single acting barrels, the size of the displacement plunger being governed by the size of the working barrel used.

FEATURES OF DESIGN—(a) Regularly built for trench line and surface discharge, through the provision of cast iron extension pieces at either side, as shown by the illustration. The extension pieces corresponding in height to that of the discharge tee, the foundation bolts extending through the extension pieces and the base of the power head to effect proper rigidity in its installation, when so equipped.

(b) Its adaptability for a variety of driving combinations; to illustrate: the belt driven deep well geared power heads may be equipped with (a) single driving gears; (b) double driving gears; (c) single driving pulley; (d) tight and loose pulley; (e) flywheel driving pulley, and (f) counterbalance weights on main driving gears. The direct connected deep well power heads may be equipped with (1) single driving gears; (2) double driving gears; (3) standard intermediate gears; (4) flywheel intermediate gear; (5) counterbalance weights on main driving gears.

(c) The solid cast iron frame construction combining the base, cross head guides, main and pinion shaft bearings; being of the column design, all vibration common to the built-up frame construction is overcome. All frames are so proportioned as to permit the double gearing of the power head without change of pattern. The opening in the base permits the removal of the packing box head, which surmounts the discharge tee.



FIG. 374
McGOWAN DUPLEX POWER PUMP

(d) Jig babbitted main and pinion shaft bearings, which process insures perfect alignment of bearings with respect to each other and with respect to the cross head guides.

(e) Gears are machine cut from the solid, and of ample strength for maximum plunger loads. Cast or wrought iron guards are provided at the meshing point of all gears, and are of such form as may be easily removed for the inspection or renewal of gears.

(f) A winding spool may be provided on the pinion shaft to afford a convenient means of raising and lowering the well parts when the connecting rod and packing box head are removed from the power head.

(g) The connecting rod is of open hearth steel I-beam section, finished with a standard babbitted bearing at the cross head and babbitted marine type bearing at crank end.

(h) The cross head is equipped with adjustable cross head shoes, conforming to the bore of the cross head guide to regulate the alignment and to provide for compensation of wear. The lower section of the cross head is provided with a lubricating chamber to effect submergence of the cross head pin.

OPERATION—The single geared deep well power heads are intended for installation in connection with wells where the water load does not exceed $\frac{1}{2}$ h. p. for the 10-in. stroke, $7\frac{1}{2}$ h. p. for the 16-in. stroke and 15 h. p. for the 24-in. stroke. Double gearing on deep well power heads permits an increase of 100% in the maximum horsepower allowed for single geared deep well power heads.

To insure the fullest degree of economy possible in the operation, the plunger load should be equalized as far as possible through the provision of proper plungers, gearing and counterbalance weights.

BULLETIN—No. 401 relates to deep well power heads.

McGowan Duplex Special Service Pumps.

Built in either packed piston, inside packed, outside center packed or ram patterns for all usual duties, in simple, compound and triple expansion types. The water works pumping engines are built in all capacities up to 5,000,000,000 gals. per day. Specifications and proposals furnished to conform to specified conditions.



FIG. 379
McGOWAN DEEP WELL POWER HEAD

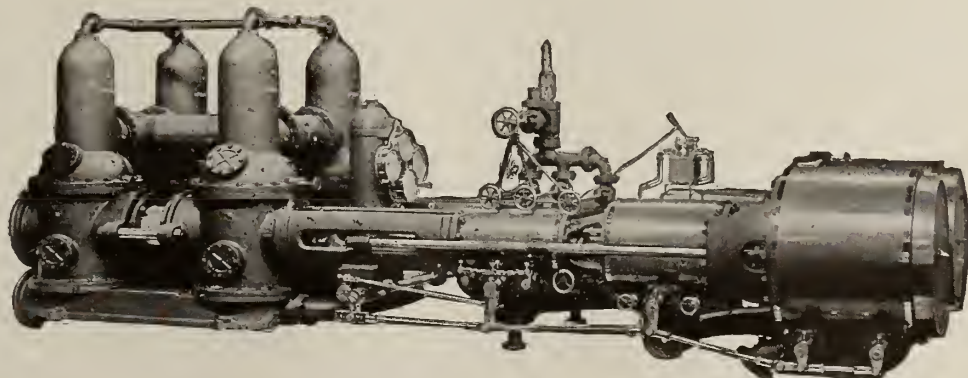


FIG. 431. McGOWAN DUPLEX SPECIAL SERVICE PUMPS

MORRIS MACHINE WORKS

Hydraulic Dredging Machinery and Centrifugal Pumps

MAIN OFFICE AND WORKS
BALDWINSVILLE, N. Y.

BRANCH OFFICES

NEW YORK, N. Y., HUNGERFORD BROS. & Co., 39-41
Cortlandt Street
CHICAGO, ILL., HENION & HUBBELL, 217-221 North
Jefferson Street
HOUSTON, TEX., H. A. PAINE
CHARLOTTE, N. C., Realty Building
PITTSBURGH, PA., HARRIS PUMP & SUPPLY Co.
BOSTON, MASS., STARKWEATHER & BROADHURST, 53 State
Street
BUFFALO, N. Y., ROOT, NEAL & Co.
CLEVELAND, OHIO, STRONG, CARLISLE & HAMMOND
TORONTO, CAN., STOREY

KANSAS CITY, MO., ENGLISH TOOL & SUPPLY Co.
ST. LOUIS, MO., N. O. NELSON MFG. Co.
NEW ORLEANS, LA., JOHN H. MURPHY IRON WORKS
CHARLESTON, S. C., CAMERON & BARKLEY Co.
TAMPA, FLA., CAMERON & BARKLEY Co.
SAN FRANCISCO, CAL., HARRON, RICKARD & McCONE
LOS ANGELES, CAL., HARRON, RICKARD & McCONE
SEATTLE, WASH., PUGET SOUND MACHINERY DEPOT
PORTLAND, ORE., GORDON & FINKHEIMER
ST. PAUL, MINN., ROBINSON, CARY & SANDS
PHILADELPHIA, PA., JACOB SHANNON & Co.
PUMP & EQUIPMENT Co.

Products.

HYDRAULIC DREDGES; DREDGING PUMPS: Steam, Belt or Electric Motor Driven, Lined or Unlined.

DREDGING AND PUMPING ACCESSORIES: Suction Hose; Ejectors; Flap and Foot Valves; Iron Elbows; Suction and Discharge Pipe; Flanges and Increasers.

STANDARD CENTRIFUGAL PUMPS for handling Water or Sewage: Belt, Steam, Turbine, Electric or Gasoline Motor Driven; Horizontal or Vertical Shaft; Submerged or Side or Double Suction Type; Single Stage or Multi-stage; Low or High Lift; High or Low Pressure; Horizontal Split.

Steam Engines: Single Cylinder Stationary and Marine Type, Single Cylinder, Compound, Triple Expansion, Vertical and Horizontal Types.

Special Centrifugal Pumping Outfits can be furnished complete, including driving engine, turbine or motor, or the pump only, adapted to engine or motor furnished by customer.

Experience.

During the 56 years devoted to this line of work, Morris experience has covered all services for which centrifugal pumps are used. Over 60,000 Morris pumps are in service in this country and abroad.

Hydraulic Dredging.

The hydraulic or suction dredge has been proved to be the most economical in handling sand, gravel, silt, mud, clay, loam, etc.; in fact, all classes of material, except solid rock. It not only dredges the material, but, with one operation, also delivers it to the desired point, and, besides, no other type dredge has the enormous capacity of some hydraulic dredges that are in service. The cost of the dredge, considering its capacity, is less than any other type. Morris dredging pumps have, in the Government dredges on the Mississippi River, handled over 3,000 cu. yds. of material per hour.

In operation, the dredging pump creates a partial vacuum in the suction pipe, producing a strong velocity of water in it, sufficient to draw in the material and keep it moving; the pump also produces the pressure necessary to force through the discharge pipe line to distance desired, and at the same time elevates to reasonable height.

Where the sand and gravel lie loose and the suction force of the pump is sufficient to draw it into the pipe without the aid of an agitator, the dredge becomes exceedingly simple. It consists principally of the dredg-



20-IN. DREDGE

ing pump with its driving equipment mounted on a scow; the suction being a pipe of sufficient length to reach to the bottom, with a piece of flexible suction hose in it to give necessary flexibility. The material is delivered into a flat deck scow with raised sides which retain the sand, and the water flows back into the river. Sometimes these dredge boats are self-propelling and provided with hoppers into which the material is pumped.

For general dredging service where all classes of material will be handled, it is necessary to use an agitator or cutter to cut and loosen the material before drawing it into the suction pipe. The suction pipe is mounted within a structural steel ladder, of suitable length and of heavy proportion, hinged to the dredge. The cutter is provided with a series of cutting blades and mounted on a powerful shaft supported on the ladder, and driven through gearing from an independent engine. If properly constructed, even shale rock can be dredged.

Naturally the dredge is most efficient when handling the greatest amount of material with the least amount of water. By the use of the rotary cutter and by systematically swinging the dredge and moving forward on the spuds, which are arranged in the stern as anchors, the amount of material fed to the pump can be regulated so that the maximum percentage of material is constantly carried.

PUMPS—Dredges are usually equipped with either 12-, 15-, 18-, or 20-in. pumps, the 20-in. having become a standard. The capacity of a pump depends on size, character of material and available power. In average dredging, allowing for delays, the output may be estimated at from 10% to 15%.

The power required to drive the dredging pump depends on the elevation to which the material is to be

raised, the length of delivery pipe, and character of material. For most economical operation the velocity through the pipe line should not be higher than is just necessary to carry the material satisfactorily. The practical maximum discharge pressure is from 45 to 55 lbs. For a long pipe line it is necessary to use relay pumps. As the pump must be built with large openings to pass all classes of material, the efficiency should be largely disregarded.

ENGINES—15-in. and larger dredging pumps are usually direct connected to compound or triple expansion engines, but can be connected to electric motors. Complete dredges have been built by this company, in which dredging pump, cutter, hoisting engine and all machinery is operated by electricity. An electric dredge requires a smaller working force than a steam dredge.

MORRIS MACHINE WORKS design and build complete dredges, including pump and driving engine, the hull and all machinery required, for steam or electricity.

Dredging Pumps.

BELT DRIVEN—This standard pump is the result of years of manufacturing dredging pumps and is very heavy and strong for average service. The pump shell is in one very heavy casting, with extra metal in parts most subject to wear. A removable disc is fitted to the suction side of the shell, giving easy

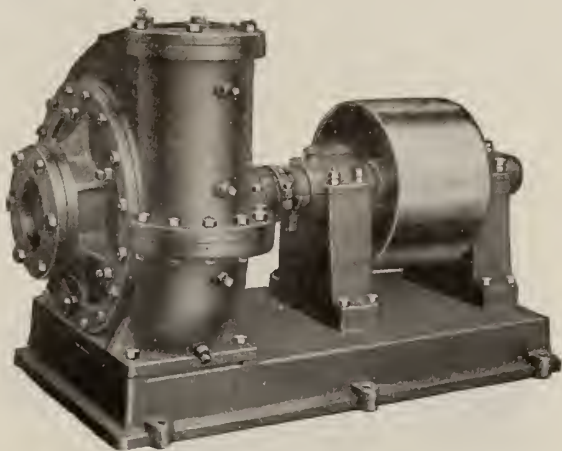
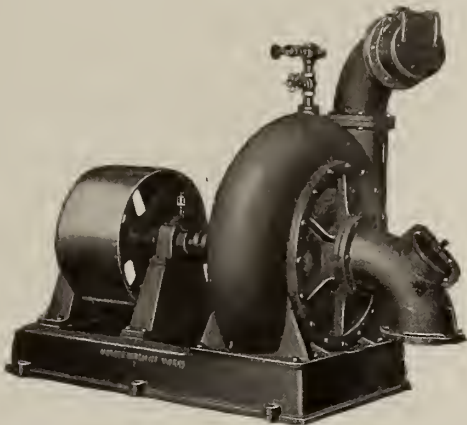
access to the interior or for the removal of the impeller. The impeller is of large size for moderate speed, with ample space between it and pump shell so that stones can not get wedged in.

Adjustable stuffing box bearing is of large size, fitted with water injection to keep sand out. Extra heavy frame and shaft pillow block have ample bearing surface. Pumps are regularly furnished complete with suction and discharge elbows, flap valve and ejector for priming.

STEAM DRIVEN—Standard dredging pumps are also furnished direct connected to single and double vertical simple engines. They are largely used by contractors in pumping out excavations, etc., on account of their ability of passing large solids.

Solid Lined Dredging Pumps (Patented).

This pump was designed for handling tailings or slimes in connection with gold recovery plants. A number are in use in this and foreign countries, and hundreds in South Africa. It has also found extensive use for ordinary dredging.



SOLID LINED DREDGING PUMP (PATENTED)

NEW SPECIAL HYDRAULIC SAND AND DREDGING PUMP						
No. pump (diam. discharge opening), in.	Diam. suction, in.	Cu. yds. material per hour, 10% to 20% of solids			H. p. re- quired for each 10 ft. ele- vation	Will pass solids, diam., in.
		10%	15%	20%		
4	4	14	21	28	4	2
6	6	30	45	60	8	4½
8	8	60	90	120	15	6
10	10	90	135	180	25	8
12	12	125	190	250	30	10
15	15	210	315	420	50	10
18	18	300	450	600	70	10
20	20	360	540	720	80	10
24	24	480	700	960	100	10
32	32	900	1350	1800	200	10
36	36	1140	1710	2280	250	12
48	48	2040	3220	4080	450	12

No. pump (diam. discharge opening), in.	Diam. and face of pulley, in.	Floor space required, in.	Shipping weight, lbs.	Price of pump with suction and discharge elbow, flap- valve and ejector	Price extra for steel lining
4	12x12	40x31	980	\$210.00	\$70.00
6	20x12	68x40	2125	300.00	100.00
8	24x14	72x48	3670	475.00	130.00
10	30x15	94x54	4975	600.00	170.00
12	36x20	114x66	7825	850.00	230.00
15	42x24	154x78	15200	1775.00	.....
18	48x30	160x80	16125	2000.00	.....
20					
24					
32					
36					
48					

Prices on application.

These pumps should run at rated speeds; or for forced work, speeds can be increased by from 10% to 25%.

No. pump (diam., dis- charge opening), in.	H. p. for each ft. head	Nominal capacity, gals. per min.	Diam. and face of pulley, in.	Floor space, in.	Shipping weight, lbs.	Price manganese steel lined
2	0.1	110	8x 8	46x20	625	\$245.00
3	0.22	260	10x10	47x27	1050	260.00
4	0.35	450	12x10	48x29	1150	275.00
5	0.5	700	14x10	59x33	2000	425.00
6	0.68	1000	14x12	60x38	2400	525.00
7	0.86	1350	18x14	74x44	3500	700.00
8	1.2	1800	20x14	75x47	4700	825.00
10	1.9	2800	22x16	84x50	5500	1040.00
10	1.9	2800	24x16	90x60	7000	1200.00
12	2.5	4000	24x16	92x63	9400	1700.00

No. pump (diam. discharge opening), in.	Price cast iron lined	Price extra suction elbow with bearing	Revolutions per minute for given heads					
			10 ft.	20 ft.	30 ft.	40 ft.	50 ft.	60 ft.
2	\$160.00	.....	505	715	875	1005	1125	1230
3	170.00	.....	400	570	700	805	910	985
4	185.00	\$26.00	435	610	745	865	970	1055
5	290.00	32.00	400	570	700	805	910	985
6	360.00	40.00	340	475	580	670	750	815
7	470.00	44.00	320	450	545	635	710	775
8	600.00	48.00	290	410	500	575	640	700
10	700.00	60.00	315	445	540	630	705	770
10	840.00	60.00	240	340	415	480	540	590
12	1150.00	70.00	220	315	380	440	490	540

Prices are for pumps, and do not include elbows, valves, or ejector. Extra price for suction elbow includes a bearing in elbow with pump shaft extended through pump into elbow. Horsepower and speeds are for total head, i. e., actual elevation plus friction head in piping and fittings. Single pumps should not be used for heads higher than 60 ft. For higher heads, use 2-stage pumps. Prices on application. For 10-in. pump, 2 patterns: one for high speed and one for low speed as preferred. These pumps also built with tight and loose pulleys, or with base extended for direct connection to motor.

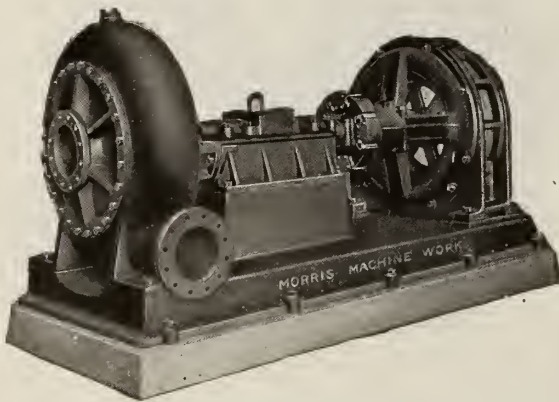
These pumps are now built in sizes from 2- to 12-in. discharge. Lining is made of manganese steel, or hard cast iron, and makes practically an independent pump enclosed within a cast iron casing. Everything is of heavy proportions; the shaft is large, the bearings of a special type, the stuffing box made to reduce the wear to the smallest possible extent.

Adjustments are made from the outside. There are no bolts or screws in the lining. No wear can come on the outer pump case, as it is completely protected by the lining. By removing the upper half of the pump shell, the lining can be taken out; or by removing the disc on the pump shell and the inner disc on the lining, the runner, of enclosed type, can be taken out.

The first cost, owing to its construction and extremely heavy proportions, is comparatively high; but when compared to its lasting qualities it will be found economical in operation.

Heavy Duty Sand and Gravel Pumps.

Designed for severe service and increased output. The double enclosed thrust bearing operating in oil eliminates troublesome thrust. The shell is extra heavy at points of wear. Stuffing box is arranged for water circulation. This type is also built for belt drive and direct connected to steam engine.



10-INCH HEAVY SERVICE DREDGING PUMP DIRECT CONNECTED TO 125 H.P. ELECTRIC MOTOR

Morris Dredging and Pumping Accessories and Parts.

Each individual unit or part of Morris machinery is designed and manufactured with uniform care, which insures machines of mechanical perfection and rugged construction. The MORRIS MACHINE WORKS guarantees its products as to design, materials and workmanship.

The Morris engineering department is at the service of clients who are in need of advice on pumping problems.

SUCTION HOSE—For contractors' and dredgers' use, a "smooth bore" rubber hose is recommended for suction purposes. Sizes above 18 in. can be made to order in any length required at 10 days' notice. Hose is furnished complete with nipples, bands and flanges for making connections to pump.

PRICE LIST OF SUCTION HOSE

Size, in.	2	3	4	5	6	7	8	9	10	12
Price, per ft.	\$2.60	4.50	6.50	8.50	10.50	13.50	16.50	19.50	22.50	27.50

PRICE LIST OF DOUBLE GALVANIZED SPIRAL RIVETED PIPE FOR SUCTION

Size, in.	3	4	5	6	7	8	9
Price, per ft.	\$0.55	0.80	1.10	1.35	1.55	1.90	2.25

Size, in.	10	12	14	15	18	22	24
Price, per ft.	\$2.90	3.50	4.50	4.90	7.10	12.00	14.00

SPIRAL RIVETED PIPE, DIPPED IN ASPHALTUM (RECOMMENDED FOR DISCHARGE PIPE)—Can be had in lengths up to 20 ft. Flanges, gaskets and bolts are charged for extra. For shorter lengths than 5 ft. the charge is the same as for 5-ft. lengths.

PRICE LIST OF SPIRAL RIVETED PIPE, DIPPED IN ASPHALTUM

Thickness, W. G.	18						
Size, in.	3	4	5	6	7	8	9
Price, per ft.	\$0.40	0.50	0.60	0.70	0.80	0.90	1.00

Thickness, W. G.	16		14			12	
Size, in.	10	12	14	15	18	22	24
Price, per ft.	\$1.40	1.75	2.50	2.65	3.25	5.00	5.50

EJECTORS—Used in priming or charging pumps when steam can be obtained. A flap valve, enclosed flap valve or foot valve, or gate valve is used in connection with the ejector. Prices include valves for connecting.

PRICE LIST OF EJECTORS

No. and size of pump	1½ and 1¾	2 and 2½	3	4	5 and 6
No. of ejector	1	1	2	3	4
Diam. steam pipe, in.	¾	¾	1½	¾	1
Diam. delivery and suction pipe, in.	1½	1½	¾	1	1½
Price of ejector and valves	\$8.00	8.00	12.00	15.00	25.00

No. and size of pump	8 and 10	12 and 15	18	22
No. of ejector	5	6	7	5
Diam. steam pipe, in.	1	1¼	1¼	2
Diam. delivery and suction pipe, in.	1½	2	2½	3
Price of ejector and valves	\$30.00	35.00	45.00	55.00

FLAP VALVES—Used on end of discharge pipe to prevent air from entering pipe when using ejector. It opens and closes automatically.

Enclosed flap valve is placed between pump and discharge pipe. Quotations will be made on gate valves, if flap valves can not be used conveniently.

PRICE LIST OF FLAP VALVES. (FLANGED)

No. of pump	1½	1¾	2	2½	3	4	5
Price, flap valve	\$5.00	6.00	8.00	9.00	9.00	13.00	15.00
Price, flap valve (enclosed)						\$35.00	

No. of pump	6	8	10	12	15	18	22
Price, flap valve	\$22.00	28.00	36.00	44.00	60.00	88.00	150.00
Price, flap valve (enclosed)	\$55.00	95.00	130.00	175.00	290.00	375.00	

FOOT VALVES—Placed at bottom of suction pipe to hold column of water and keep pump primed. Strainer is not furnished, unless ordered, except on iron valves, in which case no extra charge is made.

PRICE LIST OF FOOT VALVES

No. of pump	1½	1¾	2	2½	3	4	5
Price, iron foot valves	\$5.00	6.00	7.00	8.00	9.00	12.00	15.00
Price, brass foot valves	\$8.00	9.00	12.00	15.00	18.00	25.00	30.00

No. of pump	6	8	10	12	15	18	22
Price, iron foot valves	\$20.00	30.00	40.00	50.00	75.00	110.00	150.00
Price, brass foot valves	\$40.00						

PRICE LIST OF LONG RADIUS PLAIN AND SWIVEL IRON ELBOWS

Size, in.	1½	1¾	2	2½	3	4	5	6
Plain elbow	\$1.00	1.25	1.50	1.75	2.50	3.50	4.00	5.00
Swivel elbow	\$1.25	1.60	1.90	2.10	3.50	4.40	5.00	7.25
Plain elbow, with hand hole						\$4.25		6.50

Size, in.	8	10	12	14	15	18	20	22
Plain elbow	\$10.00	15.00	17.50	22.00	25.00	30.00	38.00	50.00
Swivel elbow	\$12.50	19.00	22.00	27.00	31.50	37.50	47.50	62.00
Plain elbow, with hand hole	\$12.00	17.50	20.00	26.50	30.00	36.00		

PRICE LIST OF IRON FLANGES, THREADED FOR STANDARD WROUGHT IRON PIPE

Size, in.	1½	1¾	2	2½	3	4	5
Price	\$0.50	0.60	0.70	0.80	0.95	1.25	1.50

Size, in.	6	7	8	10	12	14	15
Price	\$1.75	2.00	2.50	3.00	3.75	5.00	8.00

Continued on next page

PRICE LIST OF IRON INCREASERS, FLANGED

Size, in. (diam. large and small openings)	1½ to 2	1½ to 2½	1¾ to 2	1¾ to 2½	2 to 2½	2 to 3
Length, in.	4	4	4½	4½	4½	4½
Price	\$1.50	1.70	1.85	2.10	2.50	2.90

Size, in. (diam. large and small openings)	2½ to 3	2½ to 3½	3 to 4	3 to 4½	4 to 5
Length, in.	5	5	5	5	6
Price	\$3.35	3.75	4.20	4.60	5.00

Size, in. (diam. large and small openings)	4 to 6	5 to 6	6 to 7	6 to 8	8 to 10
Length, in.	6	7½	9	9	12
Price	\$6.70	8.30	10.00	12.00	20.00

Size, in. (diam. large and small openings)	10 to 12	12 to 14	12 to 15	15 to 18	18 to 20
Length, in.	15	15	15	18	18
Price	\$25.00	28.00	30.00	40.00	47.00

Installation and Operation Morris Centrifugal Pumps.

The suction elevation or lift should be made as low as possible; the suction pipe short and direct with a minimum number of elbows or bends, and absolutely airtight. The total suction head (the actual elevation plus frictional resistances through suction piping) should not exceed 25 ft., and preferably much less. The larger the discharge pipe is and the fewer number of elbows, the less the friction head and power required to drive the pump.

Foundations are not so heavy as for a reciprocating pump, but amply rigid and strong to properly support the pump and maintain correct alignment. Pump should be correctly leveled on the foundation, and not bolted down until shaft is in line and turns freely in the bearings. If direct connected, the alignment of the coupling should be proved.

With a suction lift, if pump is handling clean water, the water seal can be supplied by water from the pressure portion of the pump shell; but otherwise at least 20 lbs. pressure should be supplied from any convenient source.

If a foot valve is used, particularly with pumps working under high lifts or delivering through long pipe lines, there is danger of injury to the pump, due to excessive pressure produced by water ram when the pump is stopped and the water commences to run backwards through the pipe until the foot valve is suddenly closed. In such cases place a gate valve on the discharge, which should be closed before the pump is shut down.

Provide a strainer on the suction intake to prevent large solids from entering the pump. Hot water must flow by gravity to the pump. See that pump turns in the right direction.

If the pump is operated at the correct speed for the total head, it will deliver the quantity of water for which it was built. If the head is greater, the discharge quantity will be diminished; and if less, it means an increased capacity.

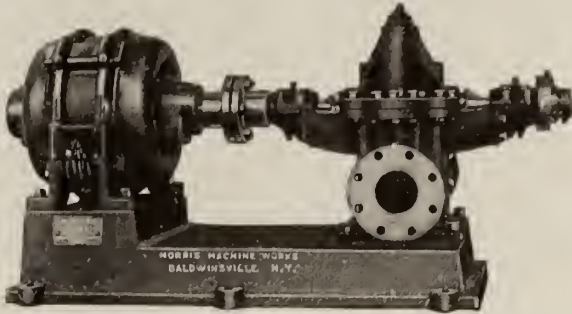
Horizontal Split, Double Suction and Multistage Pumps.

SINGLE STAGE—This type of pump is especially adapted for high efficiency and for operating at high speed for direct connection to electric motor or turbine. It is also built for belt drive. Suction and discharge openings are in the bottom half of shell, therefore top can be removed without disconnecting them.

Brief specifications are: bronze enclosed impeller, bronze sleeved steel shaft, removable babbitted bearing

shells, S. K. F. ball bearing flexible coupling, bronze stuffing box glands.

Built in sizes 2 to 20 in. Also built of acid resisting bronze for operating in aciduous water.

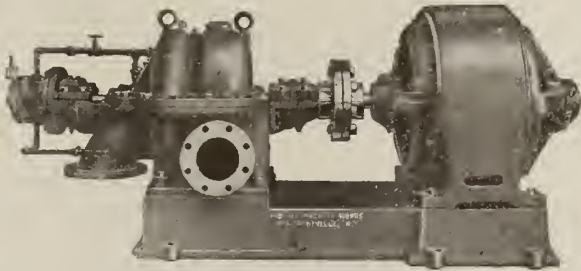


HORIZONTAL SPLIT, DOUBLE SUCTION PUMP

MULTISTAGE—Where the head is too high for the double suction pump this company builds a multistage pump.

This type is designed along the same lines as the single stage double suction type, except that, being side suction, it develops an end thrust. This thrust is taken care of by a water cooled marine type bearing, running in oil. Leakage between stages is prevented by bronze labyrinth rings.

Built in sizes 2 to 14 in. Number of stages depending on the head. Also built of acid resisting bronze for operating in aciduous water.

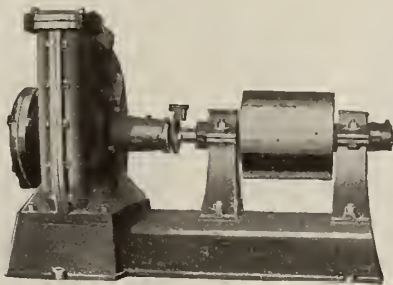


HORIZONTAL SPLIT, MULTISTAGE PUMP

Morris Improved Standard Belt Driven Horizontal Pumps.

The horizontal pump is the type most extensively used for all purposes. It is of iron construction.

The pump is intended for all classes of service where a strong, substantial pump, able to take care of itself with the least of attention, is required. The pump shell is mounted directly on the base; a substantial bearing on each side of the pulley is lined with bab-bitt; the steel shaft is of large diameter; the stuffing box bearing is long and babbitt lined; the box is deep and arranged with gland. All parts are accurately machine fitted. Pump is furnished complete with oilers, and with or without primer.



IMPROVED STANDARD HORIZONTAL RIGHT HAND PUMP

DATA, MORRIS IMPROVED STANDARD IRON HORIZONTAL PUMP

No. pump (diam. discharge opening), in.	Size pipe flange on suction, in.	Economical capacity, gals. per min.	H. p. re- quired for each ft. elevation	Diam. and face of pulley, in.	Floor space required without primer, in.
1	1¼	30	.0625	4x 3¼	12x 17
1½	2	70	.058	6x 6	17x 31
1¾	2	90	.075	7x 8	21x 32
2	3	120	.10	8x 8	23x 37
2½	3	180	.15	8x 8	24x 38
3	4	260	.22	8x 8	25x 39
4	5	470	.30	10x10	29x 41
5	6	735	.45	12x12	34x 54
6	8	1050	.59	15x12	37x 55
8	10	2000	1.00	20x12	45x 64
10	12	3000	1.52	24x12	51x 69
12	15	4200	2.00	30x14	63x 71
15	18	7000	3.50	40x15	77x 80
15*	18	7000	3.50	30x15	60x 68
18	20	10000	4.50	40x16	93x103
18*	20	10000	4.50	30x16	66x 72
20	22	12000	5.40	36x20	73x 83
22	24	13000	5.50	48x20	126x130
24	24	15000	6.50	48x36	94x137

No. pump (diam. discharge opening), in.	Shipping weight without primer, lbs.	Shipping weight with primer, lbs.	Price without primer	Price with primer	Price extra if brass fitted
1	85	...	\$30.00	...	\$9.00
1½	175	220	45.00	\$60.00	12.00
1¾	260	305	60.00	75.00	15.00
2	350	415	75.00	95.00	18.00
2½	360	430	90.00	110.00	22.00
3	415	495	110.00	135.00	25.00
4	615	720	130.00	160.00	40.00
5	940	1075	165.00	200.00	60.00
6	1180	1345	200.00	245.00	90.00
8	2065	2430	310.00	375.00	130.00
10	2610	2940	395.00	470.00	165.00
12	3615	...	500.00	...	275.00
15	7100	...	850.00	...	...
15*	3150	...	710.00	...	...
18	9000	...	1300.00	...	...
18*	4835	...	1150.00	...	...
20	6800	...	1600.00	...	...
22	...	...	...	...	...
24	...	...	...	...	...

*Refers to low lift pumps. Prices on larger pumps on application.
For priming pumps above 10-in. use foot valve or flap valve with steam ejector, which are extra. Prices on application.

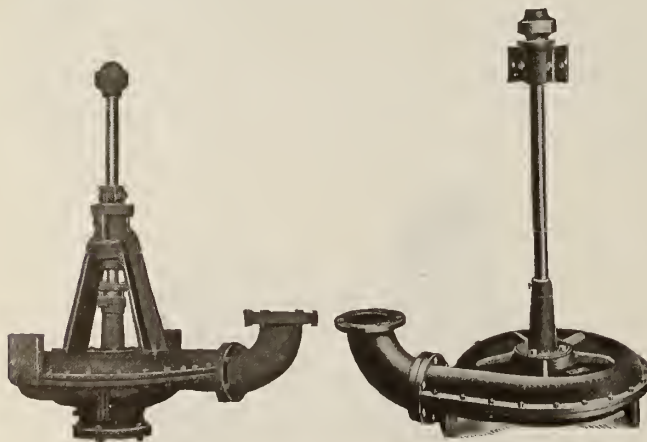
Morris Vertical Pumps, Submerged and Suction Types.

While a horizontal shaft pump should be used wherever possible, there are many situations where a vertical shaft pump would be better adapted.

The submerged type is intended to be placed entirely submerged in water. It is therefore always primed and ready to start and there is not even a stuffing box to look after.

The suction type is intended to be placed in a pit where it is impossible or impractical to use a horizontal shaft pump, but above the water line so that it will operate with a suction lift. It can also operate submerged.

MORRIS MACHINE WORKS furnish vertical pumps, single or multistage, and will make recommendations upon receipt of full data as to service.



Suction Type Submerged Type
VERTICAL PUMPS

DATA, MORRIS IRON VERTICAL PUMPS

No. pump (diam. discharge opening), in.	Econom- ical capacity, gal. per min.	H. p. re- quired for each ft. eleva- tion	Diam. and face of pulley, in.	Floor space required, in.	Distance from bot- tom of pump to center coupling, ft.	Coupling bored for connecting shaft, in.
1½	70	.058	5x 6	17x 21	2 9	1
1¾	90	.075	6x 6	21x 29	3 0	1
2	120	.10	7x 8	23x 30	3 4	1 ¼
2½	180	.15	7x 8	24x 30	3 4	1 ½
3	260	.22	7x 8	25x 32	3 6	1 ¾
4	470	.30	8x10	29x 39	4 0	1 ¾
5	735	.45	10x10	34x 45	4 7	1 ¾
6	1050	.59	12x12	37x 48	4 7	1 ¾
8	2000	1.00	18x12	45x 56	5 5	2
10	3000	1.52	20x12	51x 68	5 5	2
12	4200	2.00	24x14	63x 72	6 0	2 ¾
15	7000	3.50	30x16	77x102	6 6	3 ¼
15*	7000	3.50	30x15	60x 71	6 6	3 ¼
18	10000	4.50	36x18	98x126	7 0	3 ¾
18*	10000	4.50	30x16	66x 72	6 6	3 ¾
20	12000	5.40	36x20	73x 92	4 6	4

No. pump (diam. discharge opening), in.	Shipping weight lbs., sub- merged type	Shipping weight lbs., suc- tion type	Price extra bearings, each	Price extra bearings, each	Price com- plete as per foot- note, sub- merged type	Price com- plete as per foot- note, suc- tion, type
1½	110	135	\$1.00	\$1.50	\$40.00	\$62.00
1¾	165	200	1.00	1.50	50.00	78.00
2	198	237	1.50	2.00	65.00	100.00
2½	220	265	1.50	2.00	80.00	124.00
3	235	282	1.50	2.00	95.00	147.00
4	380	455	2.00	2.50	110.00	170.00
5	605	725	2.50	3.00	140.00	216.00
6	740	890	3.00	3.50	170.00	285.00
8	1320	1585	4.00	4.00	265.00	445.00
10	1430	1715	4.00	4.00	330.00	550.00
12	2640	3160	5.00	5.50	420.00	700.00
15	4830	5790	8.00	8.00	600.00	1000.00
15*	2400	2880	8.00	8.00	480.00	800.00
18	5300	6400	10.00	12.00	950.00	1585.00
18*	2600	3100	10.00	12.00	850.00	1420.00
20	4300	5200	15.00	20.00	1255.00	2100.00

*Refers to low lift pumps.
Each pump is furnished complete with discharge elbow, one pair couplings, pulley, and one bearing.

Methods of Priming Centrifugal Pumps.

All pumps placed above water supply must, before starting, be primed; that is, completely filled with water. By use of foot valve, pump can be filled from city water service, from an overhead tank, by means of pails or by separate small pump. Where steam is available an ejector forms a very simple means of priming and can be used either with foot valve or flap valve (gate valve or check valve). The two illustrations below show clearly the piping required for either case.

If arranged with flap valve (Fig. 43), prime as follows: open valve A, then steam valve B, which will exhaust the air from pump shell allowing water to rise through suction pipe; when water spurts from pipe C, pump is filled; then close first valve A, then valve B and start the pump.

If arranged with foot valve (Fig. 44), proceed as follows: open valve A, then valve B. Water will be drawn up through suction pipe to ejector and delivered into pump; when pump is full, close valves and start.

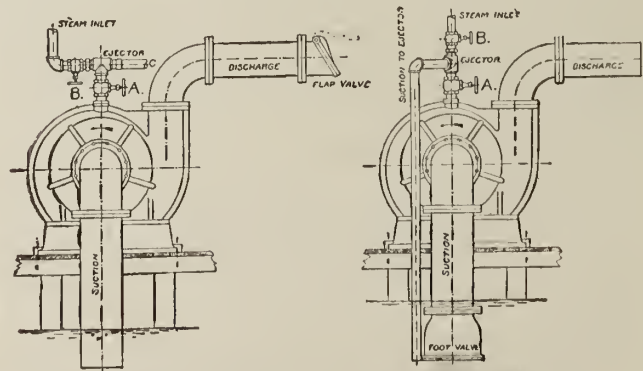


Fig. 43 Fig. 44
METHODS OF PRIMING CENTRIFUGAL PUMPS

Morris Reciprocating Engine Driven Centrifugal Pumps.

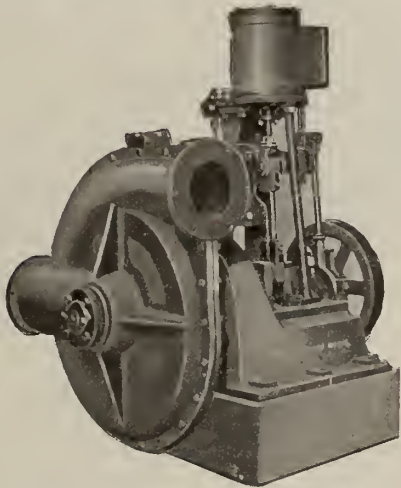
Centrifugal pumps direct connected to steam engines are self-contained, take up but little space and make the most economical pumping unit. This company builds the engines, simple, compound or triple expansion, especially designed for direct connection to centrifugal pumps.

MORRIS MACHINE WORKS have a large variety of patterns for all sizes of pumps, so that for most reasonable heads direct connected pumps can be furnished that will not have to run at excessive speeds.

The side suction pump is intended for general service, and is largely used in pumping out excavations, etc.



STANDARD SIDE SUCTION STEAM PUMP



STANDARD DOUBLE SUCTION STEAM PUMP

Determination of Right- or Left-Hand Pumps.

When standing at the pump and looking over pump shell towards pulley or driver, if the top of shaft revolves from right to left, or anticlockwise, the pump is right hand; and if from left to right, or clockwise it is left hand.

Information Required for Estimates or Ordering.

The following information should be given as com-

DATA, MORRIS STEAM PUMPS

No. pump (diam. dis- charge open- ing), in.	Economical capacity, gals. per min.	Suitable for elevations up to, ft.	Size steam cylinder, in.		Size steam pipe, in.
			Diam.	Stroke	
2	120	25	3	3	3/4
2 1/2	180	25	3	3	3/4
3	260	25	3	3	3/4
4	470	25	4	4	3/4
4	470	25	5	5	1
5	735	25	5	5	1
6	1050	30	5	5	1
6	1050	30	6	6	1 1/4
7	1400	25	5	5	1
8	2000	20	6	6	1 1/4
8	2000	25	7	7	1 1/2
8	2000	30	8	8	1 1/2
10	3000	10	6	6	1 1/4
10	3000	15	7	7	1 1/2
10	3000	20	8	8	1 1/2
10	3000	25	9	9	2
10	3000	30	10	10	2 1/2
10†	3000	40	12	10	2 1/2
12	4200	20	9	9	2
12	4200	25	10	10	2 1/2
12	4200	30	12	10	2 1/2
12†	4200	40	14	12	3
15	7000	30	14	14	3
15*	7000	22	12	10	2 1/2
18	10000	30	15	16	4
18*	10000	20	12	12	3
20	12000	20	14	14	3

No. pump (diam. dis- charge open- ing), in.	Size exhaust pipe, in.	Weight, side suc- tion, lbs.	Weight, double suction, lbs.	Price extra if brass fitted, side or double suction
2	1	500	560	\$18.00
2 1/2	1	510	585	22.00
3	1	545	550	25.00
4	1	925	1070	40.00
4	1 1/4	1150	1275	40.00
5	1 1/4	1175	1325	60.00
6	1 1/4	1325	1525	90.00
6	1 1/2	1480	1675	90.00
7	1 1/4	1400	1600	85.00
8	1 1/2	2150	2360	130.00
8	2	2450	2660	130.00
8	2 1/2	2650	2875	130.00
10	1 1/2	2800	3440	165.00
10	2	3000	3640	165.00
10	2 1/2	3100	3760	165.00
10	3	4475	5100	165.00
10†	3	4650	5290	165.00
10†	3	7200	8700	.....
12	3	4600	5500	275.00
12	3	5750	6650	275.00
12†	3	6300	7200	275.00
12†	3 1/2	9000	10000	.....
15	4	13100	14600	.....
15*	3	6700	7500	.....
18	5	15000	16600	.....
18*	3 1/2	8500	9500	.....
20	4	12800	14300	.....

*Low lift pumps. †Special high lift pumps. Quotations on larger sizes or on special combinations on application. Any steam pump with compound engines directly connected can be furnished. Prices for double and side suction iron pumps on application.

pletely as possible, to enable this company to promptly make recommendations and submit estimates:

- (1) Number of pumps required.
- (2) Capacity of pump in gallons per minute.
- (3) Kind of liquid to be handled.
- (4) What is total pumping head, including suction and discharge?
- (5) What is suction head?
- (6) What is discharge head?
- (7) What is length of suction and discharge piping, and size (if determined); also number and degree of elbows?
- (8) Is vertical or horizontal type of pump desired?
- (9) How will the pump be driven? Give full description of driver.
- (10) State position of suction and discharge preferred, and direction of rotation.

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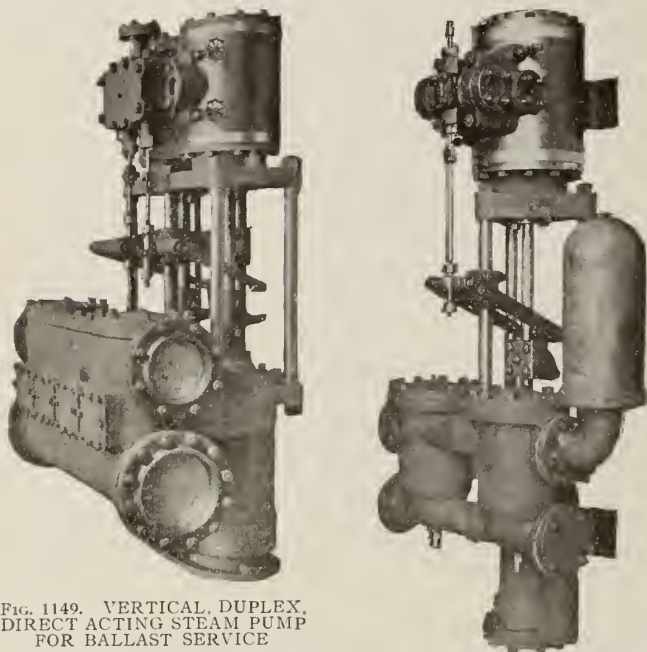


FIG. 1149. VERTICAL DUPLEX, DIRECT ACTING STEAM PUMP FOR BALLAST SERVICE
Built with tie rods to meet demand for a light weight, compact, vertical pump

FIG. 1135. VERTICAL SINGLE, DIRECT ACTING BOILER FEED PUMP

Also used for donkey feed and fire and bilge service. Valve motion has double lever drive and tappet collars, adjustable for controlling the stroke length while in operation. Suction and discharge valves removable from valve pot simultaneously. Working fluid pressure, 300 lbs.

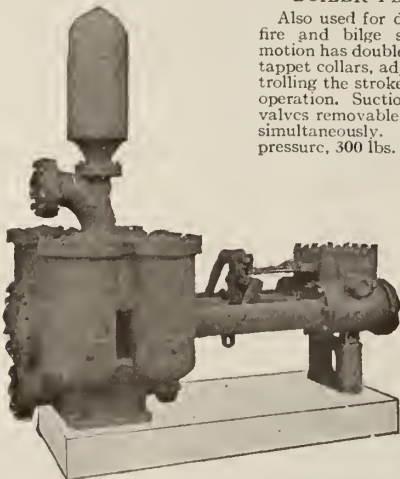


FIG. 1124. HORIZONTAL DUPLEX, DIRECT ACTING, "CHESTER" TYPE, STEAM PUMP

100% valve area. An ideal pump for tank steamers handling heavy Mexican crudes. Used for cargo, fuel oil transfer and ballast service. Working fluid pressure, 100 to 200 lbs.

FIGURE 1149, VERTICAL DUPLEX STEAM PUMPS

Steam cylinder diam., ins.	Fluid cylinder diam., ins.	Stroke ins.	Gals. per min.	Piston speed (normal)	Pipe sizes, ins.				Floor space	
					Steam	Exhaust	Suction	Discharge	Length ft. ins.	Width ft. ins.
4½	4	4	39	30	½	¾	2½	1½	3 2	1 5
6	5¾	6	108	40	1	1½	4	3	3 9	2 0
10	9	12	462	70	2	2½	6	5	7 2	3 7
10	12	12	822	70	2	2½	10	8	7 2	4 6
12	14	12	1120	70	2½	3	12	10	7 8	4 11
14	8½	12	413	70	2½	3	6	5	7 5	3 7

FIGURE 1135, VERTICAL SINGLE STEAM PUMPS

Steam cylinder diam., ins.	Fluid cylinder diam., ins.	Stroke ins.	Gals. per min.	Piston speed (normal)	Pipe sizes, ins.				Floor space	
					Steam	Exhaust	Suction	Discharge	Length ft. ins.	Width ft. ins.
6	8	12	183	70	¾	1	4½	4	6 5	1 8
10	6	12	103	70	1¼	1½	3½	3	7 0	3 4
10	6	18	132	90	1¼	1½	3½	3	8 5	3 4
12	7	18	180	90	1½	2½	4½	3½	9 3	3 9
12	8½	18	236	90	1½	2½	4½	3½	9 3	3 9
14	8½	18	236	90	2	2½	4½	3½	9 3	3 9
8	11	18	445	90	1¼	1½	7	6	9 1	4 11
8	12	18	528	90	1¼	1½	7	6	9 1	4 11
12	8½	24	295	100	1½	2½	4½	3½	10 9	3 9
14	8½	24	295	100	2	2½	4½	3½	10 9	3 9
15	11	27	590	120	2½	3	7	6	12 5	5 2
18	12	27	708	120	2½	3	8	6	12 6	5 6

FIGURE 1124, HORIZONTAL DUPLEX STEAM PUMPS, "CHESTER" CARGO TYPE

Steam cylinder diam., ins.	Fluid cylinder diam., ins.	Stroke ins.	Gals. per min.	Piston speed (normal)	Pipe sizes, ins.				Floor space	
					Steam	Exhaust	Suction	Discharge	Length ft. ins.	Width ft. ins.
10	8	12	365	70	2	3	8	6	7 8	4 6
10	9	12	460	70	2	3	8	6	7 8	4 6
10	10	12	570	70	2	3	8	6	7 8	4 6
12	8	12	365	70	2	3	8	6	7 10	4 6
12	9	12	460	70	2	3	8	6	7 10	4 6
12	10	12	570	70	2	3	8	6	7 10	4 6
12	8	18	470	90	2	3	10	8	8 7	5 1
12	9	18	590	90	2	3	10	8	8 7	5 1
12	10	18	735	90	2	3	10	8	8 7	5 1
15	10	18	735	90	3	4	10	8	9 10	6 2
15	10½	18	810	90	3	4	10	8	9 10	6 2
15	11	18	890	90	3	4	10	8	9 10	6 2
16	12	18	1060	90	2½	3	12	10	10 8	6 7
16	13	18	1240	90	2½	3	12	10	10 8	6 7
16	14	18	1440	90	2½	3	12	10	10 8	6 7
16	12	24	1400	120	3	4	12	10	11 8	6 7
16	13	24	1650	120	3	4	12	10	11 8	6 7
16	14	24	1920	120	3	4	12	10	11 8	6 7
18	12	24	1400	120	4	4	12	10	11 11	6 7
18	13	24	1650	120	4	4	12	10	11 11	6 7
18	14	24	1920	120	4	4	12	10	11 11	6 7

Power Pumps for Oil Pumping.

The use of the larger size power pumps, for pumping oil through pipe lines, is steadily increasing.

Formerly a great many of the Trunk Line pumping stations were equipped with triple expansion steam engines, the steam being supplied by oil fired boilers. The development of the Diesel oil engine has materially changed this; so much so that in some of the larger oil line pumping stations, today, the triple expansion, con-

densing steam engine has given way to power pumps driven by oil engines.

Notwithstanding the good economy of the triple expansion engines, the oil engine driven power pumping unit can be operated at approximately one-third of the cost of oil fired boiler units.

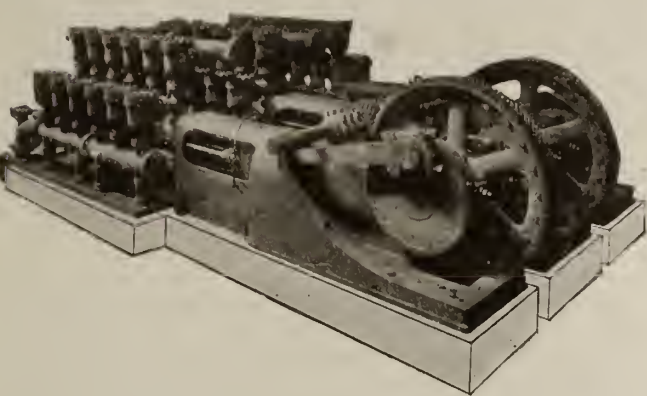


FIG. 1069. HORIZONTAL, 6-PLUNGER, TRIPLEX, END PACKED PLUNGER POWER PUMP FOR PUMPING OIL IN LARGE QUANTITIES AGAINST HIGH PRESSURES
1750 bbls. per hour against 900 lbs. pressure. Large valve areas and very accessible parts. Also built as a 4-plunger duplex power pump

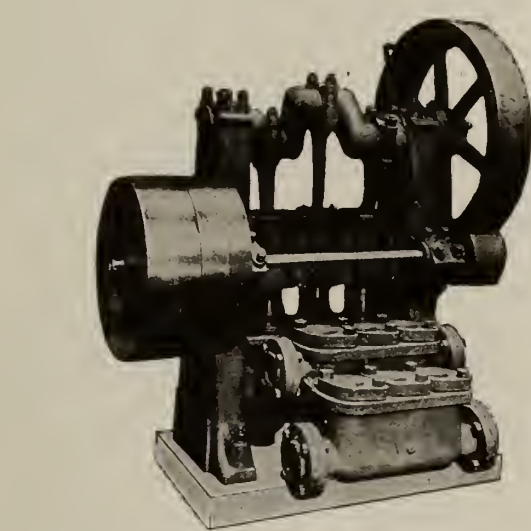


FIG. 929. VERTICAL, TRIPLEX, SINGLE ACTING, GENERAL SERVICE TYPE, POWER PUMP

Shown with single reduction of gears and tight and loose pulleys, but these pumps can also be furnished with double reduction of gears and motor base, or with friction clutch on the pinion shaft.
The valve areas and fluid passages are unusually large and are easily accessible for inspection and repair

FIGURE 929, VERTICAL TRIPLEX SINGLE ACTING POWER PUMPS

Plun- gers, diam., ins.	Stroke ins.	Gals. per min.	Revol- utions per min. (normal)	Pipe sizes, ins.		Pulley sizes, ins.		Gear ratio	Floor space		
				Suc- tion	Dis- charge	Diam- eter	Face		Length ft. ins.	Width ft. ins.	Height ft. ins.
3	4	27	75	2 1/2	2	12	3 1/4	4.87	3	7	2
3 1/2	4	37	75	2 1/2	2	12	3 1/2	4.87	3	7	2
4	6	58	60	3	2 1/2	18	4 1/2	5.00	4	1	3
5	6	91	60	4	3	18	4 1/2	4.94	4	6	3
5	8	101	50	5	4	20	5 1/2	4.96	5	10	4
6	8	146	50	5	4	20	5 1/2	4.96	5	10	4
6 1/2	8	171	50	6	5	36	6 1/2	5.07	6	1	4
7	8	199	50	6	5	36	6 1/2	5.07	6	1	4
8	8	260	50	6	5	36	6 1/2	5.07	6	1	4

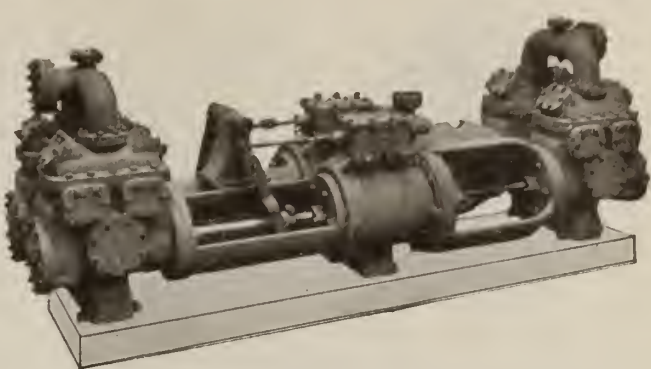


FIG. 787. HORIZONTAL, TWIN DUPLEX, DIRECT ACTING STEAM PUMP FOR THE FOAM SYSTEM OF FIGHTING OIL FIRES
One end fitted for handling sulphate solution; the other for soda solution. Other types of foam pumps are built, viz., horizontal power pump, horizontal crank and flywheel pumping engine and the regular type of horizontal duplex pump having the fluid cylinders entirely independent from each other

FIGURE 787, HORIZONTAL TWIN DUPLEX FOAM PUMP

Steam cylin- der diam., ins.	Fluid cylin- der diam., ins.	Stroke ins.	Gals. per min. each sol- ution	Piston speed (nor- mal)	Pipe sizes, ins.				Floor space	
					Steam	Ex- haust	Suc- tion	Dis- charge	Length ft. ins.	Width ft. ins.
7 1/2	5	5	10	135	66	1 1/4	1 1/2	4	3	8
9	5	5	10	135	66	1 1/2	2	4	3	8
10	5	5	10	135	66	1 1/2	2	4	3	8
9	6	6	10	194	66	1 1/2	2	5	4	8
10	6	6	10	194	66	1 1/2	2	5	4	8
10	5	5	12	153	75	1 1/2	2	4	3	9
10	6	6	12	220	75	1 1/2	2	5	4	9
12	7	7	18	400	100	2 1/2	3	8	6	14
15	7	7	18	400	100	3	8	8	6	14
12	8	8	18	520	100	2 1/2	3	8	6	14
15	8	8	18	520	100	2 1/2	3	8	6	14
15	10	10	18	815	100	2 1/2	3	8	6	14
16	7	7	18	400	100	2 1/2	3	8	6	14
16	8	8	18	520	100	2 1/2	3	8	6	14
18	8	8	18	520	100	3	4	8	6	14
20	8	8	18	520	100	4	5	8	6	14
16	10	10	18	815	100	2 1/2	3	8	6	14
18	10	10	18	815	100	3	4	8	6	14
20	10	10	18	815	100	4	5	8	6	14

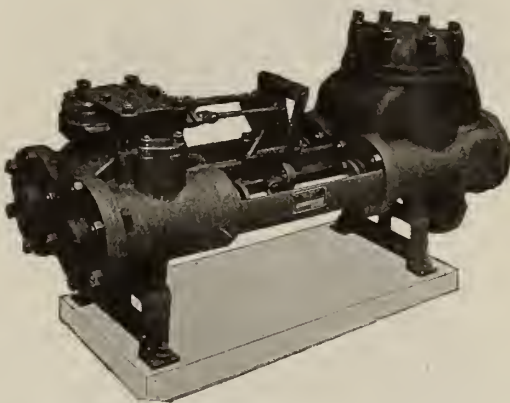


FIG. 615. MEDIUM SIZE, HORIZONTAL, DUPLEX, DIRECT ACTING PISTON PUMP OF "EAGLE WORKS" TYPE
Removable cast liners. Built for working fluid pressures of 125 to 200 lbs. Used also for donkey feed, fire and bilge, oil transfer and lubricating or fuel oil service

FIGURE 615, HORIZONTAL DUPLEX STEAM PUMPS

Steam cylin- der diam., ins.	Fluid cylin- der diam., ins.	Stroke ins.	Gals. per min.	Piston speed (nor- mal)	Pipe sizes, ins.				Floor space	
					Steam	Ex- haust	Suc- tion	Dis- charge	Length ft. ins.	Width ft. ins.
6	4	6	52	40	1	1 1/4	3	2	3	6
7 1/2	4 1/2	10	99	60	1 1/4	1 1/2	4	3	5	1
7 1/2	5 1/4	10	135	60	1 1/4	1 1/2	4	3	5	1
9	5 1/4	10	135	60	1 1/2	2	4	3	5	1
9	6	10	176	60	1 1/2	2	5	4	5	2
9	7	10	240	60	1 1/2	2	5	4	5	2
10	6	10	176	60	1 1/2	2	5	4	5	3
10	6 1/2	10	207	60	1 1/2	2	5	4	5	3
10	7	10	240	60	1 1/2	2	5	4	5	3
10	6	12	206	70	1 1/2	2	5	4	5	8
10	7	12	280	70	1 1/2	2	5	4	5	8

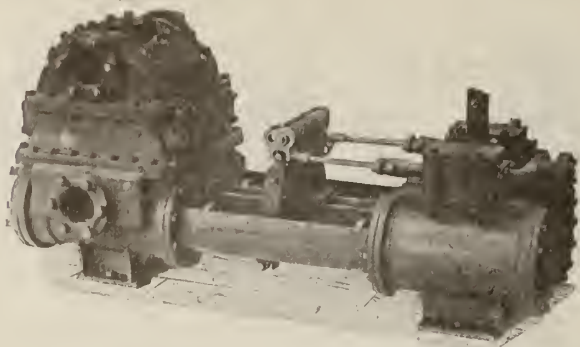


FIG. 122. HORIZONTAL, DUPLEX, DIRECT ACTING STEAM PUMP OF SEPARATE CHEST TYPE
Much used for refinery work. Separate chest construction permits the use of suction and discharge valve plates

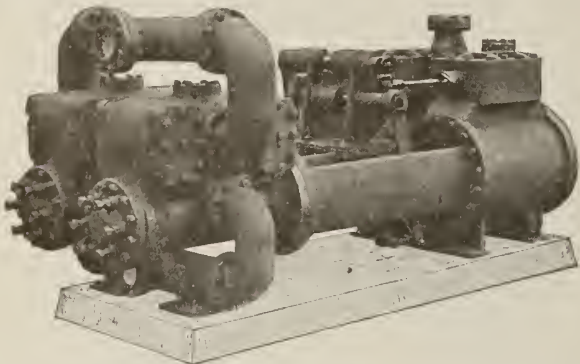


FIG. 371. HORIZONTAL, DUPLEX, DIRECT ACTING STEAM PUMP OF THE BLOCK VALVE TYPE
For pumping heavy, hot liquids, such as tar and asphalt. Has large rectangular block valves, giving generous, unobstructive areas

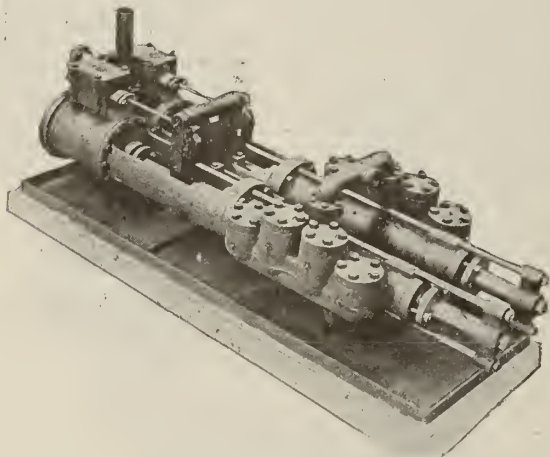


FIG. 116. HORIZONTAL, DUPLEX, DIRECT ACTING, END PACKED PLUNGER, STEAM PUMP OF THE POT VALVE TYPE
With the plunger construction any leakage becomes immediately apparent. Especially adapted for pumping gritty fluids

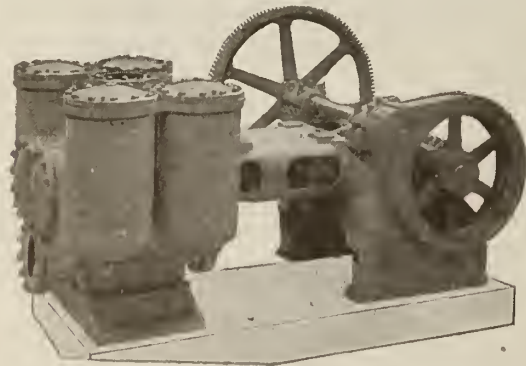


FIG. 1078. POWER PUMP FOR MARINE PURPOSES
With increasing use of electricity on board ships, motor driven power pumps are finding extensive use. Built for every purpose

FIGURE 122, HORIZONTAL DUPLEX STEAM PUMPS
WORKING PRESSURE 125 TO 150 POUNDS

Steam cylinder diam., ins.	Fluid cylinder diam., ins.	Stroke ins.	Gals. per min.	Piston speed (normal)	Pipe sizes, ins.				Floor space	
					Steam	Exhaust	Suction	Discharge	Length ft. ins.	Width ft. ins.
10	6	10	147	50	2	3	6	5	6 3	2 6
10	7	10	200	50	2	3	6	5	6 3	2 6
10	6	12	205	70	1½	2	5	4	7 0	2 10
14	7	12	280	70	2	3	8	6	8 0	3 4
12	8	12	365	70	2	3	8	6	7 3	2 10
14	8	12	365	70	2	3	8	6	8 0	3 4
12	9	12	462	70	2	3	8	6	7 3	2 10
14	9	12	462	70	2	3	8	6	8 0	3 4
12	10	12	570	70	2	3	8	6	7 3	2 10
14	10	12	570	70	2	3	8	6	8 0	3 4
10	6	18	220	75	2	3	8	6	7 6	2 10
12	6	18	220	75	2	3	8	6	7 6	2 10
12	8	18	392	75	2	3	8	6	7 6	2 10
12	9	18	495	75	2	3	8	6	7 6	2 10
15	10	18	735	90	3	4	10	8	8 7	3 5
15	10½	18	809	90	3	4	10	8	8 7	3 5
15	11	18	887	90	3	4	10	8	8 7	3 5
16	12	24	1410	120	3	4	14	10	10 7	6 4
18	12	24	1410	120	3	4	14	10	11 0	6 4
16	14	24	1920	120	3	4	14	10	10 7	6 4
18	14	24	1920	124	3	4	14	10	11 0	6 4

FIGURE 371, HORIZONTAL DUPLEX "BLOCK VALVE" PUMP

Steam cylinder diam., ins.	Fluid cylinder diam., ins.	Stroke ins.	Gals. per min.	Piston speed (normal)	Pipe sizes, ins.				Floor space	
					Steam	Exhaust	Suction	Discharge	Length ft. ins.	Width ft. ins.
12	5	18	122	60	2	3	6	6	7 9	3 9
12	5½	18	148	60	2	3	6	6	7 9	3 9
12	6	18	176	60	2	3	6	6	7 9	3 9
15	5	18	122	60	3	4	6	6	8 10	4 1
15	5½	18	148	60	3	4	6	6	8 10	4 1
15	6	18	176	60	3	4	6	6	8 10	4 1
12	7	18	240	60	2	3	6	6	7 9	3 9
12	8	18	313	60	2	3	6	6	7 9	3 9
12	9	18	396	60	2	3	6	6	7 9	3 9
15	7	18	340	60	3	4	6	6	8 11	4 1
15	8	18	313	60	3	4	6	6	8 11	4 1
15	9	18	396	60	3	4	6	6	8 11	4 1
16	7	24	300	75	3	4	6	6	10 7	5 6
16	8	24	392	75	3	4	6	6	10 7	5 6
16	9	24	495	75	3	4	6	6	10 7	5 6
18	8	24	392	75	3	4	6	6	10 9	5 6
18	9	24	495	75	3	4	6	6	10 9	5 6
20	8	24	392	75	4	5	6	6	10 10	5 6
20	9	24	495	75	4	5	6	6	10 10	5 6
22	8	24	392	75	4	6	6	6	11 0	5 6
22	9	24	495	75	4	6	6	6	11 0	5 6
24	9	24	495	75	4	6	6	6	11 6	5 6

FIGURE 116, HORIZONTAL DUPLEX POT VALVE PLUNGER PUMPS

Steam cylinder diam., ins.	Fluid cylinder diam., ins.	Stroke ins.	Gals. per min.	Piston speed (normal)	Pipe sizes, ins.				Floor space	
					Steam	Exhaust	Suction	Discharge	Length ft. ins.	Width ft. ins.
7½	1¼	10	6	50	1	1½	2	1	8 5	1 11
7½	2	10	16	50	1	1½	2	1½	8 5	1 11
7½	2½	10	25	50	1	1½	2	1½	8 5	1 11
12	3	12	36	50	2	3	4	3	9 11	3 2
14	3	12	36	50	3	4	4	3	10 0	3 2
12	3½	12	49	50	2	3	4	3	9 11	3 2
14	3½	12	49	50	3	4	4	4	10 0	3 2
12	4	12	64	50	2	3	6	4	10 2	3 10
14	4	12	64	50	3	4	6	4	10 3	3 10
12	4½	12	72	50	2	3	6	4	10 2	3 10
14	4½	12	72	50	3	4	6	4	10 3	3 10
12	4½	12	81	50	2	3	6	4	10 2	3 10
14	4½	12	81	50	3	4	6	4	10 3	3 10
12	5	12	99	50	2	3	6	4	10 2	3 10
14	5	12	99	50	3	4	6	4	10 3	3 10
12	2¾	18	23	60	2	3	3	2	12 0	3 0
12	2½	18	30	60	2	3	3	2	12 0	3 0
12	4	18	77	60	2	3	6	4	12 3	4 0
15	4	18	77	60	3	4	6	4	12 4	4 0
12	4½	18	87	60	2	3	6	4	12 3	4 0
15	4½	18	87	60	3	4	6	4	12 4	4 0
18	4	18	96	75	3	4	6	3	13 7	3 9
18	5	18	150	75	3	4	6	3	13 7	3 9
18	6	18	215	75	3	4	6	3	13 8	3 9

Bulletins.
Bulletins covering the various products will be sent on request.

THOMPSON MANUFACTURING CO.

Manufacturers of Rotary Pumps

811 Twenty-fourth Street
DES MOINES, IOWA.

Product.

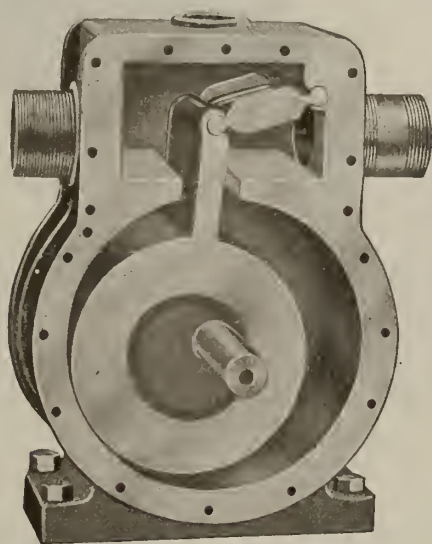
THOMPSON ROTARY PUMP for liquids, air and vacuums.

Uses.

The Thompson rotary pump is a distinct advance in both principle and design over other types. It is adaptable for use wherever there is liquid or air to be pumped, for vacuum heating, both return line and air line; for water works, irrigation pumping stations, drainage pumping stations and as bilge pump for either fresh or salt water. It gives satisfactory industrial service in oil refineries, tanneries, chemical plants, sugar refineries, foundries, oil stations and oil pipe lines; in fact, wherever there is a necessity for pumping air or liquids under vacuum or pressure.

Construction.

The cut herewith illustrates the pump with an end plate removed, showing the interior construction.



THOMPSON ROTARY PUMP
With end plate removed

There are three moving members—the crank, the impeller and a hinged plate. The hinged plate separates the suction and the discharge sides of the pump cylinder.

The pump pulley is supported by an outboard bearing and is keyed to the shaft.

The surfaces of the impeller and pump casing are cylindrical, therefore readily and accurately machined. The impeller is at no time in contact with the casing but is so adjusted as to maintain the closest clearance.

Thompson rotary pumps have been in use for 5 years without repairs or adjustment.

As compared with other types of rotary pumps this pump requires considerable less power per cubic foot displacement, due to the absence of sliding wings, gears and cams.

Equipment of Vacuum Unit.

The vacuum unit as shown consists of the Thompson rotary vacuum pump with outboard bearing and air chamber, motor belted to pump, suction strainer with air chamber, discharge chamber with air eliminator, and cast iron base.

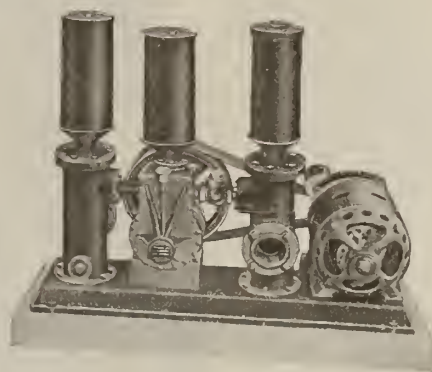
The pump, strainer, or discharge chamber can be removed from the base without disturbing the piping.

The large self-cleaning suction strainer is made of fine mesh bronze, effectively protecting the pump.

A wide, endless, waterproof, leather belt drives the pump. A gravity idler gives the belt a good rap on the motor pulley and gives a uniform belt tension.

The equipment is simple and compact, does not require a concrete base, is completely assembled and thoroughly tested before shipment.

This unit can also be furnished with a noiseless enclosed gear drive instead of the belt drive.



VACUUM RETURN LINE HEATING PUMP

THOMPSON VACUUM RETURN LINE HEATING SPECIFICATIONS

No.	Direct radiation, sq. ft.	Displacement per min., cu. ft.	Pump, r. p. m.	Motor, h. p.	Size of suction and discharge, in.
101	5,000	4 7	400	1/2	2
102	11,000	10 6	375	1	2 1/2
103	19,000	17 6	335	1 1/2	3
104	35,000	32	300	3	3 1/2

Bulletins.

The following bulletins will be sent on request: (1) Vacuum Return Line Heating Pumps. (2) Vacuum Air Line Heating Pumps. (3) Liquid Pumps. (4) Vacuum Air Pump and Compressors.

NOVO ENGINE COMPANY

C. E. BEMENT, VICE-PRESIDENT AND GENERAL MANAGER

Gasoline and Kerosene Engines and Pumping Machinery

10 Porter Street
LANSING, MICH.

CHICAGO OFFICE
800 Old Colony Building

Products.

GASOLINE and KEROSENE ENGINES, DIAPHRAGM PUMPING OUTFITS, MEDIUM and HIGH PRESSURE PUMPING OUTFITS, CENTRIFUGAL PUMPING OUTFITS.

For Novo Hoisting Outfits, see page 60; for Novo Air Compressor Outfits and Saw Rigs, see page 786.



TRADE-MARK

ally changes to kerosene. It is as simple and reliable as the Novo gasoline engine. The Novo kerosene engine operates on either kerosene or gasoline.

A gas mixer for burning natural or artificial gas can also be furnished for Novo engines at an extra cost.

Novo Gasoline and Kerosene Engines.

The Novo engine has won a countrywide reputation for reliability. Its light weight and compact, self-contained design especially adapt it to use in combination with portable or stationary power machinery.

The fuel is stored in the base, and the cooling water in the frostproof jacket over and around the cylinder. No tanks, fans, pipes or circulating pumps are required for cooling. The written guarantee with every engine covers the frost-proof feature.

Jump spark ignition is used, because it is simplest and most dependable.

Hit and miss governor is used, because it means economy of fuel consumption. At the same time, it insures absolute reliability.

The Novo kerosene engine is started on gasoline and automatic-

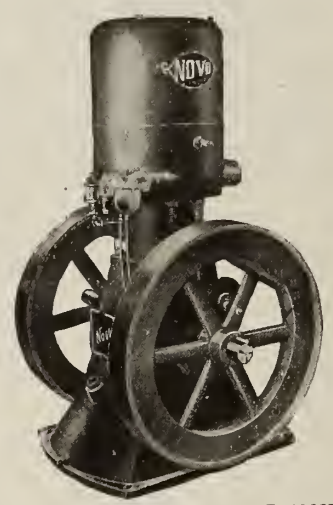


Fig. 1449. 8 H.P. AND 10 H.P. NOVO ENGINE

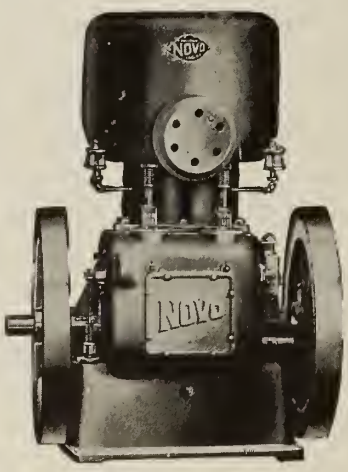


Fig. 337. 12 H.P. AND 15 H.P. NOVO ENGINE (TWO-CYLINDER)

Novo Trench or Diaphragm Pumping Outfit.

These outfits consist of single or double diaphragm pump, 3-in. or 4-in., driven by Novo engine. used by contractors for draining trenches and excavations. A rubber diaphragm, containing a flap valve, takes the place of a piston, so that the pump is not greatly affected by sand and gravel in the water.

The double diaphragm or trench pump is used for handling extra large quantities of water.

The single diaphragm or trench outfits are furnished on steel skids or on hand trucks, as ordered. The double diaphragm or trench outfits are furnished on trucks only.

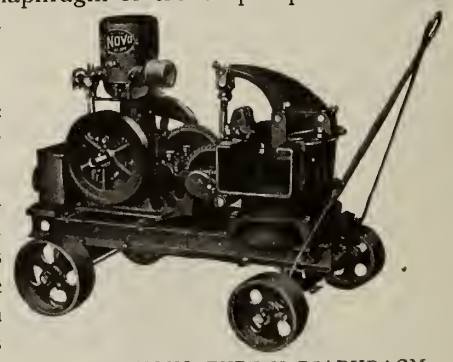


Fig. 377. NOVO TYPE N DIAPHRAGM PUMPING OUTFIT
Truck mounted

DATA, NOVO TYPE N DIAPHRAGM PUMPING OUTFITS

Outfit Number	Engine h. p.	Rated pump cap., gals. per hour	Size suc. pipe, in.	Bare weight, lbs.	Ship. weight, lbs.	Code word
WITH SINGLE PUMP (FIG. 377) TRUCK MOUNTED						
207	1½	4,000	3	450	600	Northway
208	2	4,000	3	590	740	Northwest
227	3	4,000	4	650	825	Norgo
228	2	10,000	4	640	800	Norka
229	3	10,000	4	740	890	Norode
WITH DOUBLE PUMP (FIG. 260) TRUCK MOUNTED						
230	2	8,000	two 2	1100	1350	Norque
231	3	8,000	two 3	1200	1450	Norse
232	3	20,000	two 4	1280	1525	Norvi
233	4	20,000	two 4	1400	1650	Norma

DATA, NOVO ENGINES

	1½ h. p.	2 h. p.	3 h. p.	4 h. p.	6 h. p.	8 h. p.	10 h. p.	12 h. p.	15 h. p.
Size of engine.....	600-675	600-675	525-600	475-525	450-500	425-475	400-450	400-450	400-450
Speed, r.p.m.....	15	15	18	20	24	27	29	30	30
Diam. flywheel, in.....	15½	15½	18	21½	24	27	30	30	30
Flywheel face, in.....	15½	15½	18	21½	24	27	30	30	30
Diam. crank shaft, in.....	1½	1½	1½	1½	2	2½	3	3½	3½
In. between anchor bolt holes.....	11¼x10¾	11x15	11x15	12x17	14½x20½	18x22½	20¾x24½	27¾x26¾	27¾x26¾
Diam. pulley, in.....	4	6	6	8	14	16	18	20	20
Face pulley, in.....	3	4	4	5	6	6	8	8	8
Height, in.....	28½	31½	33½	38	43½	50½	56	56	56
Fuel tank cap., gals.....	1½	2½	2½	3½	6	9	11	15½	15½
Bare weight, lbs.....	230	260	350	460	700	990	1400	1800	1900
Ship. weight, lbs.....	300	350	450	590	850	1150	1675	2000	2100
Code word.....	Nobby	Nob	Nook	Noc-turnal	Nodose	Nodule	Noon-time	Northward	Northland



Fig. 260. NOVO TYPE N DOUBLE DIAPHRAGM PUMPING OUTFIT
Truck mounted

Novo Centrifugal Pumping Outfits.

Made in two types—automobile chain drive and direct connected. Capacity from 40 to 650 gals. of water per minute. Total head from 10 to 60 ft.

The pump is of the single suction type. The impeller is cast iron. The shaft is open hearth, high carbon steel. Bearings are lubricated by grease cups.

Used by contractors for draining excavations; also used for irrigation and any pumping where a large volume of water must be handled against a moderate head.

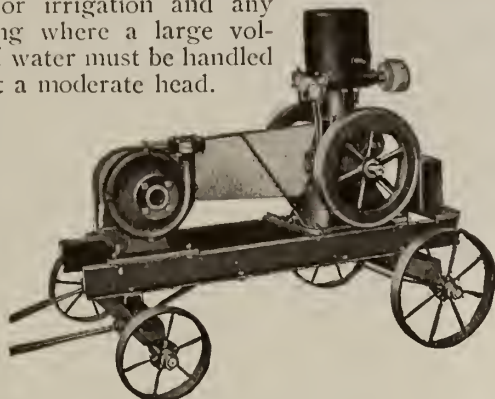


FIG. 265. NOVO CHAIN DRIVEN CENTRIFUGAL PUMPING OUTFITS
Mounted on truck

DATA, FIG. 265

Outfit Number	Engine h. p.	*Total head, ft.	Cap., gals. per minute	Size d.s. pipe, in.	Size suc. p. pipe, in.	Bare weight, lbs.	Code word without truck
30	3	10-25	120-40	2	2 1/2	700	Nice
31	4	10-35	200-60	2 1/2	2 1/2	850	Niche
32	4	10-40	300-60	2 1/2	3	875	Nick
33	6	15-60	360-60	2 1/2	3	1100	Nickle
34	4	10-30	340-60	3	4	1000	Niece
35	6	10-40	400-100	3	4	1125	Nigh
36	6	10-30	450-150	4	6	1225	Night
37	10	10-55	650-150	4	6	2150	Nightfall

If truck is wanted add word "truck" to code word, thus "Nicetruck."

Novo Triplex Pumping Outfits.

The Triplex pumping outfits, shown in Fig. 1446, are good for 150 to 200 lbs. pressure. The pump proper on these outfits embodies the principle of the three-throw crank shaft, so that the strokes follow and overlap one another. This gives a continuous and uniform flow of fluid.

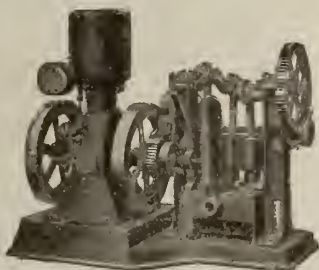


FIG. 1446. NOVO TRIPLEX PUMPING OUTFIT

DATA, FIG. 1446

Outfit Number	Engine h. p.	Pump No.	Size of pump		*Total head, ft.	Pressure, lbs.	Size suc. and dis. pipe, in.	Cap., gals. per hour	Bare weight, lbs.	Ship. weight, lbs.	Code word
			Cyl. diam., in.	Stroke, in.							
52	1 1/2	1009	2	3	350	150	1 1/4	540	800	950	Negal
53	3	1009	2 1/2	4	350	150	1 1/4	1080	1050	1250	Negar
53A	3	1157	2 1/2	4	575	250	1 1/4	720	1075	1275	Necti
98	4	1009	3 1/2	4	350	150	2	1500	1200	1400	Nedi
98A	4	1157	3 1/2	4	575	250	2	1080	1225	1425	Nefte
†54	6	1009	3 1/2	4	350	150	2	2400	1750	1975	Negat
†54A	6	1157	3 1/2	4	575	250	2	1500	1700	1925	Negab
†96	8	1009	4	6	350	150	2	3600	2700	2950	Negaf
†96A	8	1157	3 1/2	6	460	200	2	3000	2650	2900	Negah
†97	10	1009	5	6	350	150	3	4800	4575	4850	Negam
97A	10	1157	3 1/2	6	460	200	2	3600	4600	4900	Negig
99	12	1009	5	8	350	150	3	6000	5100	5500	Nejol
99A	12	1157	4	8	460	200	3	4800	5150	5550	Nekel
100	15	1009	6	8	350	150	4	7500	5300	5700	Neite
100A	15	1157	5	8	460	200	4	4800	5350	5750	Nemo

†These outfits furnished with clutch on pump.

*Total head means vertical distance from source of water supply to point of discharge, including friction of water through pipe line. Pump must not be more than 20 ft. above water supply.

Novo Pyramid Force Pumping Outfits for Medium Pressure.

Cylinder of pump has removable brass lining. Valves and valve seats are of brass, and easily accessible. Piston rod of brass to prevent corrosion.

Outfits, as shown in Fig. 268, are suitable for general water supply and are especially suited for pneumatic water systems.

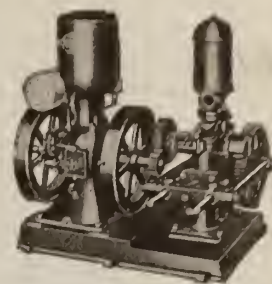


FIG. 268. NOVO FORCE PUMPING OUTFIT
Medium pressure

DATA, FIG. 268

Outfit Number	Engine h. p.	Size of pump		No. strokes per minute	Size suc. and dis. pipe, in.	Cap., gals. per hour	*Total head, ft.	Pressure, lbs.	Bare weight, lbs.	Code word
		Cyl. diam., in.	Stroke, in.							
10	1 1/2	3	5	43	1 1/2	790	175	75	600	Nostril
11	3	3	5	50	1 1/2	900	175	75	725	Nought
12	1 1/2	4	5	43	2	1400	150	43	620	Nourish
13	4	4	5	50	2	1630	175	43	775	Novel
13 1/2	4	4	5	60	2	1950	175	75	825	Novelette
14	4	5	5	40	2 1/2	2040	175	43	840	Novice
15	4	5	5	50	2 1/2	2550	175	43	930	Nozzle
49	4	6	6	40	3	3500	150	52	1235	Nativity
50	6	6	6	50	3	4300	175	52	1265	Native
116	8	6	12	40	4	6600	175	..	2200	Natively

Novo Type U Outfits for High Pressure Pumping.

These are strong, heavily built outfits for long distance pumping, high vertical lifts, high pressures, severe conditions, where the suction lift is not greater than 25 ft.

Note the simple, compact, rigid, all-iron construction of this outfit. It can not get out of alignment. It will stand up under the hardest kind of work and operate continuously and successfully.

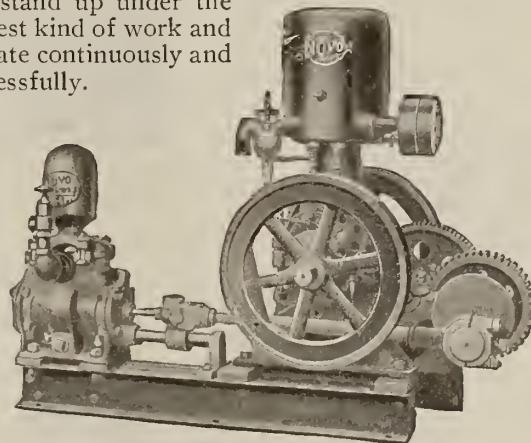


FIG. 14139. NOVO TYPE U PUMPING OUTFITS
High pressure

DATA, FIG. 14139

Outfit Number	Engine h. p.	Size of pump		Size suc. and dis. pipe, in.	Cap., gals. per hour	Double strokes per minute	*Total head, ft.	Pressure, lbs.	Bare weight, lbs.	Ship. weight, lbs.	Code word
		Cyl. diam., in.	Stroke, in.								
63	1 1/2	3	5	1 1/4	900	51	240	100	425	525	Ultima
64	3	3	5	1 1/4	900	50	400	175	590	700	Ultimate
65	3	4	5	1 1/4	1630	50	200	85	640	750	Ultimo
66	4	4	5	1 1/2	1500	44	415	180	790	915	Umbel
67	4	5	5	2	2200	44	265	115	940	1150	Umbol
68	6	5	5	2	2200	45	390	170	1240	1500	Umbor
90	4	3	5	2 1/2	900	44	690	300	790	915	Umcor
91	6	3	5	2 1/2	1500	45	690	300	1240	1500	Umcan
92	6	4	5	1 1/2	825	45	1150	500	1290	1550	Umcul

RUMSEY PUMP COMPANY, LTD.

109 Johnson Street
SENECA FALLS, N. Y.

Products.

Power Pumps for every pumping service, driven by belt, chain, gear or direct drive, including HYDRAULIC PRESSURE PUMPS; SINGLE and DOUBLE ACTING TRIPLEX PUMPS; ELECTRIC TRIPLEX PUMPS; DOUBLE ACTING POWER PUMPS; CENTRIFUGAL PUMPS; ROTARY POWER PUMPS; DEEP WELL PUMPING OUTFITS and WATER WORKS MACHINERY.

Trench Pumps, Hydraulic Rams, Hand Pumps of all kinds, Diaphragm Pumps, House Pumps, Hand and Windmill Well Pumps, Spray Pumps, etc.; Pneumatic Water Systems, Hydrants, Foot and Check Valves, Cylinders and Pump Accessories.

Complete electric, gas or gasoline pumping units may be furnished.

Catalogues.

General catalogue of Hand and Power Pumps, 56th edition, a complete reference book of pumping machinery; Catalogue A, Pneumatic Water Systems; Catalogue B, Triplex Power Pump; Catalogue C, Selected Hand Pumps; Catalogue DC, Rotary Pumps. Booklets on Centrifugal, Spray and Deep Well Pumps.

Triplex Pumps.

The design is simple and compact, with all working parts accessible for inspection or adjustment. All parts are made from the best materials. Only skilled workmen are employed for founding, machining and assembling. All pumps are rated at conservative speeds. The result is an article suitable for durable, practical service. These pumps are offered in a wide range of styles and sizes for any pumping application: For general water supply and fire protection; municipal water works; boiler feeding, circulating, mine pumping; hydraulic elevators; exerting pressures; pumping special liquids, chemicals, etc. Construction details necessarily vary according to the service for which pumps are rated or special conditions under which they are to operate. Detailed specifications of any pump will be sent on request.

Cranks are of the best cast or forged steel, of proper weight to take the heaviest strain to which they are subject. Bearings are of ample size, of bronze or lined with best babbitt scraped to a true surface. Gearing is machine cut from solid. Waterways are large and direct. Valve areas are correctly proportioned. Glands are arranged to keep the plunger packing tight with a very slight pressure on the studs, preventing undue friction. All pumps are equipped with suitable oiling devices and drips.

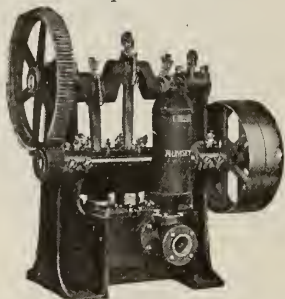


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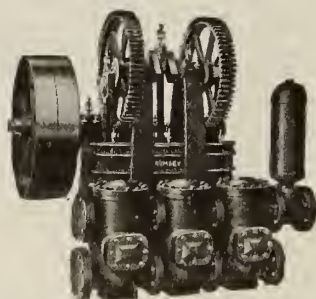
STANDARD SIZES AND CAPACITIES, MODERATE PRESSURE, SINGLE ACTING TRIPLEX PLUNGER PUMPS

Capacity per minute at moderate speed, gals.	Working pressure, lbs.	Figure No.	Plungers diameter X stroke, ins.	Displacement per rev., gals.	Pipes		Standard pulleys, ins.	Cipher
					Suc., ins.	Dis., ins.		
1.5	150	681	1 1/4 x 2	0.03	1	3/4	12x 1 1/2	Cabbage
1.5	200	684	1 1/4 x 2	0.03	1	1	12x 1 1/2	Conclave
3.5	200	684	1 1/2 x 3	0.07	1	1	12x 2	Conclude
4.5	150	681	1 3/4 x 3	0.09	1	1	12x 2	Cab
6	130	681	2 x 3	0.12	1 1/4	1 1/4	12x 2	Cabajal
8	200	684	2 x 4	0.16	1 1/4	1 1/4	12x 2 1/2	Concoet
10	150	681	2 1/4 x 4	0.20	1 1/4	1 1/4	12x 2 1/2	Cabal
13	150	681	2 1/2 x 4	0.25	1 1/4	1 1/4	12x 2 1/2	Cabaret
14	200	684	2 3/4 x 4 1/2	0.28	1 1/2	1 1/2	15x 2 1/2	Concord
20	150	681	3 x 4 1/2	0.41	1 1/2	1 1/2	15x 2 1/2	Cabin
25	150	681	3 1/8 x 4 1/2	0.50	1 1/2	1 1/2	15x 2 1/2	Cabiet
25	200	684	3 x 5	0.46	1 1/2	1 1/2	20x 3	Concur
30	150	681	3 1/2 x 5	0.62	2	2	20x 3	Cabob
35	200	684	3 1/2 x 6	0.75	2	2	20x 4	Concuss
50	150	681	4 x 6	1.00	2 1/2	2	20x 4	Caboos
60	120	681	4 1/2 x 6	1.24	3	2 1/2	20x 4	Caboosoon
75	150	681	5 x 6	1.53	3	3	24x 5	Cabotage
90	120	681	5 1/2 x 6	1.85	3	3	24x 5	Caburn
100	85	692	5 x 8	2.00	3 1/2	3	24x 4	Coping
100	150	691	5 x 8	2.00	3 1/2	3	30x 5	Communism
100	200	698	5 x 8	2.00	3 1/2	3	30x 6	Coterie
125	65	692	5 1/2 x 8	2.46	3 1/2	3	24x 4	Copse
125	125	691	5 1/2 x 8	2.46	3 1/2	3	30x 5	Comet
125	165	698	5 1/2 x 8	2.46	3 1/2	3	30x 6	Cotgare
150	55	692	6 x 8	2.93	4	3 1/2	24x 4	Coquette
150	100	691	6 x 8	2.93	4	3 1/2	30x 5	Commuter
150	140	698	6 x 8	2.93	4	3 1/2	30x 6	Cotia
175	43	692	6 1/2 x 8	3.44	4	4	24x 4	Coquina
175	85	691	6 1/2 x 8	3.44	4	4	30x 5	Comose
175	120	698	6 1/2 x 8	3.44	4	4	30x 6	Cotoin
215	85	692	6 3/4 x 10	4.30	5	4	30x 6	Cordovan
215	150	691	6 3/4 x 10	4.30	5	4	36x 6	Compact
215	200	698	6 3/4 x 10	4.30	5	4	42x 6	Cotsword
250	195	690	7 x 10	5.00	5	5	42x 6	Comprint
270	75	692	7 1/4 x 10	5.35	6	5	30x 6	Cormorant
270	125	691	7 1/4 x 10	5.35	6	5	36x 6	Combing
270	160	698	7 1/4 x 10	5.35	6	5	42x 6	Cotta
325	55	692	8 x 10	6.50	6	5	30x 6	Coronet
325	100	691	8 x 10	6.50	6	5	36x 6	Combative
325	130	698	8 x 10	6.50	6	5	42x 6	Cottage
345	150	690	8 1/4 x 10	6.94	6	5	42x 6	Compart
415	125	690	9 x 10	8.26	7	6	44x 6	Compass
415	150	690	9 x 10	8.26	7	6	42x 10*	Compeer
445	185	690	9 x 12	9.91	8	8	48x 10*	Compile
510	100	690	10 x 10	10.20	8	8	44x 6	Complex
510	150	690	10 x 10	10.20	8	8	42x 10*	Compose
550	150	690	10 x 12	12.24	8	8	48x 10*	Compress
560	85	690	10 1/2 x 10	11.25	8	8	44x 6	Compotal
560	135	690	10 1/2 x 10	11.25	8	8	42x 10*	Compotete
570	215	788	10 x 14	14.28	8	8	60x 14†	Corrigent
605	135	690	10 3/4 x 12	13.50	8	8	48x 10*	Compret
690	90	789	11 x 14	17.28	12	10	60x 10*	Corposce
690	175	788	11 x 14	17.28	12	10	60x 14†	Corrifon
820	75	789	12 x 14	20.56	12	10	60x 10*	Corposant
820	150	788	12 x 14	20.56	12	10	60x 14†	Corral
965	65	789	13 x 14	24.12	12	10	60x 10*	Corpulent
965	130	788	13 x 14	24.12	12	10	60x 14†	Correlate
1,120	55	789	14 x 14	27.98	12	10	60x 10*	Corpuscle
1,120	110	788	14 x 14	27.98	12	10	60x 14†	Corridor
1,120	200	798	14 x 16	32.00	12	10	72x 20†	Corvette
1,460	150	798	16 x 16	41.77	14	12	72x 20†	Corvine
1,650	130	798	17 x 16	47.16	14	12	72x 20†	Corylus
1,850	110	798	18 x 16	52.85	14	12	72x 20†	Corymb

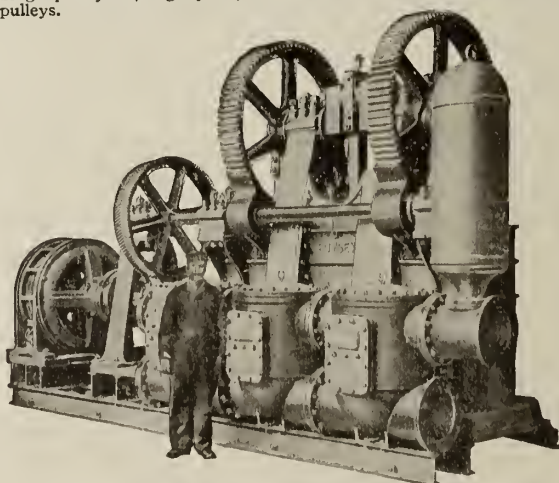
*Single pulley. †Single pulley for double belt. Other sizes have tight and loose pulleys.



SINGLE GEARED TRIPLEX PUMP, SMALL SIZES, LIGHT SERVICE



DOUBLE GEARED TRIPLEX PUMP, STANDARD TYPE, 500-GAL. GENERAL SERVICE PUMP



ELECTRIC TRIPLEX PUMP WITH GEAR DRIVE
Type of water works pump—2,000,000-gal. unit

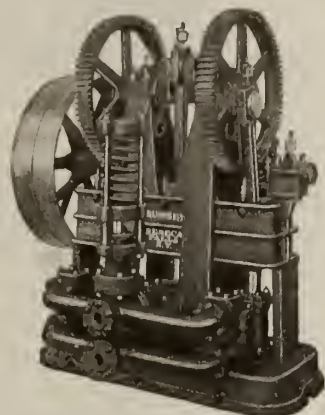
Each Rumsey triplex pump is carefully tested to its maximum working service before shipment and is fully guaranteed.

The design of our triplex pumps permits of considerable alteration from standard construction to meet special service or working conditions. Pumps are regularly fitted for handling cold water, but will be equipped for hot water without extra charge. For other alterations a slight margin above cost will be added. Any pump may be furnished with vacuum chamber, rawhide pinion, by-pass, etc., or arranged on bed plate or foundation for connection to driving power.

Single acting triplex pumps may be brass fitted to order when not regularly so equipped, and when construction limits permit, with brass covered or bronze plungers, brass lined or bronze glands and bronze bushed cylinders. Double acting triplex pumps may be brass fitted to order, with removable brass lined iron cylinders or removable bronze cylinders, iron pistons with brass followers or bronze pistons, or bronze piston rods.

DIRECTIONS FOR INQUIRIES—It will facilitate correspondence if clients, in asking for recommendations and prices, will furnish the following information:

- (1) For what purpose the pump is to be used.
 - (2) Quantity of liquid to be pumped per minute.
 - (3) Whether service is constant or intermittent, and the average number of hours per day pump will run.
 - (4) Height to which liquid is to be raised by suction, and diameter and length of suction pipe.
 - (5) Height in feet or pressure in pounds against which liquid has to be forced, also diameter and length of discharge pipe.
 - (6) Nature of liquid to be pumped, whether hot or cold, salt or fresh, acid, clear or gritty.
 - (7) Power available for driving pump.
- If a deep well pump is required, give information covered by items 1, 2, 3, 6 and 7 above. Also:
- (8) Total elevation between surface of the water and discharge point; and diameter and length of discharge pipe.
 - (9) Diameter and depth of well or pit, and distance from surface of ground to low water level.
 - (10) Vertical distance that the cylinder will be placed above low water level if not actually submerged at all times.



HYDRAULIC PRESSURE PUMP
WITH SPRING ALLEVIATOR

A sketch showing relative position of supply, pump and discharge point, with dimensions, and giving length, size and turns or bends of pipe lines, will be a great aid to a thorough understanding of conditions under which pump is to operate.

Double Acting Power Pumps.

Reliable pumps for tank pumping and general use where an inexpensive outfit is desired. Made with brass lined cylinder, leather packed piston, metal valves, large air chamber and back gearing.

These pumps are offered in capacities of from 4 to 65 gals. per minute. Illustration shows a 2 x 3-in. pump; larger sizes differ in design.

Geared or belted electric outfits can be furnished complete with, or ready to receive, electric motor.

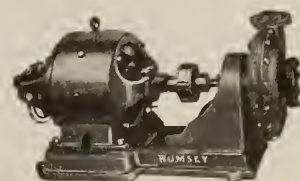
Geared engine outfits complete with engine are offered in several sizes.



DOUBLE ACTING PUMP

Low Lift Centrifugal Pumps.

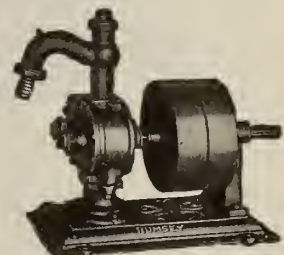
Rumsey centrifugals are offered in both horizontal and vertical types and in sizes from 1 to 10 ins., capacities 10 to 2400 gals. per minute for heads not more than 50 ft. Pumps for contractors, industrial plants, mines and quarries, for circulating, handling thick liquids and chemicals and many special applications. Direct connected electric sump pumps and horizontal pumps, and direct connected and geared gasoline pumping sets can be supplied.



ELECTRIC CENTRIFUGAL
PUMP

Rotary Power Pumps.

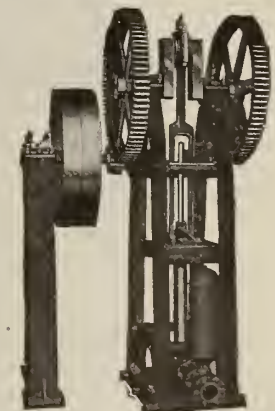
Rotaries are used with economy by thousands of manufacturers for handling liquids such as oils, acids and other chemicals. For water supply, they are popular because of their low cost and large capacity. For fire protection, rotaries are most dependable, throwing a continuous stream with a uniform strain on pump and driving power. Built in capacities to discharge up to four standard fire streams and arranged for hose or for piping to hydrants or sprinkler system.



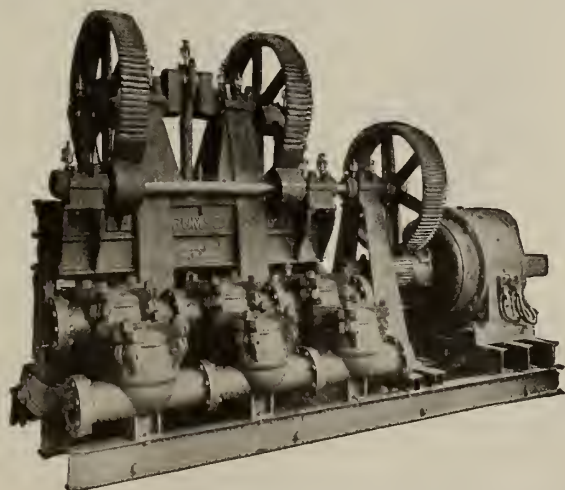
SMALL TYPE OF ROTARY
POWER PUMP

Deep Well Pumping Sets.

The selection of equipment for raising water from deep wells is most important. Strength in the machine must be combined with accessibility of working parts; as the strain is severe and adjustments and repairs are expensive and difficult. Rumsey deep well working heads are correctly designed to give dependable, lasting service. Offered in a range of styles suitable for wells of any depth for operating Rumsey single or double acting cylinders.



DEEP WELL WORKING HEAD
Style for deep artesian wells



ELECTRIC TRIPLEX PUMP FOR HEAVY DUTY
This stationary mine pump replaced three relays of centrifugals

TABER PUMP COMPANY

295 Elm Street
BUFFALO, N. Y.

Products.

PUMPS: Rotary, Centrifugal, Sump and Hand Force.

Taber Rotary Pumps, Type G.

These pumps are built in several sizes for belt drive (Fig. 175) or for motor drive (Fig. 179).

They are carefully machined and gears are finished over-all. Accessibility to inlet and outlet connections is a desirable feature.

These pumps are adapted for handling various kinds of liquids including oils, chemical solutions and water, and are made in iron and bronze.

Fully described in Bulletin 25.

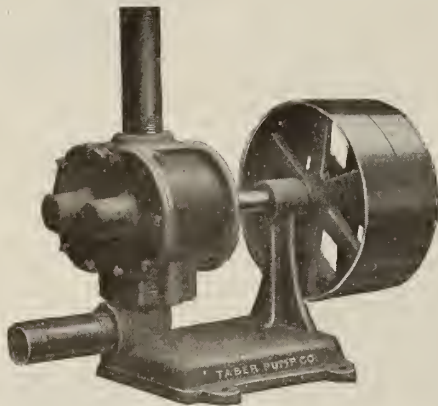


FIG. 175. TYPE G BELT DRIVEN ROTARY GEAR PUMP

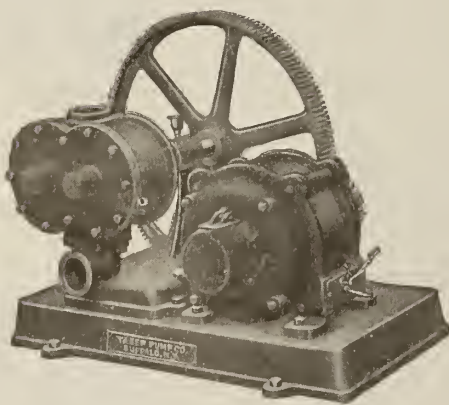


FIG. 179. TYPE G MOTOR DRIVEN ROTARY GEAR PUMP

CAPACITIES, TABER TYPE G PUMPS

R. p. m.	Capacity, gals. per min.			
	No. 1	No. 2	No. 3	No. 4
100	4	14	32	40
150	7.25	22	52	64
200	13	32	67	84
250	16	45	86	104
Suction, in.	1	1½	2	2½
Discharge, in.	1	1½	2	2½
Pulleys, in.	8 by 2¼	10 by 2¼	12 by 3¼	17½ by 3¼
Weight, lbs.	55	75	140	210

Taber Rotary Pumps, Type S.

These pumps are made particularly for handling gasoline and oils. They are very close fitted and are of the 4-bucket type.

The distinctive advantage of this type of pump for handling light liquids is that the buckets are hydraulically balanced and self-compensating, a new feature upon which patents are pending.

Pumps operate smoothly, and have wonderful suction properties, delivering efficiently against a 100-ft. head.

These pumps are of special interest to oil refineries. They are made for either belt, gasoline engine or electric motor drive, and where conditions require air chamber and low pressure relief valve, these can be furnished.

Fully described in Bulletin 31.

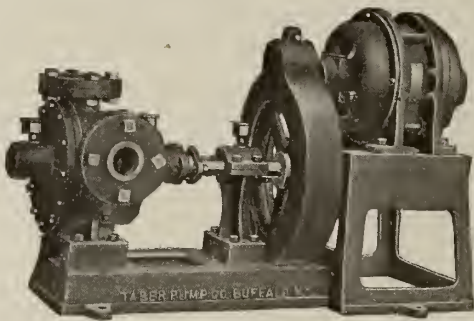


FIG. 300A. TYPE S MOTOR DRIVEN ROTARY PUMP

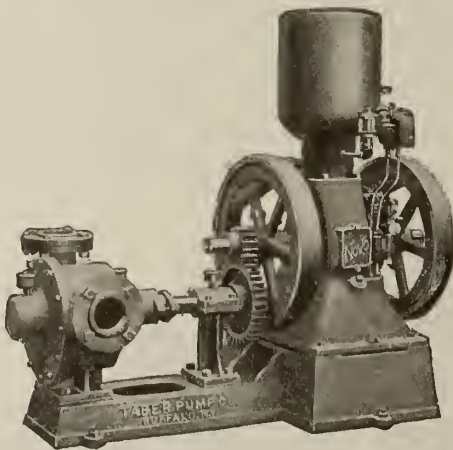


FIG. 307. TYPE S ROTARY PUMP CONNECTED TO NOVO ENGINE

Taber Rotary Pumps, Type T.

These pumps are particularly adapted for handling viscous materials, such as soap stock, asphalt, paints, molasses or any other products of this nature, there being a design for each specific requirement.

Made for belt, motor or engine drive.

Constructed of iron or bronze.

Fully described in Bulletin 22.

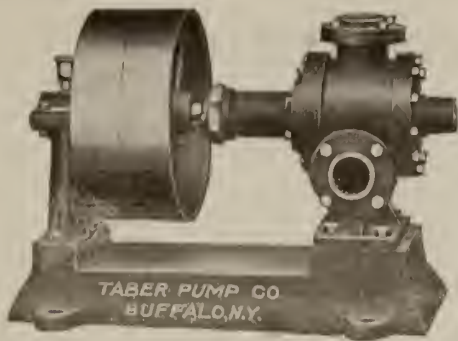


FIG. 146. TYPE T BELT DRIVEN CIRCULATING PUMP



FIG. 186. TYPE SV SINGLE-STAGE DOUBLE SUCTION PUMP

Taber Centrifugal Pumps, Type V.

Type V centrifugal pumps are carefully designed, single suction, open impeller type pumps. They are extensively used for circulating water and other fluids. When constructed of bronze, they are particularly adapted for circulating corrosive liquids such as tanning liquors and brine for refrigeration purposes.

Fully described in Bulletin 20.

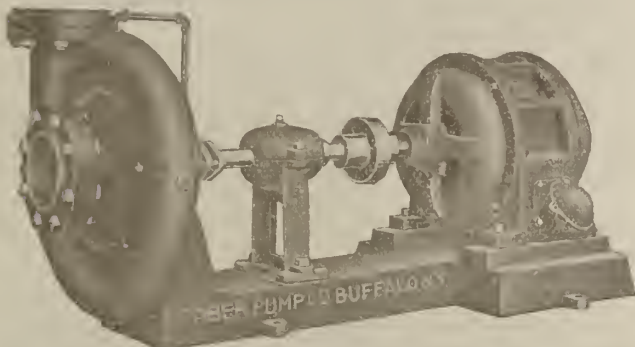


FIG. 190. TYPE V CENTRIFUGAL PUMP

CAPACITIES OF TABER TYPE V PUMPS

Pump No.	Suction, in.	Discharge, in.	Nominal capacity, gals.	H. p. per ft. head	Head in feet										
					10	20	30	40	50	60	70	80	90	100	
V-1	1 1/4	1	30 G	.035	1425	1800	2075	2300	2490						
V-2	1 1/2	1 1/4	50 G	.040	1200	1450	1640	1800	1990	2140	2260	2375			
V-3	2	1 1/2	100	.075	905	1175	1360	1535	1680	1810	1950	2075	2175	2275	
V-4	2 1/2	2	150	.085	800	980	1135	1255	1400	1490	1600	1715	1800	1880	
V-5	3	2 1/2	200	.105	730	900	1030	1200	1275	1410	1500	1600	1675	1760	
V-6	4	3	300	.140	550	725	850	940	1040	1130	1210	1300	1360	1435	
V-7	5	4	600	.280	500	680	800	880	965	1040	1120	1175	1240	1300	
V-8	6	5	900	.460	570	675	810	860	925	1000	1070	1125	1190	1250	
V-9	8	6	1200	.550	510	615	680	780	860	925	995	1050	1120	1165	

MOST EFFICIENT HEADS, SPEEDS AND CAPACITIES AT WHICH TO OPERATE TABER TYPE V PUMPS

Pump No.	Suction, in.	Discharge, in.	Capacities and speeds	Head in feet										
				10	20	30	40	50	60	70	80	90	100	
V-1	1 1/4	1	G. p. m. 17	24	29	33	37							
			R. p. m. 1150	1680	2050	2340	2600							
V-2	1 1/2	1 1/4	G. p. m. 23	32	40	46	50							
			R. p. m. 875	1240	1500	1775	2000							
V-3	2	1 1/2	G. p. m. 53	73	92	108	122							
			R. p. m. 800	1100	1350	1600	1750							
V-4	2 1/2	2	G. p. m. 88	120	150	170	190							
			R. p. m. 700	940	1150	1300	1450							
V-5	3	2 1/2	G. p. m. 125	158	183	203	220							
			R. p. m. 625	790	1050	1210	1325							
V-6	4	3	G. p. m. 170	225	270	305	350							
			R. p. m. 475	670	840	960	1055							
V-7	5	4	G. p. m. 350	450	520	575	620							
			R. p. m. 450	640	770	875	970							
V-8	6	5	G. p. m. 475	650	775	890	975							
			R. p. m. 450	615	745	860	955							
V-9	8	6	G. p. m. 800	1025	1200	1350	1475							
			R. p. m. 440	575	680	800	885							

Taber Centrifugal Pumps, Type SV.

These pumps are made up in single-stage units only, being of a double suction volute type, which can be furnished for either belt or motor drive from 150 to 1200 gals. per minute.

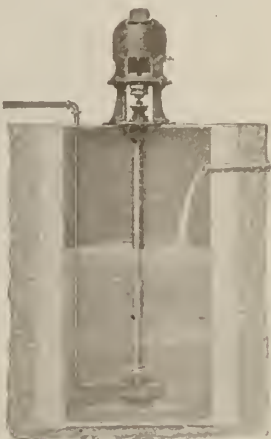


FIG. 194. SUMP PUMP

Tabilge Hand Force Pumps.

Fig. 171B illustrates the Tabilge high grade sump pump. These pumps are fitted with ball bearing thrust. Can be supplied with automatic starting and stopping device. Fully described in Bulletin No. 20.

Tabilge Hand Force Pumps.

Fig. 171B illustrates the Tabilge hand force pump, bronze fitted throughout. These pumps are built in accordance with Navy Yard Specifications and are of special interest to ship-chandlers and ship-builders.

Fully described in Bulletin 21.



FIG. 171B. SINGLE HANDED TABILGE HAND FORCE PUMP

Taber Hand Pumps, Type S.

Fig. 305 illustrates the Taber Type S suction hand pump. These pumps are similar in design to the Type S power pumps, having high suction properties and large delivery. It is never necessary to prime these pumps.

Fully described in Bulletin 30.



FIG. 305. TYPE S HAND PUMP

TRIMOUNT ROTARY POWER CO.

Manufacturers of Rotary Pumps

19 Heath Street

BOSTON, MASS.

FACTORY: 290 Whiting Avenue, EAST DEDHAM, MASS.

Products.

TRIMOUNT ROTARY PUMPS: Hand, Bilge, Power, Motor Driven, High Vacuum.

Also, Air Compressors, Motor Boat (friction driven) Whistle Outfits.

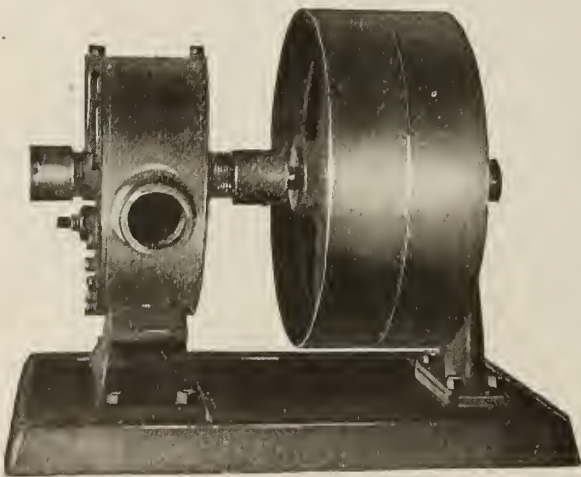
Trimount Rotary Pumps.

Owing to the unique construction of Trimount rotary pumps, the parts are few, thus reducing friction and wear to a minimum. There are no springs or weak parts to break or get out of order. When wear occurs, it is readily taken up by means of an adjusting screw.

Trimount rotary pumps require absolutely no priming. As no packing is used, they can be utilized for pumping any fluid of any density, and at any temperature. All the pumps, except high vacuum pumps and air compressors, are made entirely of bronze, giving them long life.

A strong feature of Trimount pumps is their high suction lift of from 6 to 25 ft., depending on the fluid pumped. Candy manufacturers and dealers in heavy oils, greases and liquids of similar viscosity, have found these pumps especially suitable for their needs.

The Trimount will pump anything that flows, no matter how heavy and sluggish that flow may be.



NO. 5 TRIMOUNT ROTARY PUMP WITH TIGHT AND LOOSE PULLEYS, MOUNTED ON BED PLATE

DATA, BRONZE POWER PUMPS

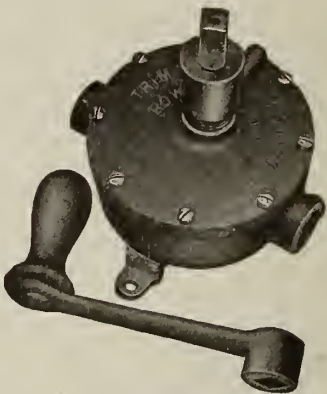
No.	Gals. per min.	R. p. m.	H. p.	Inlet, ins.	Outlet, ins.
2	1 3/4	300	1 1/8	1 1/4	1 1/4
3	3 1/4	250	1 1/8	1 1/2	1 1/2
4	7	200	1 1/8	1 3/4	1 3/4
5	11	175	1 1/8	1 1/2	1 1/2
6	14	150	1 1/8	1 1/2	1 1/2
7	25	140	1	1 1/2	1 1/2
8	43	130	2	2	2
9	85	100	4	2 1/2	2 1/2

Trimount Hand Pump.

This hand pump has small lugs on back to fasten to wall or partition (as for bilge purposes, or gasoline pumping in private garages).

If desired, these pumps are made with 5-in. pedestal to screw to flooring.

Three sizes of Trimount hand pumps are made.



NO. 0 TRIMOUNT HAND PUMP

DATA, TRIMOUNT HAND PUMPS

No.	Gals. per min.	R. p. m.	Guaranteed suction, ft.
0	6	85	6
1	10	85	15
2	20	85	20

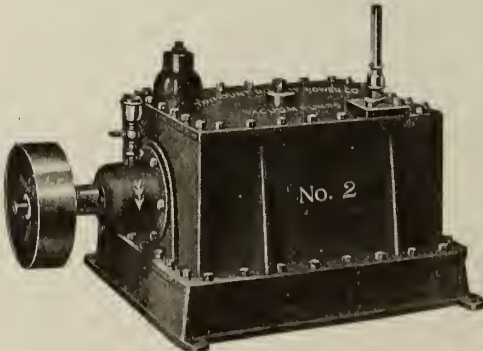
High Vacuum Pump.

Designed for high pressure vacuum purposes such as exhausting incandescent lamp bulbs, vapor lamps, mercury arc rectifiers, X-ray tubes, thermos bottles, etc.

Immersed in oil in airtight case, driving shaft provided with oil-sealed bearing to prevent air from entering case.

It is intended that this pump be supported by a pump giving a vacuum within a few millimeters of the barometric height, and it is recommended that pump No. 1 be used for this purpose. A single No. 1 pump will serve for a number of the No. 2 pumps.

Special vacuum pump catalogue sent on request.



NO. 2 TRIMOUNT HIGH VACUUM PUMP

No.	Vacuum obtained	Height, ins.	Width, ins.	Length, ins.	Weight, lbs.	R. p. m.
1	.5MM or 1-50 in.	12	11 1/2	16	77	300
1 1/2	.00015 MM or 6 in. 1,000,000	17	15	18 1/2	134	300
2	.000025 MM or 1 in. 1,000,000	14	17	24	190	300

TWINVOLUTE PUMP & MFG. CO., INC.

Manufacturers of Centrifugal Pumps

WORKS AND MAIN OFFICE

NEWARK, N. J.

NEW YORK OFFICE: 55 William Street

Products.

CENTRIFUGAL PUMPS, including Horizontal Split Case, Vertical Split Case and Solid Case Types.

Services and Guarantee.

The Twinvolute centrifugal pump, covered by basic patents, is the result of 20 years' experience in the building of centrifugal pumps, and embodies all the latest improvements in this type of apparatus.

This company maintains an engineering department who will co-operate with the customer in selecting the best pump for the service, thereby effecting a saving in first cost as well as in operating expense.

All pumps are guaranteed to fulfil all that is claimed for them when properly installed and cared for.

This company will supply, without charge, any part returned, prepaid, within one year of shipment, which bears evidence of imperfection in material or workmanship.

Quotations will be made on listed or special pumps when requested.

Horizontal Split Case Pumps.

Made in sizes from 1½ in. and up, in single-stage and multistage types.

Head of 300 ft. can be obtained with single-stage pumps.

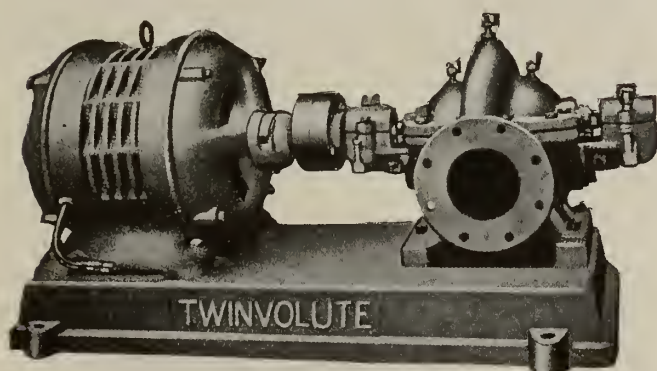
SPECIAL FEATURES—Peculiar design of labyrinth wearing rings.

Vertically split bearing shells.

Design and method of holding sleeves on shaft in place.

High economies.

Send for Bulletin No. 90.

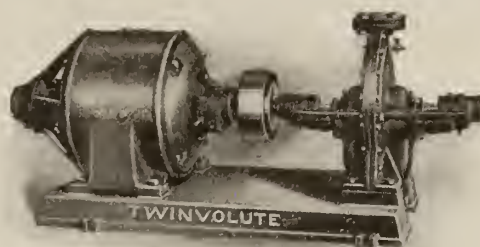


HORIZONTAL SPLIT CASE PUMP, TYPE AS

Vertical Split Case Pumps.

Made only in single-stage type in sizes from 1½ in. and up.

Good for heads up to 120 ft. at normal speeds.
Has double suction impellers and outboard ring oiled bronze bearings.



VERTICAL SPLIT CASE PUMP, TYPE AE

Solid Case Pumps.

Made in sizes from 1 in. and up, in single-stage and two-stage types.

Single-stage pumps are known as type "NAO" and "AEO."

Two-stage pumps are known as type "BE" and have impellers back to back or are right- and left-hand, eliminating end thrust.

On sizes from 1½ in. up, outboard ring oiled bronze bearings are employed.

Send for Bulletin No. 87.



SOLID CASE PUMP, TYPE BE

Data Required for Estimates.

Number of pumps required?

Gallons per minute for each pump?

Is the water taken directly from the city main or from an open suction tank?

If connected to a city main, what is the pressure at the pump suction?

Give total discharge head.

Give total suction lift.

Is pump to work continuously or intermittently?

Hot or cold water?

MOTOR DATA—If direct current, give voltage.

If alternating, give voltage, phase and cycles.

The more information received, the better service can be rendered.

WORTHINGTON PUMP AND MACHINERY CORPORATION

115 Broadway
NEW YORK, N. Y.

WORKS:
HARRISON, N. J.

BRANCH OFFICES

ATLANTA, GA., 435 Trust Co. of Georgia Building
BIRMINGHAM, ALA., American Trust & Savings Bank Building
BOSTON, MASS., 465 John Hancock Building
BUFFALO, N. Y., 707 Iroquois Building
CHICAGO, ILL., 820 Old Colony Building
CINCINNATI, OHIO, 1503 First National Bank Building
CLEVELAND, OHIO, 304 Rockefeller Building
DENVER, COLO., 435 Seventeenth Street
DETROIT, MICH., 839 Majestic Building
EL PASO, TEX., 510 Mills Building
HOUSTON, TEX., 425 Southern Pacific Building
KANSAS CITY, MO., 825 Scarritt Building

LOS ANGELES, CAL., 209-210 Higgins Building
NEW ORLEANS, LA., 533 Baronne Street
PHILADELPHIA, PA., 1516 North American Building
PITTSBURGH, PA., 407 Oliver Building
ST. LOUIS, MO., 701 Laclede Gas Building
ST. PAUL, MINN., 613 Merchants' National Bank Building
SALT LAKE CITY, UTAH, 113 W. Second South Street
SAN FRANCISCO, CAL., 306 Sharon Building
SEATTLE, WASH., 203 Maynard Building
TULSA, OKLA., 123 West First Street
WASHINGTON, D. C., 426 Homer Building
LONDON, ENG., Queen's House, Kingsway

Products.

PUMPS and PUMPING EQUIPMENT of every type and for all purposes.

FEED WATER HEATERS, Open and Closed Type; SURFACE, JET and EJECTOR CONDENSERS; WATER METERS; AIR, GAS and AMMONIA COMPRESSORS; CORLISS PUMPING ENGINES; GYRATORY CRUSHER; JAW CRUSHERS; CRUSHING ROLLS; CRUSHER SCREENS; SAND RIDGLERS; CORE WIRE STRAIGHTENERS; OIL, GAS and GASOLINE ENGINES; WOOD PRESERVING MACHINERY and EQUIPMENT.

Also Stamp Mills, Log Washers, Sampling Machinery, Converters, etc.; Steam Accumulators; Gas Expanders and Vacuum Pumps; Huntington Grinding Mills; Wet Grinding Tube Mills; Gas Generating Plants.

Services.

Many years of experience in designing and building pumping machinery, meeting and overcoming every variety of problems have given our engineering staff a valuable and extensive knowledge of every phase of pumping. This experience and knowledge is at the disposal of prospective purchasers of pumping equipment. Correspondence is invited concerning any special service, which will have the prompt consideration of our engineering department. No pumping proposition is too large or too small, too severe or too unusual, to interest us.

Complete working drawings for the erection of crushing plants to meet every requirement and of any desired capacity will be furnished, together with foundation plans, including timber estimate, bolt list and masonry specifications.

Organization and Facilities.

The Worthington Company has larger plants, greater facilities and a more abundant production than any other pump manufacturer in the world. This corporation comprises:

Worthington Works, Harrison, N. J.
Blake-Knowles Works, East Cambridge, N. J.
Power & Mining Machinery Works, Cudahy, Wis.
Ingeco Works, Cudahy, Wis.
Deane Works, Holyoke, Mass.
Laidlaw Works, Elmwood Place, Cincinnati, Ohio
Snow Holly Works, Buffalo, N. Y.
Epping Carpenter Works, Pittsburgh, Pa.

Located in the principal manufacturing districts of the United States they afford unusual facilities for the prompt shipment of pumping machinery and equipment.

In addition to the regular lists, this corporation has on hand many odd patterns originally built to suit unusual or peculiar conditions, and is equipped to build special pumps of any size and for every purpose.

Duplex Piston Pump.

For all general purposes where water pressure does not exceed 150 to 200 lbs. per sq. in. and where a direct acting steam pump is the proper installation. Piston pattern pumps are designed for boiler feeding, tank supply, fire, hydraulic elevators and small water works service. The removable lining pattern has been designed for severe service—where the pump is subjected to unusual wear, owing to the presence in the water of large quantities of grit, or due to any cause.



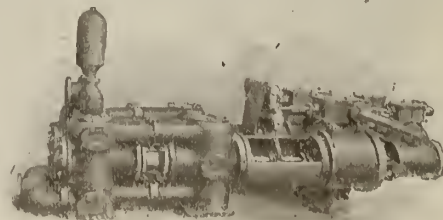
DUPLIX PACKED PISTON PUMP
SIZES AND CAPACITIES, WORTHINGTON DUPLIX PISTON PUMPS

Fig. No.	Diam. steam cyl., in.	Diam. water piston, in.	Stroke	Gals. per stroke each piston	Single strokes per min. each piston	Gals. per min.	Pipes, in.				Length, ft., in.	Width, ft., in.
							Steam	Exhaust	Suction	Delivery		
1	2	1 1/4	23 1/4	.014	160	4.5	3/8	1/2	1	3/4	1 9	0 7
2	3	2	3	.039	160	12.5	3/8	1/2	1 1/4	1	2 0	0 9
3	4	2 1/2	4	.065	150	19	3/8	3/4	1 1/2	1 1/4	2 4	0 9
4	5	3	5	.098	150	29	1/2	3/4	2	1 1/2	2 9	1 1
5	6	4	6	.201	140	56	1/2	3/4	2 1/2	1 1/2	3 2	1 4
6	8	5 1/2	8	.310	130	80	1	1 1/4	3	2	3 8	1 5
7	10	7	10	.485	130	126	1 1/2	2	4	3	3 9	1 10
8	12	8 1/2	12	.654	96	132	1 1/2	2	4	3	4 11	1 10
9	14	10	14	.900	96	173	2	2 1/2	4	3	5 1	1 11
10	16	12	16	1.175	96	225	2	2 1/2	5	4	5 2	2 2
11	18	14	18	1.62	96	310	2	2 1/2	6	5	5 0	2 2
12	20	16	20	1.94	90	350	2	2 1/2	6	6	6 4	2 7
13	22	18	22	1.94	90	350	2 1/2	3	6	6	6 6	2 9
14	24	20	24	2.87	90	515	2	2 1/2	6	6	6 4	2 7
15	26	22	26	2.87	90	515	2 1/2	3	6	6	6 6	2 9
16	28	24	28	2.87	90	515	2 1/2	3	6	6	6 7	3 4
17	30	26	30	4.09	90	735	2 1/2	3	8	7	6 10	3 1
18	32	28	32	4.09	90	735	2 1/2	3	8	7	6 10	3 4

Outside Packed Plunger Pumps.

These pumps are designed for rough and heavy service, for working pressures 140 to 250 lbs. per sq. in., and where it is important that the moving parts can be quickly removed.

Capacity up to 5650 gals. per minute.

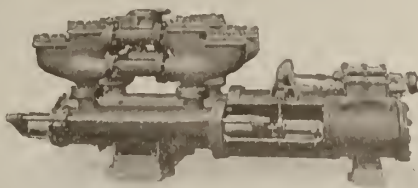


COMPOUND PACKED PRESSURE PUMP
Seranton pattern; 250 lbs. pressure

Pot Valve Pressure Pump.

Designed for high pressure boiler feeding and other

services requiring high water pressure. Good for 300 lbs. working pressure. Other pumps of this type are furnished for pressures up to 2000 lbs. per sq. in., suitable for hydraulic press work, steel mills and similar uses. Special pumps will be built for any service.



PRESSURE PATTERN BOILER FEED PUMP

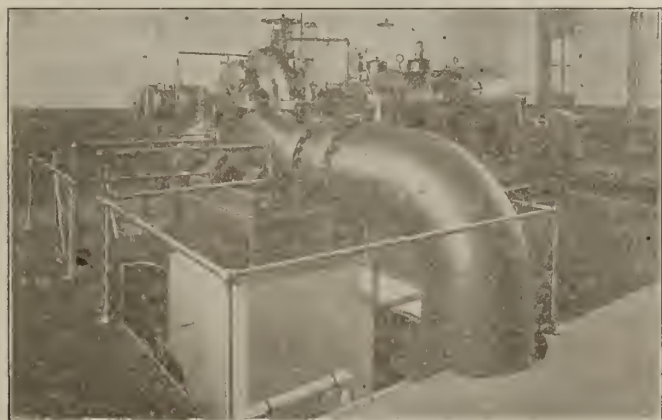
Volute Centrifugal Pumps.

Built in three standard designs: the single side suction type, the double suction solid case type, and the double suction pump with horizontal split casing. Single suction pumps give best results when operating at heads under 80 ft. Double suction pumps in standard sizes range from 1- to 24-in. discharge; special pumps to 54-in. discharge. They are suitable for operating heads up to 200 ft. The pumps may be used for a great variety of purposes: the most important of which are water works service, sewage pumping plants, dry dock pumps, irrigation and drainage service.



60-IN. DOUBLE SUCTION VOLUTE PUMP

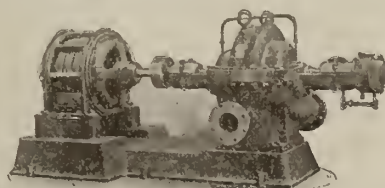
Circulating pumps for surface and barometric condensers, paper mills, sugar factories, etc. Pumps can be arranged for direct drive from steam and oil engines, and from electric motors. They can also be arranged for belt or chain drive. Standard sizes range from 3- to 24-in. discharge; special sizes up to 60-in. discharge.



STEAM TURBINE DRIVEN PUMP ENGINE INSTALLED AT NEW HAVEN WATER COMPANY

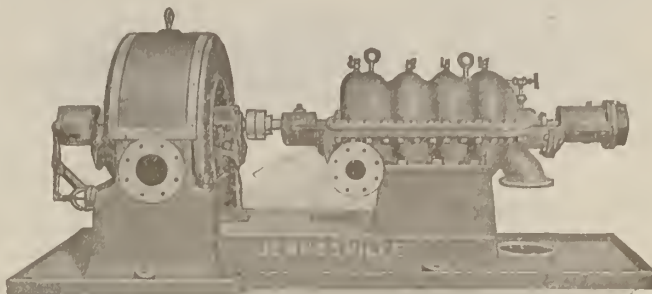
Turbine Centrifugal Pump.

This type of pump is now universally accepted by the best engineers for all services where it is desired to de-



6-IN. TWO-STAGE CENTRIFUGAL PUMP

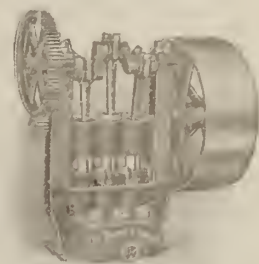
liver water against high heads. These pumps are designed for operating by high speed motors or steam turbines and are particularly adapted for water station pumps, for mine water drainage, hydraulic mining, boiler feed service, underwriters' fire pumps, municipal high pressure fire service, etc.



THREE-STAGE DOUBLE SUCTION TURBINE CENTRIFUGAL PUMP

Deane Power Pumps.

Power pumps of every type are built for every conceivable purpose. These pumps are strong and durable. The designs are such that maximum strength, rigidity and durability are obtained with minimum wear.



TRIPLEX SINGLE ACTING PUMP

Simplex Feed Pumps.

SINGLE HORIZONTAL PISTON PUMPS—This company manufactures a full line of both horizontal and single steam pumps equipped with the well-known Blake, Model "A," simplex steam valve gear.

These pumps are simple, compact, accessible and durable machines, having large direct water passages and full valve areas, which reduce water friction to a minimum and particularly adapt the pumps for boiler feeding.

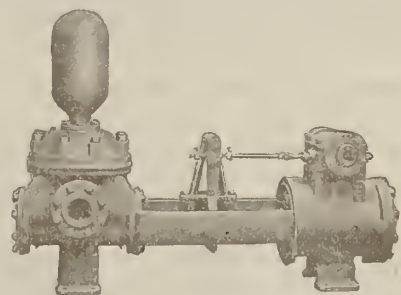
All parts of the pumps are interchangeable and can therefore be readily duplicated in case of accidental breakage or unusual wear.

Maximum working pressure: steam end, 250 lbs.; water end, 250 lbs.

VERTICAL VALVE POT TYPE PISTON PUMPS—This pump is a vertical direct acting type, equipped with Simplex Style "A" steam valve gear. Water end is double acting piston type having cylindrical or pot valve form of valve chambers. Made in a large range of sizes and capacities.

Special pumps are made with different combinations of steam and water cylinders adapted to individual conditions.

These pumps are especially adapted for marine service.



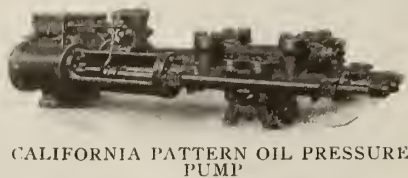
SINGLE HORIZONTAL BOILER FEED OR PRESSURE PISTON PUMP
Size, 7½ x 4½ x 10 in.



VERTICAL SIMPLEX PISTON PUMP VALVE POT TYPE
Size, 14 x 10 x 24 in.

Oil Pressure Pumps.

The California pattern is especially designed for handling oils of high viscosity, such as are found in the California and Mexican oil fields, that frequently require heating in order to minimize excessive pipe friction. They are intended for working pressures from 500 to 600 lbs. per sq. in., and can safely withstand shock pressures of 800 lbs.



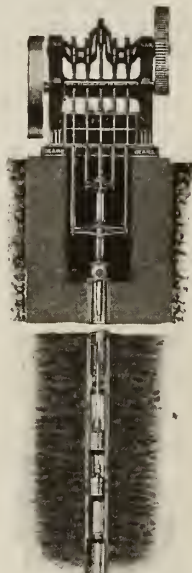
CALIFORNIA PATTERN OIL PRESSURE PUMP

Deep Well Pumps.

The Glendora pump is unexcelled for deep well pumping in connection with municipal supply, irrigation, railroad tank service, office and factory buildings, paper mills, ice making plants and packing houses. It can be used in connection with any well 8 in. in diameter and above, and is most particularly applicable in deep wells where the service is severe and continuous.

Briefly stated the advantages of the Glendora type are:

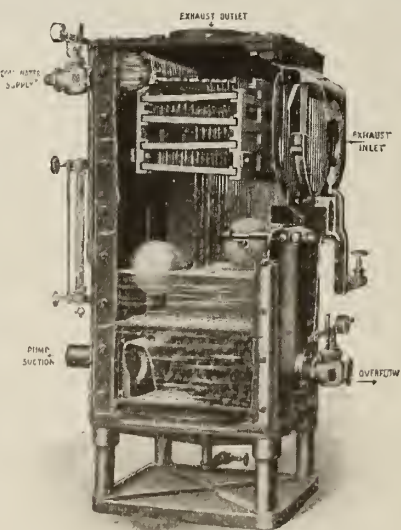
Larger capacity from a given well than any other reciprocating pump; high mechanical efficiency; uniform, continuous flow of water in riser pipe; uniform load on prime mover; small engine or motor required to operate; absolute reliability; low operating cost; low maintenance cost; ability to discharge directly into mains; accessibility; heavy substantial construction.



GLENDORA DEEP WELL PUMP

Open Feed Water Heater.

The Blake-Knowles open feed water heater consists of a vertical, rectangular tank, comprising oil separator, heater, purifier, filter and receiver, in which cold water and exhaust steam are brought together in direct contact. The oil separator, which is made a part of the heater, effectively extracts all the oil present in the incoming exhaust steam. The cold water supply and overflow are controlled by floats and balanced valves. The boiler feed pump suction is arranged to draw off filtered and purified water only. This heater is particularly adaptable for heating systems, and wherever it is desired to pipe the return water direct to the heater.



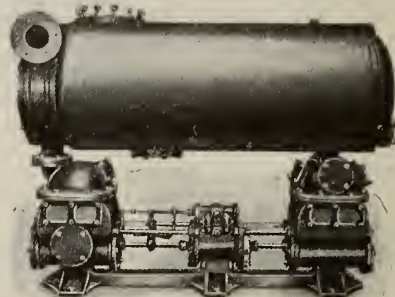
SECTIONAL VIEW OF OPEN FEED WATER HEATER
Type 100 to 400 h.p.

Cylindrical types are also made where headroom will not permit rectangular type.

Surface Condensing Apparatus.

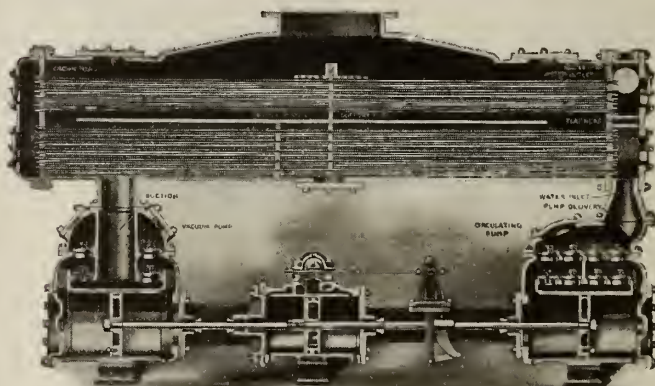
The largest and most important power plants in the United States—the plants which hold and are establishing new records for economical production of power, cost of operation and maintenance—are equipped with Worthington condensing apparatus.

The Worthington Company was the pioneer in the development of surface condensers for use in connection with steam turbines. The success with this type of apparatus has been due to the very careful consideration given to every phase of the problem present, but especially to the fact that this company alone, correctly analyzed the various attending phenomena, and from the very outset adopted the system and type of apparatus which has now become the standard for all builders of condensing apparatus.



WORTHINGTON SURFACE CONDENSER

Mounted on single combined air and circulating pump



SECTIONAL VIEW OF SURFACE CONDENSER
Mounted on single combined air and circulating pump

Jet Condensers.

The Worthington Company manufactures every type of jet condensing apparatus in use, including both the spirojector and ejector types, as well as the barometric type.

The latter is constructed of both the parallel and the counter current types.

All other condensers are of the counter current type.

Various so-called centrifugal jet condensers are also manufactured, in which a jet condenser is mounted directly on a centrifugal pump, which removes condensed steam and condensing water and delivers them to the desired point.

Apparatus of this type is operating satisfactorily with units up to 5000 kw. capacity.



COUNTER CURRENT JET CONDENSER



EJECTOR CONDENSER

Water Meters.

Worthington meters are built in three general types : the disc pattern, the turbine pattern and the duplex piston pattern, with variations of each type designed to suit particular conditions.

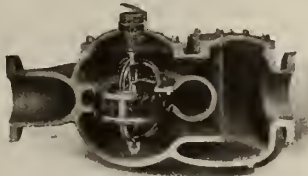
STANDARD FLAT DISC METER—The construction of this meter embodies the results of a wide experience. The disc spindle measuring chamber, abutment plate, interior screws (there are only



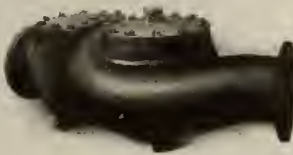
MODEL G., WORTHINGTON METER
Made in sizes 5/8, 3/4 and 1 in.

two), and the train of moving parts are of non-corrosive monel metal the natural alloy. These parts are those most subject to chemical action of acidulous or alkaline water, and this method is the only insurance against such chemical action. This train will outwear any other form or make of train gearing hitherto manufactured.

TURBINE METER—The Worthington turbine meter is a development of the Worthington turbine pump. It is of the current or velocity type, designed primarily to handle large volumes of water with minimum loss of pressure. The wheel is surrounded by a chamber of the volute pattern, providing at all points of the circumference the proportional cross-sectional area required for the volume of water discharge by the wheel. This form of casing reduces frictional losses by avoiding sudden changes in direction of flow. The wheel is of hard rubber, practically the specific gravity of the water, and is carried on a tobim bronze shaft which has a monel metal pivot turning on a sapphire jewel.



SECTION THROUGH 6-IN. TURBINE METER



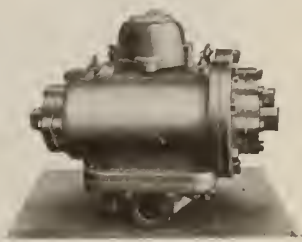
VELOCITY TURBINE PATTERN

Standard meters suitable for 150 lbs. Pressure meters Nos. 2, 3, 4 and 6, for pressures up to 250 lbs.

SIZES AND CAPACITIES, TURBINE WATER METERS												
Sizes	Gals. per min.		Over all dimensions, in.			Flanges			Weight, lbs.			
	Normal capacity	Maximum capacity	Length	Width	Height	Diam., in.	Holes	Size of holes, in.	Net	Skidded	Crated	Boxed
2-in.	150	240	16 3/4	9	12 1/2	capped	4	3/8	80	105	110	
3-in.	330	540	24	12	13	7 1/2	4	3/8	160	180	195	210
4-in.	600	960	27	16	16	9	8	3/8	250	280	305	325
6-in.	1300	2100	36	22	20	11	8	3/8	475	515	560	595
8-in.	2350	4000	48	29	20	13 1/2	8	3/8	875	955	975	1025
10-in.	3700	6000	60	35	29	16	12	1	2000	2100	2160	2225
12-in.	5300	7500	70	42	31	19	12	1	2400	2525	2625	2700

DUPLEX PISTON METER—This type of meter is especially adapted for measuring crude oil, petroleum, etc., and recording amount used in connection with oil burn-

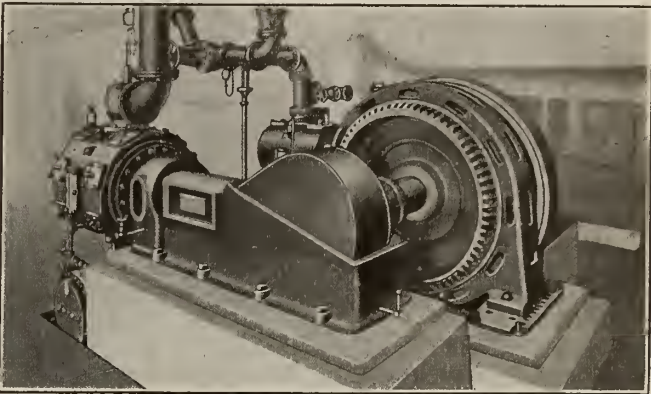
ing apparatus. This type of meter is also essential to the proper testing of the boiler plant. For this purpose, the duplex piston meter should be connected on a by-pass so that the meter may be thrown in and out of service as desired without interrupting the flow of water to the boilers.



For the continuous measuring of large volumes of hot boiler feed water under pressure, the Worthington turbine hot water meter is recommended. Made in 8 sizes from 1/4 in. to 6 in. Capacity, 1 to 220 gals. per minute.

Feather Valve Compressor for Air, Gas and Ammonia.

Direct connected motor driven compressors designed for high rotative speed. Liberal bearing surfaces, increased pin sizes, greater strength of running gear and a volume regulator of great simplicity and high efficiency are provided to take care of requirements imposed by



100-CU. FT. FEATHER VALVE COMPRESSOR
Size, 18 x 11 x 14; speed, 257 r.p.m.

high speed. The Feather (Reg. U. S. Patent Office) valve adopted after years of investigation has, however, been the most important factor in the success of the Feather valve compressors. This valve consists of light strips of steel restrained but not rigidly secured at the end, and free to lift from the seat, in the middle, to permit the passage of air. The valve has no springs and no point of rigid contact. It seats by contact and not by impact so that the closing instead of being noisy and destructive, becomes merely an increase in the point of contact.



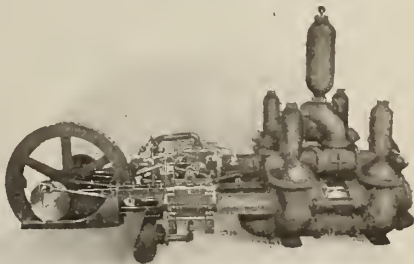
Completely Assembled



Showing Detailed Construction
FEATHER VALVE

Corliss Pumping Engines.

The Worthington high duty Corliss engines are adapted and used for every form of hydraulic pumping in which it is desired to do the work with a minimum cost of fuel con-



CORLISS PUMPING ENGINE INSTALLED
FOR CORN PRODUCTS CO., ARGO, ILL.
Size, 27 x 13 3/4 x 24; capacity, 5,000,000 gals.

sumption. Engines of this type are being used in water works plants; furnishing hydraulic power in steel mills, rolling mills and furnace works; oil pipe line pumping, general mine pumping.

These engines are completely built in the company's own shops. In this way, knowing best the conditions and requirements to be met, an engine perfectly adapted to do the work is produced.

Crushers.

SUPERIOR McCULLY GYRATORY (PATENTED)—These crushers are capable of receiving and crushing the hardest rock or ore of any size that can be handled by the dipper of the largest steam shovels. When handling rock of this class its function is that of a preliminary crusher.

Force feed lubrication to eccentric; cut steel gears; main shaft 100% stronger than standard gyratories. Other models of the Superior McCully crushers are built to crush rock to pass through $\frac{3}{4}$ -in. ring.

Capacities, 4.5 to 1500 tons per hour, depending on size of crusher and the ring size of material crushed.

Receiving openings range from 8 to 72 in.; weight, 700 to 900,000 lbs.

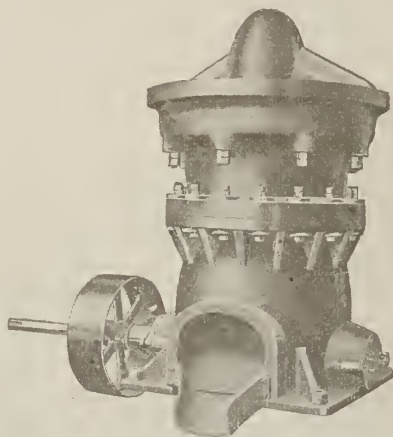
JAW CRUSHERS—Superior—Crusher for coarse and intermediate crushing. Size of jaw openings, 36 by 24 in. to 84 by 66 in. Capacity, 70 to 600 tons per hour, depending on size of crushers and ring size of rock crushed.

All main bearings water cooled and easily removable for renewal.

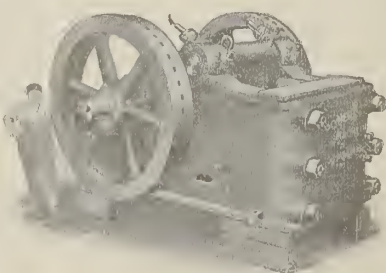
Dodge—Crusher for uniform and medium fineness. The jaw being hinged at the bottom, the greatest movement is at the top.

This is directly opposite in principle to the Superior crusher in which the jaw is hinged at the top and has its greatest movement at the bottom. Size, 7 by 9 in. to 10 by 16 in. Ring size of crushed material $\frac{1}{2}$ to $1\frac{1}{2}$ in.

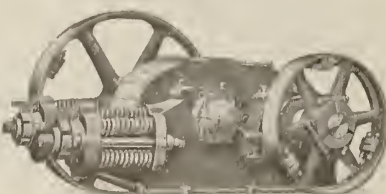
GARFIELD ROLLS—For re-crushing oversize from preliminary crushers. Require less power to produce large quantities of comparatively finely crushed stone or ore than any other type of re-crushing machine. Sizes, 36 by 12 in. to 72 by 24 in. Used extensively for hard and continuous service by large iron ore and copper mining companies.



36-IN. SUPERIOR McCULLY CRUSHER



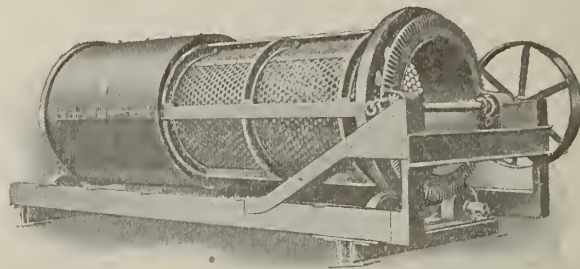
SUPERIOR JAW CRUSHER
36 by 24 in.



GARFIELD CRUSHING ROLL

Crusher Screens.

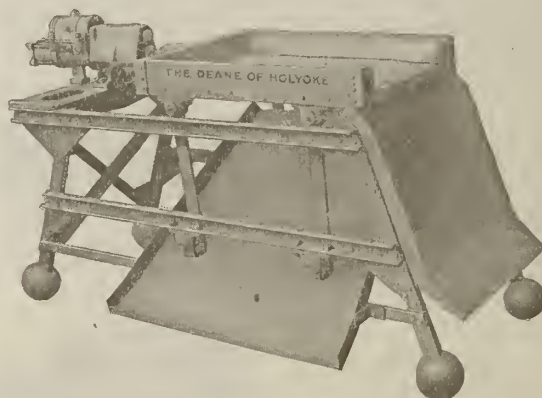
Of heavy construction to handle the large pieces and enormous quantities of material discharged by jaw crushers. These screens are of the open end type, having no obstruction of any kind to impede the discharge of the material, and there are, therefore, a minimum number of parts subject to wear, and those that do wear can be easily and cheaply replaced.



STANDARD PIPE STRUT BAR SCREEN
Made in sizes 48 to 108 in. diameter and 8 to 30 ft. long

Sand Riddlers.

Rugged simplicity, high efficiency and enormous screening capacity of the Deane power riddlers have won for them an enviable reputation for use in construction work. The rectangular portable type here illustrated is capable of riddling 1 cu. yd. of sand in 5 minutes. On the saving in labor cost alone this machine will pay for itself in a very short time.



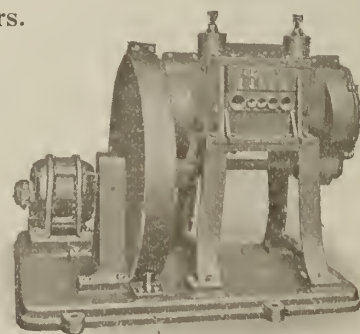
DEANE SAND RIDDLER

Core Wire Straighteners.

For straightening wire reclaimed from used cores.

A very simple and durable machine constructed of cast iron with working parts of forged steel. Can be operated at a very low cost by most unskilled labor.

Made in sizes to straighten wires from $\frac{1}{16}$ to $\frac{3}{4}$ in. in diameter.



CLIMAX CORE WIRE STRAIGHTENER

Oil Engines.

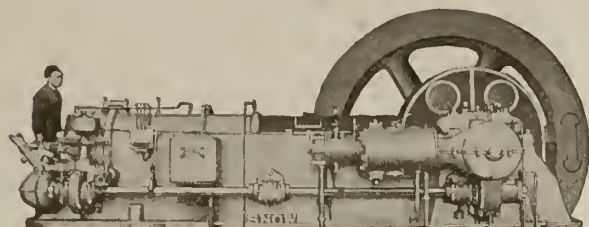
Of the high compression or Diesel cycle. The operation shows economies that greatly exceed those obtained by gas engines, steam engines or any other type of prime mover. The heaviest and cheapest oil that can be used for fuel. Only pure air is compressed and combustion takes place at a practically constant pressure.

In the four-stroke cycle used in the "Snow" oil engine, the sequence of events is as follows:

(1) Suction stroke. The piston travels out and pure air is drawn into the cylinder through the main inlet valve.

(2) Compression stroke. On return, stroke is compressed reaching a pressure of 480 lbs.

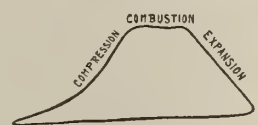
(3) Expansion stroke. Slightly before the beginning of the expansion stroke the spray valve opens, and the fuel is injected in a finely divided spray by means of compressed air at from 800 to 1000 lbs. pressure (55 to 70 atmospheres). The ignition and burning of the fuel



SINGLE CYLINDER ENGINE, 150 H.P.



NORMAL INDICATOR CARD



INDICATOR CONNECTED TO ROTATE 90° IN ADVANCE OF ENGINE CRANK, THEREBY INCREASING LENGTH OF CARD AT TIME OF ADMISSION OF FUEL

maintains the pressure at that of the maximum compression for a period depending on the load the engine is carrying. After the fuel is burned, and as the piston travels forward, the resulting mixture expands and the pressure falls gradually to the end of the stroke.

(4) Exhaust stroke. During the next stroke the exhaust valves open and the production of combustion escapes from the cylinder.

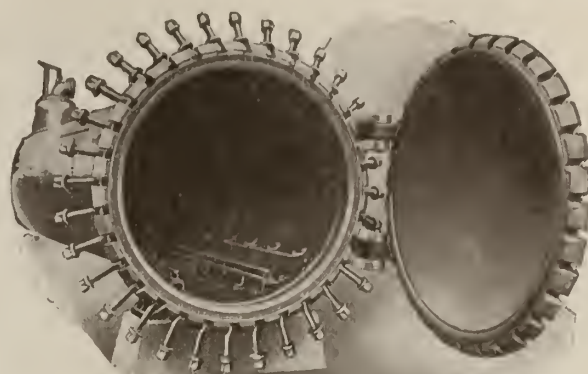


DEANE FORGED END HORIZONTAL POWER PUMP FOR OIL LINE HEAVY PRESSURE WORK

Wood Preserving Machinery.

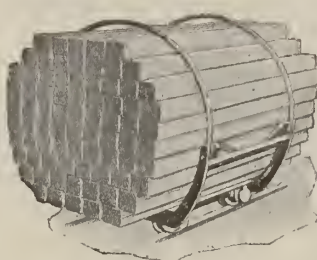
This company manufactures complete wood preserving plants consisting of:

Steel impregnating cylinders or retorts; steel storage, charging, measuring, underground and emptying tanks; tie, block and bolster cars for handling the timber in and out of retorts; vacuum pumps and condensers either of the direct acting or flywheel pattern, for withdrawing the moisture and sap and surplus preservatives; general service or tank pumps for transferring the preserving fluids from tanks to retorts; pressure pumps for injecting the preservatives into the wood cells; centrifugal pumps for transferring preservative and for circulating and agitating hot creosote oil and zinc chloride, as demanded by the Card process; air compressors for blowing back the oil from retorts to tanks and for agitating and impregnating purposes; underwriter fire pumps for fire protection; feed pumps for feeding the boilers; feed water heaters of the open and closed pattern, for preheating boiler feed water, and such other equipment that goes to make up a complete plant.

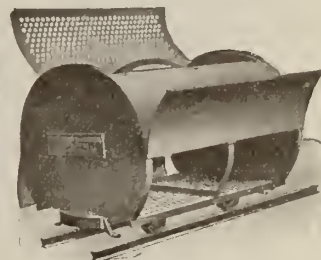


IMPREGNATING RETORT

Standard form of retort is a hollow cylinder 6 to 9 ft. in diameter and from 50 to 150 ft. long. Built of extra heavy steel plate and fitted with steel doors at both ends. Track laid in cylinder as shown above



RAILROAD TIE CAR



PAVING BLOCK CAR

Ingeco Engines.

Oil, gas, gasoline and kerosene engines are manufactured by this company ranging in sizes to accommodate every need. The following is a partial list of the Ingeco engines with their sizes and uses:

1 h.p. Ingeco type "W" gasoline engine with built-in magneto.

1 3/4 h.p. Ingeco type "W" gasoline engine with oscillating magneto and speed regulator.

Ingeco type "W" throttling governor kerosene, distillate, gasoline and gas engines 3 to 15 h.p. with oscillating magneto. Most reliable and economical for general service, electric storage battery work, factory, foundry, feed mills, elevator, shops or farm.

Ingeco type "W" industrial engines, 10 and 15 h.p. for grain elevator and other industrial service.

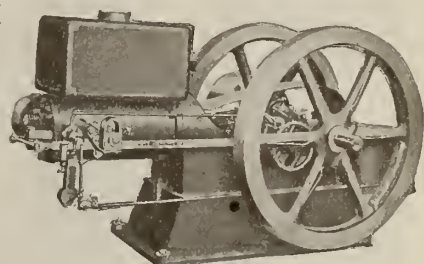
Ingeco portable engines, hand and team trucks, 1 to 25 h.p.

Ingeco standard horizontal engines 6 to 160 h.p. with oscillating magneto. Operate on oil (39° Baume), kerosene, distillate, gasoline and gas, for general power and electric light service.

Ingeco oil country type gas engines, 35 to 160 h.p. with kilowatt high tension magnetos.

Ingeco semi-Diesel 2-cycle crude oil engines, 10 to 120 h.p. horizontal type.

Ingeco combined pumps and geared base engines for deep wells. Pumping engines in all sizes and modifications.



INGECO TYPE "W" ENGINE

Kerosene-oil-distillate-gasoline throttling governor. Illustrating 8, 10, 12 and 15 h.p. sizes

YEOMANS BROTHERS COMPANY

Sewage Ejectors and Pumping Machinery

1420 Dayton Street

CHICAGO, ILL.

REPRESENTATIVES

BOSTON, POWER EQUIPMENT Co., 131 State Street
 NEW YORK, E. A. JULIE, 51 East 42nd Street
 PHILADELPHIA, C. C. ENDERLE, 621 Commercial Trust Building
 PITTSBURGH, C. D. BUSHNELL, Park Building
 CLEVELAND, CLEVELAND PUMP & SUPPLY Co., 427 Guardian Building
 DAYTON, CHAS. M. KELSO Co., Reibold Building
 UTICA, N. Y., CHAS. M. KELSO Co., Jones Building
 DETROIT, POWER PLANT SUPPLY Co., Penobscot Building
 MINNEAPOLIS, HEALY-RUFF Co., Plymouth Building
 OMAHA, McCULLEY, WIDENER & WRIGHT, W. O. W. Building
 KANSAS CITY, McCULLEY, WIDENER & WRIGHT, 303 East 10th Street
 PORTLAND, ORE., GORDON & FINKBEINER, 224 Pine Street
 SEATTLE, A. H. COX & Co., 307 First Avenue, South

SAN FRANCISCO, CALIFORNIA HYDRAULIC ENGINEERING & SUPPLY Co., 70 Fremont Street
 LOS ANGELES, F. C. MILLARD Co., Marsh-Strong Building
 HOUSTON, TEX., ROSSITER & SANER, Union National Bank Building
 NEW ORLEANS, BRIAN & POWERS, Canal Bank Building
 SALT LAKE CITY, HAWLEY - RICHARDSON - WILLIAMS Co., Dooly Building
 BUTTE, MONT., C. H. COBB, Daly Bank Building
 CHARLOTTE, N. C., J. R. PURSER, Commercial Bank Building
 ATLANTA, GA., HALL & SMITH, Third National Bank Building
 MONTREAL, TORONTO, WINNIPEG, CALGARY, DARLING BROTHERS, LTD.
 VANCOUVER, B. C., FRANK DARLING & Co., 1142 Homer Street

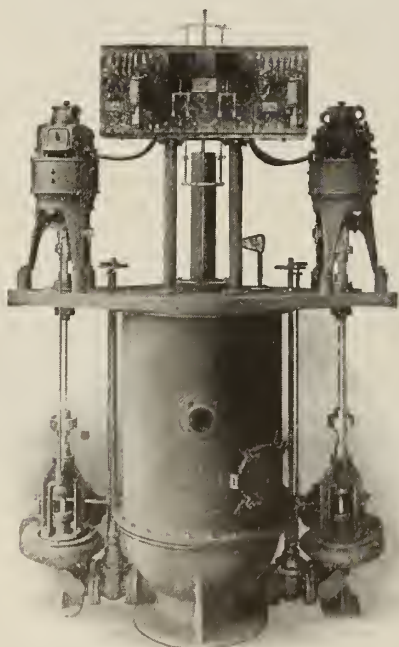
Products.

YEOMANS FORM "A" DUPLEX CENTRIFUGAL ELECTRIC SEWAGE EJECTORS; SHONE PNEUMATIC SEWAGE EJECTORS; YEOMANS SINGLE and DUPLEX ELECTRIC BILGE or SUMP PUMPS; YEOMANS HOUSE PUMPS; CONDENSATION RETURN PUMPS.

Also, Pumping Machinery for all purposes.

Yeomans Form "A" Sewage Ejector.

A duplex equipment consisting of two special vertical centrifugal pumps operating in dry pit, connected to cast iron sewage receiver and driven by direct con-



FORM "A" DUPLEX EJECTOR

nected vertical motors mounted on receiver cover, equipped with automatic controllers, high water alarm, pit drainage connections, cast iron bar screen of large area, gate and flush back check valves. Pumps arranged so that top plate can be raised without disturbing shafting, bearings or impellers. No accumulation of solids in receiver; minimum space requirements; high efficiency; noiseless; sanitary and reliable.

DATA, FORM "A" DUPLEX SEWAGE EJECTORS

No.	G. p. m. each unit	Pit diameter	Depth of pit below inlet
3	100-125	8 ft.	4 ft.
4	150-200	8 ft.	4 ft.
5	250-350	8 ft.	4 ft.
6	400-500	10 ft.	5 ft.

Shone Pneumatic Sewage Ejector.

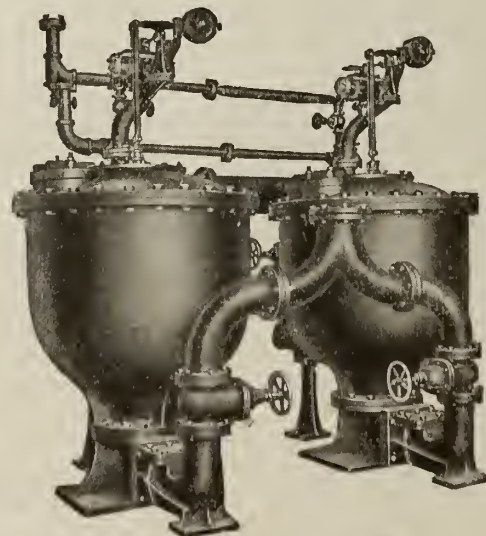
The Shone ejector has been in successful service in all parts of the world for over 35 years. First installation in this country in 1888 is still in service.

At the World's Fair in Chicago in 1893, 52 Shone ejectors handled all sewage.

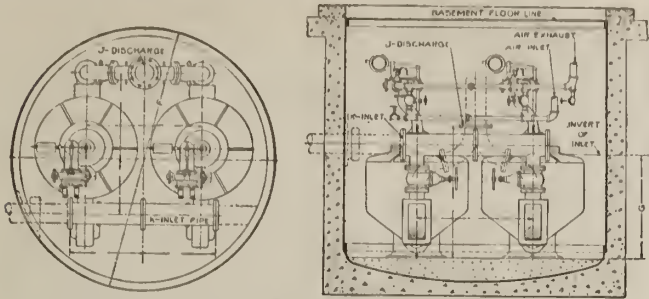
Unequalled for substantial design, durability, economy and reliability in operation. No screens required; bottom discharge and no accumulation of solids; special non-clogging check valves; no airtight floats; bronze, pressure operated, quick acting piston type automatic air valves.

Furnished with either motor or steam driven air compressors.

Compressors can be located at any desired distance from ejectors. Ejectors can be operated from air supply maintained for general purposes in industrial plants. Especially recommended for municipal work.

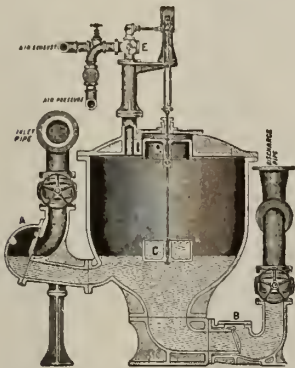


250-GALLON SHONE DUPLEX EJECTOR



DIMENSION DIAGRAM OF SHONE DUPLEX EJECTOR

G. p. m. each unit	G	SINGLE EJECTORS			DUPLEX EJECTORS	
		F	J	K	F	J and K
50	3'-1"	6'	4"	6"	8'	6"
100	3'-7"	7'	5"	6"	9'	8"
150	4'-5"	7'	5"	6"	9'	8"
200	5'-10"	8'	6"	8"	11'	8"
250	6'-5"	8'	6"	8"	11'	8"
300	7'-0"	8'	6"	8"	11'	8"
400	7'-3"	13'	12"	12"	14'	12"
500	8'-0"	13'	12"	12"	14'	12"
600	8'-9"	13'	12"	12"	14'	12"
750	8'-0"	14'	14"	14"	16'	14"
1000	9'-0"	14'	16"	16"	16'	16"



SHONE EJECTOR, SECTIONAL VIEW

Yeomans Single Electric Bilge Pumps.

Automatic, self-contained, heavily constructed, slow speed machines, with submerged centrifugal pumps, vertical direct connected motors and automatic controllers for handling waste water and sewage.

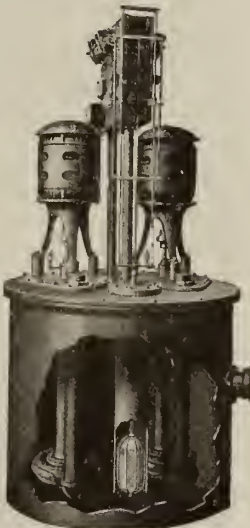
Built in two grades: Grade 1 pumps operating at slow speeds and equipped with high water alarm, pipe casing for float, force feed lubricated bearings, etc. Grade 2, moderate speed.

DATA, SINGLE ELECTRIC BILGE PUMPS

No. 1 1/2	15-25 g.p.m.	24-in. diam. basin
No. 1	35-50 g.p.m.	36-in. diam. basin
No. 2	50-75 g.p.m.	36-in. diam. basin
No. 3	100-125 g.p.m.	36-in. diam. basin
No. 4	150-200 g.p.m.	36-in. diam. basin
No. 5	250-350 g.p.m.	48-in. diam. basin
No. 6	400-500 g.p.m.	48-in. diam. basin



GRADE 1 BILGE PUMP



YEOMANS DUPLEX ELECTRIC BILGE PUMP

Yeomans Duplex Electric Bilge Pumps or Submerged Type Sewage Ejectors.

Construction similar to single bilge pumps; units

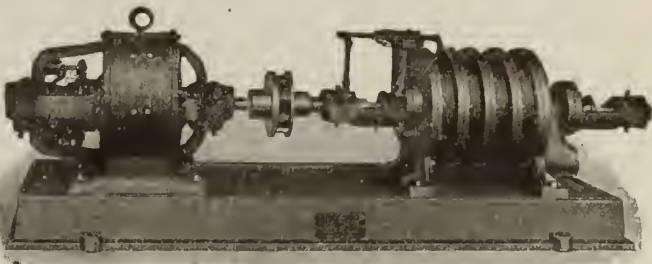
arranged so that one can be removed without disturbing the other.

Capacities per unit same as single bilge pumps.

Basin diameters: Nos. 1 and 2, 36 ins.; No. 3, 48 ins.; Nos. 4 and 5, 60 ins.

Yeomans Centrifugal House Pumps.

Most improved type, single and multistage, high efficiency, quiet running pumps with ring oiled, water cooled external shaft bearings, perfectly balanced rotors, flexible couplings. Special attention given to noiseless pumps for high class apartment buildings, residences and hotels. Complete automatic equipments furnished for either roof tank or compression tank service, any capacity.



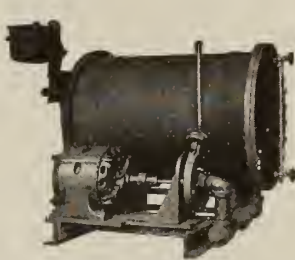
YEOMANS MULTISTAGE CENTRIFUGAL HOUSE PUMP

Yeomans Condensation Return Pumps.

High grade equipments consisting of cast iron receiver with water glass, direct connected centrifugal pump and motor, all on one base, enclosed quick break butt contact automatic switch, seamless copper float and protective devices.

TYPE "H" PUMPS—For returns above basement floor level.

TYPE "V" PUMPS—For returns close to or below basement floor.



TYPE "H" CONDENSATION RETURN PUMP



TYPE "V" CONDENSATION RETURN PUMP

DATA, TYPES "H" AND "V" CONDENSATION RETURN PUMPS

No.	G. p. m.	Maximum sq. ft. direct radiation
1	5	1,000
2	10	3,000
3	15	6,000
4	20	10,000
5	30	15,000
6	60	30,000

References.

Yeomans pumps and Shone ejectors have been in service in important city buildings, industrial plants and municipalities for many years. Installations can be referred to in all parts of the world.

A. D. COOK

Deep Well Pumps, Strainers and Accessories

LAWRENCEBURG, IND.

Products.

Manufacturer of COOK PATENT BRASS TUBE WELL STRAINERS; DEEP WELL PUMPS, Single and Double Stroke, Steam, Belt and Motor Driven.

Also, Cylinders (Working Barrels), Check Valves, Sucker Rods, Well Tools and Accessories.

Brass Tube Well Strainers.

The Cook strainer offers the most direct passage from sand stratum into the well, while the area of opening per lineal foot is equal to or greater than that of any other strainer. The absence of pockets for lodgment of sand and the low friction due to free passages materially increase the efficiency of this strainer.

CONSTRUCTION—The outstanding superiority of the Cook strainer is found in its strong integral construction. It is made from special hard drawn seamless brass tubes coupled securely to any desired length. Where electrolysis or mineral contents of the water would pit the strainer by attacking the zinc in the brass tubes, the tubes are made of pure copper, free from zinc.

The slots are milled uniformly and accurately from the inside of the metal tube. They are wider on the inside than on the outside, preventing choking up by allowing the free passage of any particle which enters through them.

The length of the strainer is governed by the conditions of drilling, pumping and well construction.

Bulletin No. 30 giving full details of the Cook strainer will be sent on request.



WELL STRAINER WITH STANDARD FITTINGS

GAUZE NUMBER EQUIVALENTS

Gauze number.....	120	100	90	80	70	60	50	40	30	20
Slot number.....	4	5	6	7	8	10	14	20	25	40

MAY 1, 1919 DATA AND PRICE LIST COOK STRAINERS

Nominal size (inside diam. of well pipe) in.	Price		Diameters			Approx. weight per ft., lbs.	Swedge block and bar (used for expanding lead packer)	
	Strainer per ft.	Standard fittings	Outside, in.	Through packer, in.	Through coupling, in.		Price	Weight, lbs.
2	\$4.25	\$3.00	1 7/8	1 1/2	1 1/4	3	\$6.00	3
2 1/2	5.00	3.50	2 1/4	1 3/4	1 1/2	3 1/4	7.00	4
3	6.00	5.00	2 3/4	2 1/4	2 1/4	3 1/2	8.00	7
3 1/2	6.75	6.00	3 1/4	2 3/4	2 3/4	5	9.00	10
4	8.00	8.00	3 3/4	3 3/8	3 3/8	6 1/2	10.00	14
4 1/2	9.25	8.50	4 1/4	3 3/8	3 3/8	7	11.00	17
5	10.00	9.50	4 1/2	3 7/8	3 7/8	8 1/2	12.00	21
6	12.50	14.00	5 1/2	4 7/8	4 3/4	10	13.00	30
7	16.00	17.00	6 1/2	5 7/8	5 3/4	15	14.00	40
8	19.00	21.25	7 1/2	6 7/8	6 3/4	16	15.00	50
9	22.25	26.00	8 1/2	7 3/4	7 3/4	18		
10	27.75	35.00	9 1/2	8 3/4	8 3/4	20	20.00	75
12	39.25	52.50	11 3/4	10 3/4	10 3/4	30	25.00	100
14	52.00	75.00	13 3/4	12 3/4	12 1/2	35	30.00	
15	56.50	98.00	14 1/4	13 1/4	13 1/4	40	35.00	146

A 6-in. 15-ft. strainer lists as follows:

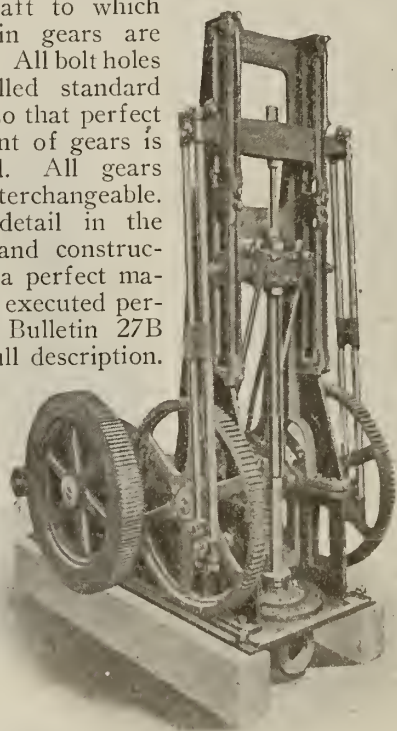
15 ft. of strainer at \$12.50..... \$187.50
Standard fittings..... 14.00

\$201.50

Double Stroke Deep Well Pump.

OPERATION—The double stroke pump head actuates two plunger valves in the working barrel, one lifting water while the other is filling. The upper plunger is attached to the lower crosshead of the pump head by a line of hollow rods and the lower plunger is attached to the upper crosshead by a line of solid rods, the rods being furnished in matched weights and lengths.

DISTINCTIVE FEATURES—The center of gravity is down close to the base plate, causing the pump to operate without vibration and eliminating any tendency toward top-heaviness, also rendering the pump more accessible for oiling and inspection. The crank shaft is a crucible nickel steel casting, heat treated, with flanges integral with shaft to which the main gears are bolted. All bolt holes are drilled standard to jigs so that perfect alignment of gears is obtained. All gears are interchangeable. Every detail in the design and construction of a perfect machine is executed perfectly. Bulletin 27B gives full description.



SIZE 2L DOUBLE STROKE DEEP WELL PUMP DIRECT (CONNECTED TO 15 H.P. ELECTRIC MOTOR)



ALL BRASS WORKING BARREL

DATA, DOUBLE STROKE DEEP WELL PUMPS

Working barrel		Cap. U. S. Gal. (Actual plunger displacement)		Size of drop pipe, in.	Diam. smallest size well that drop pipe will go in, in.	Size no. of pump rod
Inside diam., in.	Length of tube, in.	Per rev.	At 30 r.p.m.			
3 3/4	84	1.72	51.6	4	5 5/8	1 1/2
4 1/4	84	2.21	66.3	4 1/2	6	1 1/2
4 1/2	84	2.47	74.1	*4 3/4	6	1 1/2
4 3/4	84	2.76	82.8	5	7	2
5 1/4	84	3.37	101.1	*5 5/8	7	2
5 3/4	84	4.04	121.2	*6 1/4	8	2
6	84	4.4	132	*6 5/8	8	2
6 1/4	84	4.78	143.4	7	9	2
6 3/4	84	5.57	167.1	*7 5/8	9	2
7 1/4	96	6.43	192.9	8	10	2 1/2
7 3/4	96	7.34	220.2	*8 1/4	10	2 1/2
8	96	7.83	235	9	12	2 1/2
8 3/4	96	9.37	281.1	10	12	2 1/2
9 3/4	100	11.63	348.9	10	15	3
11 3/4	100	16.9	507.2	12		

*Casing threaded for inches.

The foot valve may be left out as it does not affect the quantity discharged by the plungers when the valves and leathers are in good condition.

INGERSOLL-RAND COMPANY

Manufacturers of Compressors, Pumps and Drilling Equipment

11 Broadway
NEW YORK, N. Y.

BRANCHES

BOSTON
DETROIT
LOS ANGELES

BIRMINGHAM
DULUTH
NEW ORLEANS
SAN FRANCISCO

BUTTE
EL PASO
PHILADELPHIA
SCRANTON

CHICAGO
HOUGHTON
PITTSBURGH
SEATTLE

CLEVELAND
JUNEAU
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DALLAS

DENVER
KNOXVILLE
SALT LAKE CITY

FOREIGN OFFICES

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HAVANA

PARIS

MADRID
TORONTO

JOHANNESBURG
TOKIO

RIO DE JANEIRO
MELBOURNE

SANTIAGO, CHILI
MONTREAL

Products.

AIR COMPRESSORS; PISTON and CENTRIFUGAL PUMPS; ROCK DRILLS; PNEUMATIC TOOLS; PORTABLE HOISTS.

Also, Vacuum Pumps, Condensing Plants, Water Pumps, Air Lift Pumping Systems, Drill Sharpeners.

Air Compressors—"Ingersoll-Rand" and "Imperial" Types.

Each type of air compressor that this company builds is designed to meet the requirements of some one particular application.

Each size is constructed with the ultimate object in view of supplying some one demand more efficiently, more economically, than could be done by the same size of machine, made by any other manufacturer.

Each detail of every compressor built by this company receives the benefit of the best engineering skill, while the materials entering into the construction of every Ingersoll-Rand compressor are selected with particular reference to the functions they are called upon to play in conjunction with the machine's entire operation.

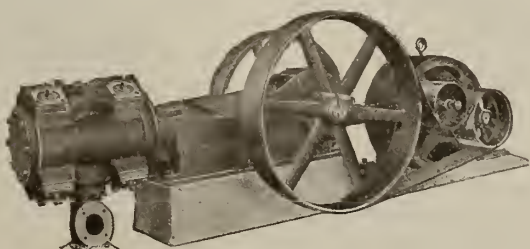
Each machine's workmanship is typical of all Ingersoll-Rand workmanship, the very best obtainable.

Summed up, such attention to design, materials and workmanship, means, that with an Ingersoll-Rand compressor, compressed air can be produced at bedrock prices, because more air is produced with a similar item of attendance, with a lower power input and a lower maintenance cost.

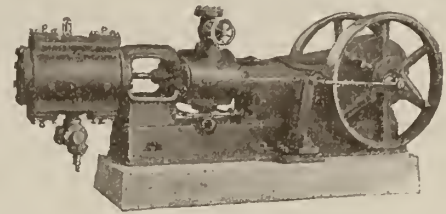
All Ingersoll-Rand compressors are of wholly enclosed construction with automatic splash and flood lubrication of the reciprocating parts. This makes for cleanliness, the exclusion of dirt and grit from wearing surfaces, economy of lubricant and lessened need of attendance.

Classes "ER" and "FR" Compressors.

Horizontal, double acting, single-stage machines with belt wheel, short belt drive complete with motor, or direct connected, piston valve steam engine, the latter with automatic cut-off control.



"INGERSOLL-RAND" CLASS "ER" COMPRESSOR



"INGERSOLL-RAND" CLASS "FR" COMPRESSOR
DATA, CLASS "ER" COMPRESSORS—BELT DRIVE

Piston displac., cu. ft. per min.	Pressure, lbs. per sq. in.	Speed, r. p. m.	B. h. p., inc. belt loss	Floor space
28	100-150	500	4 -4.3	4' 7" x 1' 6"
44	20-100	500	3.8-6.5	4' 10" x 1' 6"
44	100-150	400	6.5-7	6' 2" x 1' 9 1/2"
64	45-100	400	7.3-9.3	6' 6" x 1' 9 1/2"
67	100-140	350	10-10	6' 6" x 1' 11"
92	45-100	350	11-13	6' 7" x 1' 11"
113	100-130	250	19-21	7' 11" x 2' 6 1/4"
145	65-100	250	21-24	8' 1" x 2' 6 1/4"
223	100-120	250	39-42	9' 9" x 3' 2 1/4"
324	50-100	250	43-57	9' 5" x 3' 2 1/4"
340	100-115	220	60-62	11' 0" x 4' 1 3/4"
464	40-100	220	53-74	11' 3" x 4' 1 3/4"

Data on standard machines for low pressures on request.

DATA, CLASS "FR" COMPRESSORS—STEAM DRIVE

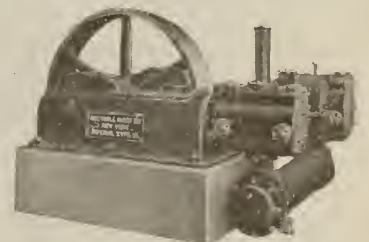
Air pressures to 125 lbs. Steam pressures, 80 to 175 lbs.

Piston displac., cu. ft. per min.	Pressure, lbs. per sq. in.	Speed, r. p. m.	I. h. p., in steam cyl.	Floor space
67	80-125	350	9-10	8' 2" x 2' 3"
92	55-100	350	11-13	8' 3" x 2' 3"
136	80-125	300	21-25	10' 2" x 2' 8"
173	65-100	300	24-29	10' 3" x 2' 8"
245	80-125	275	39-46	12' 0" x 3' 2"
355	60-100	275	51-62	11' 10" x 3' 2"
386	28-125	250	61-70	13' 8" x 4' 1"
528	45-100	250	66-88	13' 9" x 4' 1"

Data on standard machines for low pressures on request.

Imperial Type "XB" Compressors.

Single-stage and two-stage belt driven machines of duplex type. May also be had as complete units with electric motor and short belt drive.



"IMPERIAL" TYPE "XB" COMPRESSOR

DATA, "IMPERIAL XB-2" COMPRESSORS

Air pressures, 80 to 100 lbs.

Piston displac., cu. ft. per min.	Speed, r. p. m.	B. h. p., at 100 lbs.	Belt wheel	Floor space
203	225	36	54" x 8 1/2"	7' 8" x 5' 3"
327	210	37	60" x 10 1/2"	8' 4" x 5' 7"
446	210	76	72" x 12 1/2"	9' 0" x 6' 1"
509	185	104	84" x 16 1/2"	11' 0" x 7' 8"
888	170	152	96" x 20 1/2"	12' 6" x 8' 0"
1190	170	206	96" x 28 1/2"	13' 0" x 9' 2"
1482	155	254	108" x 31 1/2"	15' 1" x 9' 11"

Data on standard machines for low pressures on request.

Imperial Types "X" and "XPV" Compressors.

Single-stage and two-stage steam driven machines of duplex type. Simple and cross compound steam cylinders. The Type "X" has plain D steam valves on small sizes and Meyer adjustable cut-off type on larger units. The Type "XPV" has balanced piston steam valves and is suitable for high steam pressures and superheat.

DATA, IMPERIAL "XPV" COMPRESSORS—STEAM DRIVE
Air pressures 80 to 110 lbs. Steam pressures 80 to 150 lbs.

Piston displac., cu. ft. per min.	Spec'l. r. p. m.	I. h. p. in steam cyl.		Floor space
		80 lbs.	100 lbs.	
648	200	102	120	12' 0" x 7' 8"
940	180	148	174	13' 6" x 8' 9"
1260	180	200	235	14' 0" x 9' 2"
1531	160	242	284	17' 4" x 10' 3"

Data on standard machines for low pressures on request.

Class "PRE" Compressors.

Duplex, single-stage and two-stage, direct connected, electrically connected units of capacities to 7500 cu. ft. per minute, pressures to 115 lbs. per sq. in. Regularly fitted with automatic clearance control.

Complete detail specifications and capacity ratings will be gladly furnished those who plan the installation of a machine of this type.

Class "ORC" Compressors.

Duplex steam driven compressors with single-stage or two-stage air cylinders and simple or cross compound Corliss valve steam cylinders. Capacities range from 1200 to 8500 cu. ft. per minute, pressures to 115 lbs. per sq. in.

For full details, address the nearest office.

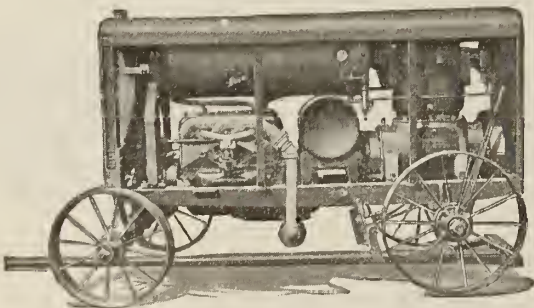
Portable and Semiportable Compressors.

This Company builds portable and skid-mounted, semiportable air compressors with gasoline engine, electric motor or steam engine drive.

Units, such as these I-R outfits are ideal for construction work. They are easily taken to and erected on a job. They are compact, wholly self-contained and require no other foundation than the mounting provided.

Truck mounted outfits are remarkably light weight, yet sturdy, being all-steel in construction. Each unit is complete with compressor, driving unit, fuel tanks, air receiver, pressure gages, haulage attachments, ready for operation.

A substantial housing with curtains protects the machinery from the elements.



210 CU. FT. PORTABLE COMPRESSOR

DATA, PORTABLE AIR COMPRESSORS—GASOLINE MOTOR DRIVE
"Imperial Fourteen"

Piston displac., cu. ft. per min.	Air pressure, lbs.	Driving motor	Drive	Weight, com- plete, lbs.
45	90	Single-cyl.-2-cycle	Direct	1500
118	100	Four- cyl.-4-cycle	Direct	4000
210	100	Four- cyl.-4-cycle	Geared	6000

Data on electric and steam driven outfits, also skidded units, on request.

"Jackhammer" Rock Drills.

These tools are universally used for rock cutting, tearing up concrete, ditch digging, road construction, mining, quarrying and general work.

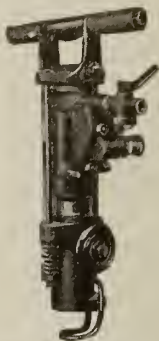
All these drills are of all-steel construction, automatically lubricating and self-rotating. Although primarily designed for use with compressed air, certain types will operate satisfactorily on steam.

"Jackhammers" weigh considerably less than the older piston drills, and require only one man to operate.

DATA, "JACKHAMER" ROCK DRILLS

Type	Weight, lbs.	Depth of hole	Described in Bulletin No.
BAR-33	21½	5 ft. (soft rock)	4043
BBR-13	35	8 ft.	4131
BCR-430	41	9-12 ft.	4321*†
DDR-13	70	18-20 ft.	4142*†

*Furnished in wet and dry patterns.
†Furnished with mounting if desired.



"JACKHAMER"
ROCK DRILL

"Sergeant" Tripod Drills.

For deep hole work, and for large diameter drill holes, the "Sergeant" drill is offered. It is sturdy in design, and can be relied on for uninterrupted high duty service.

Bulletin No. 4302.



"SERGEANT"
TRIPOD DRILL

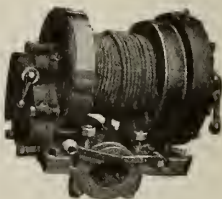
"Little Tugger" Portable Hoists.

There are many places for this little hoist in all sorts of work. It can be clamped or bolted to any handy support and operated in any position. Either compressed air or steam furnishes power.

The load limit is a half ton and the drum capacity 450 ft. of 5/16-in. wire rope.

It finds application in handling everything, placing machinery on foundation, skidding heavy crates, hauling cars, hoisting ash buckets, erecting scaffolding, pulling scrapers and backfillers, handling pipe in trenches and a host of kindred jobs.

Bulletin No. 4333 for a full description.



"LITTLE TUGGER"
PORTABLE HOIST

"Little David" Riveting Hammers.

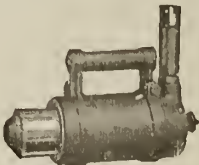
Sturdy, hard hitting tools for every grade of work. Distinctive in design and of superior ability to resist abuse.

They can be taken down or assembled in the field—a simple wrench is all that is needed.

Built in 5 sizes, with inside and outside triggers, and with or without safety rivet set retainers.



NO. 60 "LITTLE DAVID"
OPEN HANDLE RIVETER



NO. 1 "LITTLE
DAVID" JAM
RIVETER

Under equal test conditions, "Little David" riveters will exceed the work of any other hammers of like size.

The air consumption is low for the results obtained. They spend more time on the work and less time in the repair shop than any other make of riveters.

DATA, "LITTLE DAVID" RIVETING HAMMERS

Size No.	Piston stroke, in.	Piston diam., in.	Length exclusive of set, in.	Standard piston, in.	Weight without set, lb. s.	Size hose connection, in.	Size hose recommended, in.
5	4	1 1/8	14 3/4	3	14	1 1/4	1 1/2
50	5	1 1/8	16 1/4	2 1/2	18	1 1/4	1 1/2
60	6	1 1/8	17 1/4	3	20	1 1/4	1 1/2
80	8	1 1/8	19 3/4	3	22	1 1/4	1 1/2
90	8	1 1/4	19 3/4	3 1/2	24 1/2	1 3/4	1 1/2

"LITTLE DAVID" JAM RIVETER

0	4	1 1/4	11 7/8	2 1/2	31	1 1/4	1 1/2
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"LITTLE DAVID" HOLDERS-ON

2	3	3 1/8	7 1/4	13 1/2	3 1/2	1 1/2
4	4 1/2	3 1/8	12 1/4	26	4 1/4	1 1/2
5	4 1/2	3 1/8	12 1/4	25	4 1/4	1 1/2

"Little David" Drills and Wood Borers.

Simple, pneumatic tools for drilling, reaming, tapping in metal, running down lag screws, tightening bolts and boring in wood. Built in 29 sizes and gearing combinations—a tool for every grade of work.



NO. 2C "LITTLE DAVID" DRILL



NO. 9 "LITTLE DAVID" CLOSE QUARTER DRILL

DATA, "LITTLE DAVID" NON-REVERSIBLE DRILLS

Size No.	Average free speed 90 lbs. pressure, r. p. m.	Weight, lbs.	Length of feed, in.	Reaming, in.	Standard twist drill will drive	Length over all, in.	Morse taper socket	Hose, in.
1B	275	55	5 1/2	2	2 1/4	16	4	3/4
1C	225	55	5 1/2	2 1/2	3	16	4	3/4
1SE	100	68	5 1/2	Extra heavy drilling Reaming and tapping		19 1/8	5	3/4
2	475	42	4 7/8	1	1 1/4	14 1/2	3	3/4
2S	475	43	4 7/8	1	1 1/4	15	4	3/4
2C	325	42	4 7/8	1	1 1/4	14 1/2	3	3/4
2SC	325	43	4 7/8	1 1/4	1 1/2	15	4	3/4
3	700	25	4 3/8	3/4	3/4	11 3/4	2	3/4
3S	700	25	4 3/8	3/4	3/4	12 1/2	3	3/4
3SB	325	27	4 3/8	1	1 1/4	13 3/8	3	3/4
3SC	200	27	4 3/8	1	1 1/4	13 3/8	3	3/4
3AA	900	25	4 3/8	3/4	3/4	11 3/4	2	3/4
3SAA	900	26	4 3/8	3/4	3/4	12 1/2	3	3/4
5	900	15	2 1/2		1 1/2	14 3/4	1	1 1/2
5A	1500	15	2 1/2		1 1/2	14 3/4	1	1 1/2
44	1400-3000	9			5/8 chuck	14 5/8		3/8

"LITTLE DAVID" CLOSE QUARTER DRILL

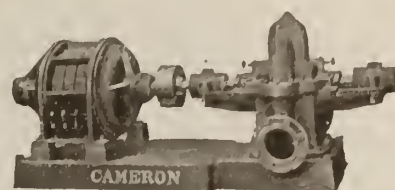
9	170	39	3 3/4	2	3	9	4	3/4
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Cameron Pumps.

These pumps have been manufactured and sold for over 50 years and the name Cameron together with its acorn trade-mark is a guarantee that the pump will be both efficient and lasting. The idea of simplicity and rugged strength has been carried out in the manufacture of all Cameron equipment, together with the accompanying principle of the use of very few parts—each having exceptional strength and wearing qualities. Every Cameron pump is designed in accordance with the best engineering practice and from the view point of the actual work which the particular pump is scheduled to perform. All metals used in the manufacture of Cameron pumps are carefully chosen for strength and wearing qualities together with a view to the nature of the fluids to be handled.

Centrifugal Pumps.

Cameron centrifugal pumps are manufactured in the following sizes and styles to meet service conditions:—



CAMERON CENTRIFUGAL PUMP

Classes "DV" and "FV" are single-stage, horizontal, double suction volute pumps made in sizes of from 2-in. to 24-in. diameter discharge, with capacities from 90 to 20,000 g.p.m. under total heads of from 10 to 230 ft.

Classes "MT" and "ST" are horizontal, single suction, multistage turbine pumps built for general high head service and in from 2 to 5 stages. They are manufactured in seven sizes varying between 2 1/2-in. to 10-in. diameter discharge with capacities from 125 to 2400 g.p.m. and operate against heads of from 45 to 230 ft. per stage.

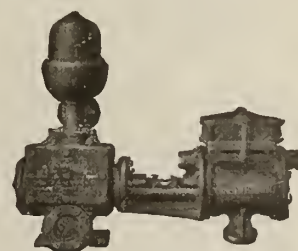
Class "BT" single suction, multistage turbine pumps are made in 3 and 4 stages in 1 size only having a 5-in. diameter discharge. These pumps have capacities of from 400 to 550 g.p.m. against pressures of from 150 to 250 lbs. per sq. in.

All of the pumps mentioned above are mounted on a heavy cast iron bedplate of sufficient size and strength to lend rigidity to the entire unit and accommodate the driver if the pump is to be direct coupled to steam turbine, engine, electric motor, gas engine or other form of direct driver. If the pumps are to be belt driven, two outboard pedestal bearings and a flexible coupling are furnished.

In addition to the double suction volute pumps and the single suction multistage turbine pumps, the company also manufactures a single suction, open impeller pump arranged for belt drive. These pumps are extremely simple, having but 15 integral parts. They are made in sizes from 1-in. to 12-in. diameter discharge and have capacities from 15 to 6200 g.p.m. against heads of from 40 to 70 ft.

Simplex Direct Acting Pumps.

The Cameron Simplex pumps are extremely well known and universally recognized as the pumps having fewer working parts than any other in the same class. Their rugged construction, absence of outside valve gear; simplicity and special features in design and manufacture make them especially desirable for work which entails hard duty and continuous performance under adverse conditions. There are many different models in both horizontal and vertical types to suit conditions encountered. Cameron Simplex sinking pumps are suited for use in shaft sinking, contracting and, in fact, wherever a vertical pump can be used. Special vertical piston pumps are manufactured for use on board ship to meet the special need of this class of service.



CAMERON DIRECT ACTING PUMP

CHICAGO PNEUMATIC TOOL COMPANY

Air Compressors, Semi-Diesel Oil and Gas Engines

GENERAL OFFICES

1002 Chicago Pneumatic Building
NEW YORK, N. Y.

SALES AND SERVICE BRANCHES
DOMESTIC

BIRMINGHAM
BOSTON
BUFFALO
CHICAGO

CINCINNATI
CLEVELAND
DETROIT
EL PASO

HOUSTON
JOPLIN
LOS ANGELES
MILWAUKEE

MINNEAPOLIS
NEW ORLEANS
PHILADELPHIA
PITTSBURGH

PORTLAND, ORE.
RICHMOND
SALT LAKE CITY
SAN FRANCISCO

SEATTLE
ST. LOUIS
TUCSON

FOREIGN

BARCELONA
BERLIN
BOMBAY
BRUSSELS

BUENOS AIRES
CADIZ
CHRISTIANIA
FRASERBURGH

HAVANA
HONOLULU
JOHANNESBURG
LISBON

LONDON
MADRID
MILAN
MONTREAL

OSAKA
PARIS
SEOUL
TOKYO

TORONTO
VANCOUVER
WINNIPEG

Products.

Manufacturers of Air Compressors: Steam, Belt, Short Belt with Idler, Oil, Gasoline Engine and Direct Motor Drive; Oil, Gas and Gasoline Engines.

Also, Vacuum Pumps, Gasoline Extraction Outfits, Air Hoists, etc.

For Pneumatic Tools, Electric Tools, Rock Drills, Hammers and Geared Hoists, see pages 32-33.



TRADE-MARK

free air per minute. This compressor is guaranteed to run satisfactorily on any natural or artificial gas containing 600 B.t.u's. per cu. ft. or over.

The Class N-SGL Chicago Pneumatic Simplate valve compressor is guaranteed to run satisfactorily on any grade of gasoline.

Both machines are well suited to rough, heavy duty and in locations where the services of highly trained attendants are not available. In operation they require little attention.

Compressors.

This company's line of compressors is particularly complete and embraces machines for all possible requirements and conditions of service, up to capacities of 6000 ft. per minute. Standard sizes for steam, belt, electric and oil, gas and gasoline engine drive can be shipped promptly. Special types can be built to meet special requirements.

Chicago Pneumatic Simplate Disk Valves.

They are used exclusively in Chicago pneumatic compressors. The "Simplat" is unique and distinctive in both design and construction. Its chief advantages are that it is simple; that its plates are independent in action, one of another; that each plate has its individual springs; that the tension on the inlet and discharge valves differs according to the air handled; and lastly, that it is applicable to all positions and conditions.

Class N-SG Semi-portable Air Compressors (Gas and Gasoline Driven).

Due to its portability, this compressor is especially adapted to contractors' use. As shown, power and compressor cylinders are arranged tandem on same piston rod, thereby eliminating all gearing or other power consuming transmissions.

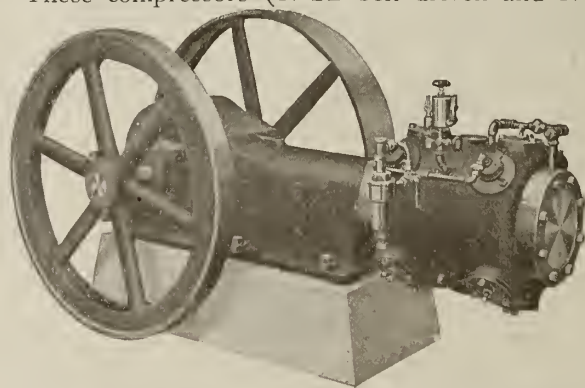
The Class N-SG Chicago Pneumatic Simplate valve compressor is made in capacities up to 325 cu. ft.

Class N-SO Compressors.

They are similar in design to the N-SG, except that they are guaranteed to operate on the following: any mineral oil of 28° Baume scale or lighter, containing not over 1% sulphur. Most of the common crude oils, fuel oils and residuums are included in the guarantee, such as star oil, diesel, calol, stove oil, solar oil, gas oil, kerosene, and all of the distillates between kerosene and lubricating oil.

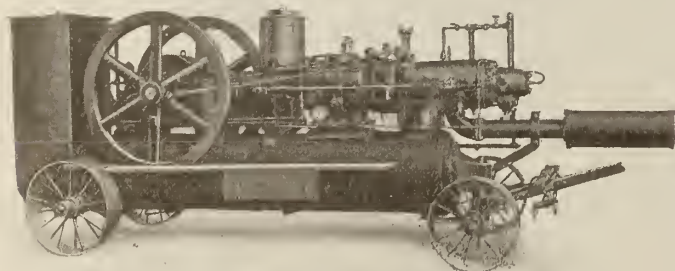
Class N Compressors.

These compressors (N-SB belt driven and N-SS



CLASS N-SB SIMPLATE VALVE COMPRESSOR, BELT DRIVEN

N-SB		Cu. ft. free air per minute, piston displ.	Piston displ. per rev.	R.p.m.	Air pres., lbs.
Code word	Size				
Nababsom	6-6	54	.189	275	80-125
Nabacrid	7½-6	84	.302	275	50-100
Nabadora	8-8	116	.452	250	80-125
Nebaegger	9-8	147	.580	250	70-100
Nebaffling	10-8	182	.716	250	40-70
Nebaggot	12-8	262	1.032	250	15-40
Nebahia	10-10	218	.891	240	80-125
Nibajirn	12-10	314	1.295	240	50-100
Nibajos	15-10	491	2.045	240	30-50
Nibaklet	17-10	631	2.548	240	15-30
Nibalena	12-12	361	1.548	230	80-125
Nobampo	14-12	491	2.117	230	50-100
Nobandis	17-12	725	3.152	230	30-50
Nobaola	20-12	1004	4.363	230	15-30
Nobaptist	14-14	549	2.463	220	80-125
Nobaqua	17-14	809	3.677	220	40-80
Nubaron	20-14	1120	5.059	220	15-40



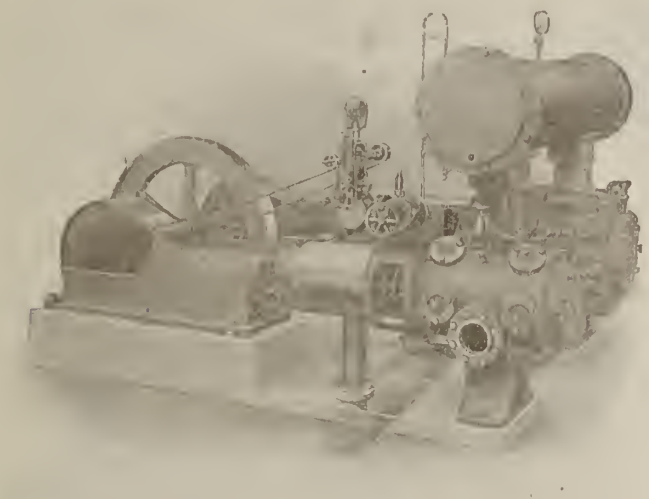
CHICAGO PNEUMATIC SIMPLATE VALVE TANK MOUNTED PORTABLE COMPRESSOR

Can be operated on oil, gas or gasoline; also built for electric motor drive

steam driven) are rugged, self-contained machines, designed for hard service and require minimum of care and attention. Equipped with Simplate flat disk type of inlet and discharge valves.

Class O-CSC 2-stage Steam Driven Air Compressors.

These compressors are of enclosed construction, rugged design and high rotative speeds, simplified steam valve gear and unexcelled system of automatic lubrication. Equipped with Simplate valves.



CLASS O-CSC 2-STAGE CHICAGO PNEUMATIC SIMPLATE VALVE COMPOUND STEAM DRIVEN COMPRESSOR

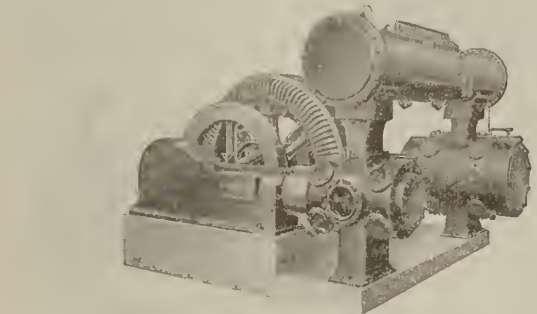
Code name	Cylinders					Displ. per rev.	Displ. per min.	R.p.m.	H.p.	Approx. floor space	
	Steam		Air		Stroke					Lth. ft. in.	Wth. ft. in.
	High pres.	Low pres.	Low pres.	High pres.							
Oroncio..	10	16	15	9	10	2.045	511	250	90	10 10	7 1½
Oropeles..	12	19	17	10	12	3.15	741	235	130	12 3	8 2
Oropion..	14	22	20	12	14	5.09	1145	225	201	14 0	9 6
Orottere..	16	26	23	13	16	7.69	1730	225	304	17 3	9 6
Orphaney	16	26	24	14	18	9.42	1884	200	331	18 2	9 8
Orpat *...	16	26	26	15	18	11.06	2212	200	390	18 6	9 8

* Suitable only for 150 lbs. steam pressure

Class O-CE Electric Motor Driven Air Compressors.

Class O-CE compressors are highly efficient and compact.

A variable volume of air delivered at a constant speed, and with a minimum power consumption, is one of its characteristics. Equipped with Simplate valves.



CLASS O-CE 2-STAGE CHICAGO PNEUMATIC SIMPLATE VALVE MOTOR DRIVEN COMPRESSOR

Code name	Cylinders			Displ. per rev.	Displ. per min.	R. p. m.	H. p.	Approx. floor space	
	Low pres.	High pres.	Stroke					Lth. ft. in.	Wth. ft. in.
Orlero	20	12	14	5.09	1145	225	199	12 0	12 0
Ormillie	23	13	16	7.69	1730	225	301	14 5	11 3
Ormolu	24	14	18	9.42	1884	200	327	17 6	14 8
Ovalis	26	15	18	11.06	2212	200	384	18 6	15 3

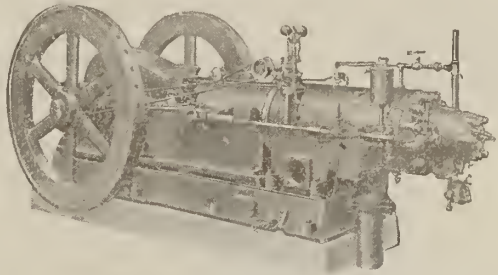
"Giant" Semi-Diesel Oil Engines.

For pumping, hoisting and power purposes generally, in mills, factories, grain elevators, electric plants, construction work, mine haulage and ventilation.

Of the horizontal, straight line crosshead type. In the larger sizes it is mounted on a substantial subbase so designed that when the machine is in operation, it is free from vibration. Parts are relatively few in number and the engine is well suited to rough, heavy duty under conditions that prevent the employment of a highly trained attendant. In operation, it requires little attention. Economy and durability are its characteristics. General design is strong, compact and graceful; the symmetry of every feature indicates the care used in its development.

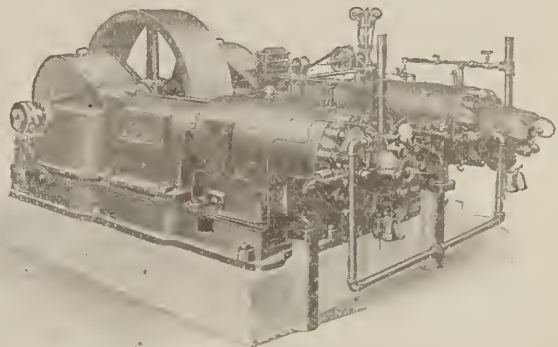
"Giant" engines are guaranteed to run on any mineral oil of 28° Baume scale or lighter, containing not over 1% sulphur. Most of the common crude oils, and residuums are included in the guarantee, such as star oil, diesel, calol, stove oil, solar oil, gas oil, kerosene, and all of the distillates between kerosene and lubricating oil.

Principal features of this engine are: valveless 2-cycle power cylinders; positive self-oiling system of lubrication; hot plate ignition; no electrical firing devices; governed fuel injection; economy of fuel; perfect scavenging of cylinder; crosshead type of construction; rugged horizontal enclosed frame, removable covers and accessible bearings.



"GIANT" SINGLE A-O OIL ENGINE

Code name	Brake h. p.	R. p. m.	Diam., flywheels, in.	Floor space	
				Lth., ft. in.	Wth., ft. in.
Avachir	12	325	42	7 2	3 6
Avadavit	20	300	54	8 8	3 5
Avalanche	30	300	62	10 2	5 3
Avalancite	40	300	60	11 1	6 3
Avaliste	50	275	60	12 9	7 5
Avalon	60	250	63	13 6	7 1
Avalix	80	230	72	16 2	8 4



"GIANT" DUPLEX A-DO OIL ENGINE

Code name	Brake h. p.	R. p. m.	Belt wheel		Floor space	
			Diam., in.	Face, in.	Length, ft. in.	Width, ft. in.
Avobismel	100	300	60	16½	11 6	8 2
Avobath	120	250	72	19	13 6	10 3
Avobun	160	230	72	23	14 9	12 6

NOVO ENGINE COMPANY

C. E. BEMENT, VICE-PRESIDENT AND GENERAL MANAGER

Air Compressor Outfits, Saw Rigs and Woodworkers

10 Porter Street
LANSING, MICH.

CHICAGO OFFICE
800 Old Colony Building

Products.

NOVO AIR COMPRESSOR OUTFITS, RIP and SWING CUT-OFF SAW RIGS, and COMBINATION WOODWORKER.

For Novo Hoisting Outfits, see page 60; for Novo Engines and Pumping Outfits, see pages 764-65.

Novo Air Compressor Outfits.

The engine and compressor are mounted on a cast iron base supported on heavy steel trucks, with the receiver slung under, between the sills of the truck as shown in Fig. 276; or, if desired, this receiver can be mounted on end of truck. The engine drives the compressor by flexible coupling on sizes up to and including 6 h.p.; and by a clutch coupling on larger sizes.

In the pipe between the compressor and the receiver is a 3-way cock, which permits any air in the receiver to be retained, but the outlet from the compressor is opened for ease in starting.

The equipment of these air compressor outfits includes the proper size air receiver, pressure gage, relief



TRADE-MARK

valve, drain to receiver, stop cock for pipe or hose connection, and on outfits 6 h.p. and above an unloader is furnished.

Fig 276 shows the way the larger sizes of Novo air compressor outfits are mounted on steel team trucks. The construction of the smaller outfits is similar, but smaller hand trucks are used.

Novo Rip and Swing Cut-off Saw Rigs.

This saw rig is strong and rugged, built for handling large and long timbers. For cross-cutting, the material is placed against the gage and the saw moves forward cutting the timber. The swing arbor is operated by a foot lever, carefully balanced and strong in every way; for ripping, the swing arbor is locked in permanent position.

Outfits furnished complete with rip and cut-off saws and guides.

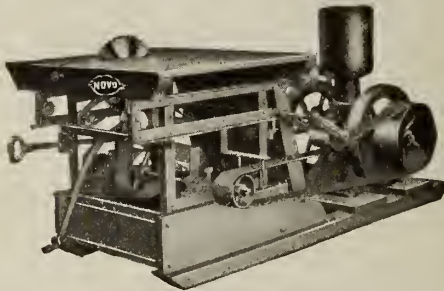


FIG. 342. NOVO RIP AND SWING CUT-OFF SAW RIG

SPECIFICATION DATA, NOVO SAW RIGS. FIG. 342

Outfit No.	Engine h.p.	Rip saw, ins.	Cut-off saw, ins.	Rips lumber in one cut, ins.	Cuts off lumber in one cut, ins.	Bare weight, lbs.	Shipping weight, lbs.	Approx. ship. weight, lbs., export	Approx. cu. ft. space, export	Code word
6	4	14	16	3 1/4	4 1/4	1110	1325	1700	145	Sabe
7	6	16	20	4 1/4	5 1/4	1150	1575	2000	160	Sada
8	8	16	20	4 1/4	6 1/4	1640	1875	2400	180	Saft

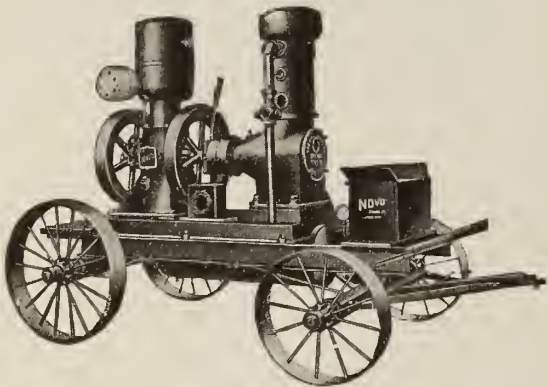


FIG. 276. NOVO IMPERIAL AIR COMPRESSOR OUTFIT MOUNTED ON TEAM TRUCK WITH UNDERSLUNG RECEIVER

SPECIFICATION DATA, NOVO AIR COMPRESSOR OUTFITS

Outfit No.	Engine h.p.	Com- pressor		Displacement, cu. ft. per minute	Pressure, lbs. per sq. in.	Receiver		Bare weight, lbs.	Shipping weight, lbs.	Code word, truck mounted
		Bore	Stroke			Diam., ins.	Lgth., ins.			
NOVO IMPERIAL AIR COMPRESSORS, MOUNTED ON HAND TRUCK										
158	1½	2½	3	5	100	14	26	765	965	Ima
159	4	3½	4	10	100	14	48	1275	1600	Imes
160	6	4½	5	21	100	14	48	1665	2000	Imic

NOVO IMPERIAL AIR COMPRESSORS, MOUNTED ON TEAM TRUCK—FIG. 276

161	8	6	6	42	75	20	60	3625	3625	Imur
162	10	6	6	40	100	20	60	4200	4200	Imix
163	15	8	6	70	100	20	60	5800	5800	Imle

NOVO TYPE H DUPLEX AIR COMPRESSOR OUTFITS, MOUNTED ON TEAM TRUCKS

178	10	4 1/2	4 1/2	38	100	20	60	4200	4200	Unth
174	15	6	6	80	100	20	60	4900	4900	Unur

NOTE—The above outfits are water cooled of the reservoir type, with the exception of Type H compressors, which are water cooled by circulating pumps. †Outfits are equipped with 2-cylinder 15 h.p. engine and are similar in design to Fig. 276.

Novo Combination Woodworker.

This is a small outfit with attachments for ripping, cross-cutting, boring, sanding, grooving, planing and grinding. It is furnished with 12-in. rip saw, 14-in. cut-off saw, two gages, 6-in. joiner, 9-in. adjustable dado, 8-in. emery wheel, 10-in. sander, boring attachment with sliding table and 3/8-in., 1/2-in. and 3/4-in. bits. Band sawing attachment can be furnished with this outfit at an extra cost.

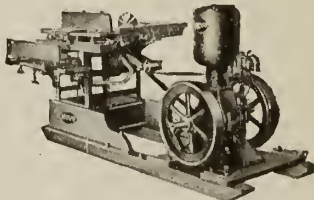


FIG. 348. NOVO COMBINATION WOODWORKER

SPECIFICATION DATA, NOVO COMBINATION WOODWORKER—FIG. 348

Outfit No.	Engine h.p.	Bare weight, lbs.	Shipping weight, lbs.	Export		Code word
				Approx. ship. weight, lbs.	Approx. cu. ft. space	
9	3	1090	1240	1700	140	Sage
10	4	1200	1350	1900	150	Sail

WHEELER CONDENSER AND ENGINEERING CO.

CARTERET, N. J.

BRANCHES

NEW YORK	BOSTON	SAN FRANCISCO	PHILADELPHIA	NEW ORLEANS	ATLANTA
DENVER	CINCINNATI	CHARLOTTE	PITTSBURGH	CHICAGO	ST. LOUIS
LONDON	YOKOHAMA	MELBOURNE	HAVANA	SHANGHAI	

Products.

Manufacturers of complete CONDENSING EQUIPMENT: HIGH VACUUM SURFACE, and JET CONDENSERS; WHEELER TURBO AIR PUMPS; WHEELER-EDWARDS AIR PUMPS; WHEELER STEAM JET AIR PUMPS; WHEELER ROTATIVE DRY VACUUM PUMPS; FORCED DRAFT STEEL, and NATURAL DRAFT WOODEN COOLING TOWERS; BRASS and COPPER TUBES; LILLIE and STANDARD EVAPORATORS; ATMOSPHERIC RELIEF VALVES.

Barometric Condensers, Feed Water Heaters, Receivers, Reheaters.

High Vacuum Surface Condensers.

For turbines of any capacity, condensing equipments operating on wet or dry system, with tube surface of condenser arranged to give best distribution of steam for high efficiency and maximum rate of heat transmission.



WHEELER HIGH VACUUM SURFACE CONDENSER, 50,000 SQ. FT.

Atmospheric Relief Valves.

Water sealed, can not chatter, closes vertically on its seat, has no outside working parts or packings, built in either the horizontal or vertical types, and protects the condenser.



ATMOSPHERIC RELIEF VALVE

Lillie and Standard Evaporators.

Multiple effects for all practical purposes. Lillie evaporators are manufactured and furnished exclusively by this company. Film evaporation; small space; mechanical circulation.

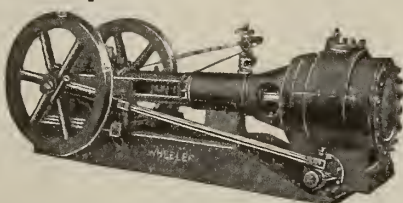


LILLIE VAPOR REVERSING QUADRUPLER EFFECT

Rotative Dry Vacuum Pump.

Will maintain a vacuum within 0.5 in. of barometer.

For high vacuum jet condenser and large surface condensing equipments. Clearance effect reduced.



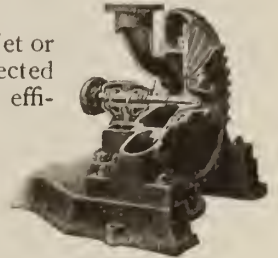
ROTATIVE DRY VACUUM PUMP

Turbo Air Pump.

High speed rotary type for jet or surface condensers, direct connected to turbine or motor. A highly efficient and reliable pump.

Wheeler-Edwards Air Pumps for Air and Condensate.

Eliminate expense of independent air and hot well pumps. No suction or bucket valves. Single, duplex, or triplex sizes.



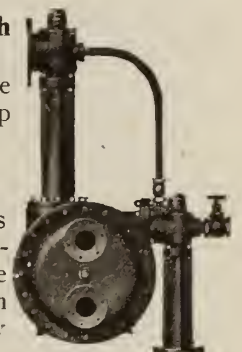
TURBO AIR PUMP

Wheeler Steam Jet Air Pump with Intercondenser.

This steam jet air pump is the most efficient steam jet air pump made.

Wheeler Jet Condensers.

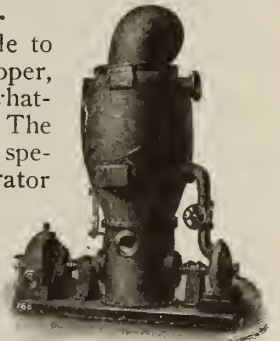
For steam turbine. Vacuums 28 in. and up. Built on the counter-current rain type principle to insure maximum temperature and minimum quantity of discharge water and low pumping cost.



STEAM JET AIR PUMP

Brass and Copper Drawn Tubes.

Seamless drawn tubes made to specifications whether brass, copper, Muntz, Admiralty, tinned, or whatever special mixture is desired. The new Wheeler tube mill makes a specialty of condenser and evaporator tubes drawn and heat treated by experts in condenser work. We ourselves use over 2,000,000 lbs. per year.



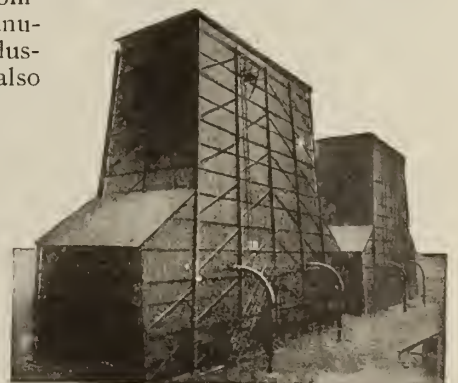
VERTICAL TURBINE-DRIVEN JET CONDENSER

Cooling Towers.

Where ground space is limited Wheeler-Balcke forced draft steel towers are recommended.

Usually the Wheeler-Balcke natural draft wooden tower is recommended for manufacturing and industrial plants, also central stations where a supply of cooling water is scarce. Operating cost consists of water pumping costs only.

Designed for special low lift, so as to reduce this cost to a minimum.



WHEELER-BALCKE NATURAL DRAFT COOLING TOWER

ALBERGER HEATER COMPANY

BUFFALO, N. Y.

Products.

ALBERGER MULTIHEAD HEATERS: Domestic Service Heaters, Feed Water Heaters, Forced Circulation Hot Water Heaters, Laundry Heaters, Oil Heaters.

Condensers, Wort Coolers, Air Coolers, Oil Coolers and Heat Interchangers.

General Description.

The Alberger multihead heater is the ideal heater in the estimation of thousands of users, because it is a closed heater of the water tube type, giving an adequate supply of hot water at minimum cost for repairs and cleaning. It embodies the most efficient type of heater for delivering the highest rate of heat transmission, *without* the usual internal troubles, such as scale, corrosion, split tubes, leaky joints and heads, and expansion strains.

Construction.

The shell, tube heads, water channel, and the steam and water heads are made of a special grade of cast iron, selected for that purpose, as it is free from corrosion from water.

The tubes are of pure copper. Copper, being a homogeneous material, will not split under temperature changes when drawn into tubes, and will last indefinitely.

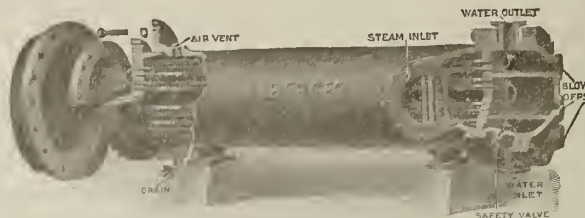
All water and steam connections are on the body of the shell, so that it is not necessary to break these connections to secure access to the heating surface.

The standard tubes used in the Alberger heaters are $\frac{3}{4}$ -in. spirally corrugated, and, being straight, any one tube may be removed or replaced without disturbing any other tube.

The tubes are small, because conclusive experiments and practical usage show that small tubes transmit a much greater quantity of heat per square foot of heating surface.

Also, there is shown to be an increase of over 50% in the amount of heat transmitted through *corrugated* tubes over *plain* tubes of the same size.

Further, when water passes through a spirally corrugated tube, the rotating motion produces a scouring effect which keeps the tube free from scale.



HORIZONTAL TYPE OF HOT WATER HEATER

Expansion.

In the Alberger multihead heater, the unavoidable expansion due to temperature changes is properly taken care of by the use of "floating" heads, into which the tubes are expanded at one end of the heater. With this series of "floating" tube heads, the several groups of tubes can expand or contract entirely independent of each other, thus eliminating dangerous strains on the tubes and tube heads.

Capacities.

Alberger heaters are made in capacities from 200 to 200,000 gals. per hour. Standard parts are carried in stock so that prompt deliveries can be made on practically all sizes.

Made in 1-, 2-, 4- or 8-pass, either horizontal or vertical types, as required.

DIMENSIONS OF HOT WATER HEATERS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	Weight, lbs.
A	9	12 1/2	15 3/4	X	X	2 1 1/2	8 1/4	1 1/2	1	1	X	4 1/2	34 3/4	12 1/2	X	7	6	300
B	11 1/4	20 1/2	30	15 3/4	8	4 1/2	23	1	1	1	10	10	52 3/4	15	1	8	11	650
C	11 1/4	20 1/2	30	15 3/4	8	5 3/4	23	1	1	1	10	10	70 1/4	15	1	8	11	750
D	13 1/4	23 1/2	35 1/4	16 3/4	8	6 3/4	23 1/4	1	1	1	11	12	71	18	1	9	12	1,050
F	13 1/4	23 1/2	35 1/4	16 3/4	8	6 3/4	23 1/4	1	1	1	11	12	82 1/8	18	1	9	12	1,150
F	15 1/4	26	40 1/2	16 3/4	8	6 4	24	1	1 1/2	12	13 1/2	82 3/4	20	1 1/4	10 1/2	13	1,550	
G	15 1/4	26	40 1/2	16 3/4	8	6 4	24	1	1 1/2	12	13 1/2	94 3/4	20	1 1/4	10 1/2	13	1,650	
H	17 1/4	29	40 3/4	16 3/4	8	8 4	24 1/4	1	1 1/2	13 3/4	14 1/2	95 1/2	22	1 1/4	12	14	1,900	
L	20 3/4	32 1/2	50 1/2	19 3/4	9	10 4	30 1/8	1	2	15 1/2	16 1/4	101 1/2	28	1 1/4	14 1/2	16 1/2	2,650	
J	22 3/4	34 1/2	54	19	9	10 4	30	1	2	17	18	101 1/2	28	1 1/4	14 1/2	16 1/2	4,100	
K	22 3/4	34 1/2	54	19	9	10 4	30	1	2	17	18	112 1/2	28	1 1/4	14 1/2	16 1/2	4,400	
L	26	40 1/2	59 1/4	20 3/4	9 1/2	12 6	33 3/4	2	2 1/2	19	21	103 3/4	33	2	17	18	4,700	
M	26	40 1/2	59 1/4	20 3/4	9 1/2	12 6	33 3/4	2	2 1/2	19	21	115 1/4	33	2	17	18	4,900	
N	30	44	60 1/4	22 3/4	9 1/2	12 6	35 1/4	2	3	21 3/4	22 1/2	105 1/4	36 1/4	2	18 1/2	19 1/2	6,600	
O	30	44	60 1/4	22 3/4	9 1/2	12 6	35 1/4	2	3	21 3/4	22 1/2	117 1/4	36 1/4	2	18 1/2	19 1/2	6,900	
P	31 3/4	46 3/4	64 1/4	24 1/4	10	14 8	36 1/4	2	3	22 1/2	24	110 7/8	38 1/4	2 1/4	20	22	7,200	
C	31 3/4	46 3/4	64 1/4	24 1/4	10	14 8	36 1/4	2	3	22 1/2	24	122 1/2	38 1/4	2 1/4	20	22	7,500	
R	35 7/8	52	68	27 1/8	10	14 8	45	2 1/2	3	25	27 1/2	117 3/4	43	2 1/2	22	25 1/2	10,000	
S	35 7/8	52	68	27 1/8	10	14 8	45	2 1/2	3	25	27 1/2	123 3/4	43	2 1/2	22	25 1/2	11,000	

NOTE.—M—F= Horizontal length. Water flanges = H.P. Openings above 2 1/2" are flanged. Steam flanges = L.P.

CAPACITIES COVERING HEATERS OPERATING UPON STEAM AT ATMOSPHERIC PRESSURE OF 212° FAHR.

G.p.h.	Temp.	50 to 120	50 to 130	50 to 140	50 to 150	50 to 160	50 to 170	50 to 180	50 to 190	50 to 200	G.p.h.	50 to 120	50 to 130	50 to 140	50 to 150	50 to 160	50 to 170	50 to 180	50 to 190	50 to 200
200 Heater.	A.1	A.1	A.2	A.3	A.5	A.6	A.9	A.12	B.5	1,750	B.10	C.5	C.7	C.10	D.2	D.5	E.7	F.3	G.4	
Lbs. st.	125	140	155	170	185	210	220	240	260		1,070	1,220	1,375	1,530	1,680	1,830	1,980	2,120	2,290	
300 Heater.	A.2	A.4	A.5	A.8	A.10	A.12	B.4	B.6	C.4	2,000	C.4	C.7	C.10	D.1	D.4	E.5	F.8	G.5		
Lbs. st.	185	210	235	260	285	310	335	360	385		1,225	1,400	1,560	1,750	1,900	2,100	2,250	2,425	2,600	
400 Heater.	A.3	A.5	A.6	A.9	A.11	B.4	B.8	B.9	C.8	2,500	C.8 A	C.12 A	D.2	D.4	E.6	E.7	F.3	G.9		
Lbs. st.	230	280	310	350	380	420	460	485	520		1,525	1,750	1,960	2,200	2,400	2,600	2,825	3,025	3,250	
500 Heater.	A.5	A.7	A.11	A.13	B.6	B.8	C.4	C.6	C.10	3,000	C.10 A	C.14 A	D.4	E.6	E.8	F.2	F.7	G.5		
Lbs. st.	310	350	395	435	475	525	570	600	650		1,825	2,075	2,350	2,600	2,850	3,125	3,400	3,650	3,900	
600 Heater.	A.7	A.10	A.12	B.6	B.8	C.3	C.6	C.8	C.11	4,000	C.15 A	D.6 A	E.6	F.2	F.6	G.2	G.5	H.7		
Lbs. st.	370	415	465	525	575	625	680	730	780		2,300	2,780	3,100	3,475	3,800	4,175	4,600	4,850	5,200	
750 Heater.	A.10	A.12	B.6	B.8	C.1	C.4	C.8	E.1	E.4	5,000	D.6 A	D.9 A	E.13 A	G.1	G.3	H.3	I.6	J.13		
Lbs. st.	460	520	580	650	720	780	850	900	975		3,050	3,500	3,900	4,350	4,800	5,200	5,650	6,075	6,500	
1,000 Heater.	A.13	B.6	B.8	B.11	C.7	C.8	C.11	E.3	E.7	6,000	D.7 A	E.12 A	F.9 A	F.11 A	H.3	I.4	J.11	K.17		
Lbs. st.	610	700	785	875	950	1,050	1,125	1,225	1,300		3,625	4,150	4,700	5,200	5,725	6,250	6,800	7,300	7,800	
1,250 Heater.	B.7	B.9	C.4	C.7	C.8	C.11	D.3	E.5	F.2	7,500	E.11 A	F.8 A	F.10 A	I.3	I.4	I.12	J.3	K.11		
Lbs. st.	775	880	990	1,090	1,195	1,300	1,405	1,510	1,615		4,550	5,250	5,900	6,500	7,200	7,800	8,450	9,100	9,750	
1,500 Heater.	B.8	B.16	C.5	C.8	C.11	D.3	D.6	E.8	F.5	10,000	F.9 A	F.12 A	G.7 A	I.11	I.11	J.8	K.11	L.1		
Lbs. st.	915	1,040	1,170	1,300	1,450	1,575	1,700	1,800	1,915		6,100	7,000	7,850	8,700	9,550	10,400	11,300	12,200	13,000	

NOTE.—Heater = Size required. Lbs. st. = No. of pounds of steam required. Steam at 212°.

FOUNDED 1867

THE GRISCOM-RUSSELL CO.

Manufacturers of Power Plant and Marine Auxiliaries

CABLE ADDRESS:

"GRISPEN, NEW YORK"

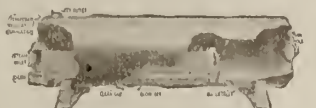
91 West Street
NEW YORK, N. Y.WORKS:
MASSILLON, OHIO**Products.**

STORAGE, OIL and WATER HEATERS; EVAPORATORS; OIL COOLERS; FEED WATER FILTERS; STEAM, OIL and AIR SEPARATORS.

Grease Extractors.

Russell Storage Heater.

For supplying hot water in hotels, apartment houses, laundries, dye houses, etc. The water is in the shell and the steam in the tubes. A storage capacity of hot water is assured at all times. Shell is of steel and heating surface of seamless drawn brass tubing.



RUSSELL STORAGE HEATER

Reilly Heater.

This is a closed type heater for either marine or stationary power plants for boiler feed or other purposes. Steam is the heating medium. Shells are of cast iron and heating surface consists of seamless drawn copper tubing. Built in any required size.



REILLY HEATER

"G-R" Instantaneous Heater.

For heating boiler feed water or for supplying hot water for general service. Steam is the heating medium. Shell of cast iron and heating surface of straight seamless drawn brass tubing. Floating head construction permits expansion and contraction of tubes without strain on tube joints.



G-R INSTANTANEOUS HEATER

Massillon Open Heater.

For purification and heating of boiler feed water by direct contact of steam with water. Shell and trays of cast iron. A "Stratton Junior" Oil Separator can be supplied, if required, for the removal of oil from exhaust steam before it enters heater.



MASSILLON OPEN HEATER

Reilly Evaporator (Submerged Type).

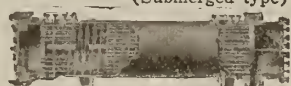
The up-to-date method of purifying boiler feed water is by the use of Reilly Evaporators (submerged type). This system provides pure water, eliminates scale and boiler blow-down, reduces boiler take-down and boiler maintenance. Pays for itself in 6 months' to 1 year's operating time.



REILLY EVAPORATOR (Submerged type)

Multiwhirl Cooler.

For cooling lubricating oil used in turbine bearings, reduction gears, etc., and for quenching oils used in the heat treatment of steel.



MULTIWHIRL COOLER

Practically standard in United States Navy and Merchant Marine. Particular feature is a helical baffle which directs oil in its passage through cooler without causing appreciable pressure loss.



TRADE-MARK

Reilly Fuel Oil Heater.

Because of the high price of coal, fuel oil is receiving particular attention at the present time. In order to burn heavy oils properly, they must be heated before they are fed to the burner.

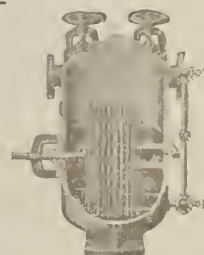
The Reilly Fuel Oil Heater is designed for this purpose. Oil passes through coils of seamless drawn steel tubing and high pressure steam is supplied to shell. Steam condensation is usually returned to boilers. Construction of Reilly Fuel Oil Heater prevents any contamination of condensed steam by oil, as oil joints are all outside of steam space.



REILLY FUEL OIL HEATER

Multiscreen Feed Water Filter.

The Multiscreen Filter is designed to remove the oil which is found in considerable quantities in the return condensed steam from engines, heating systems, etc., and thus protects the boiler from damage.



MULTISCREEN FEED WATER FILTER

Stratton Steam Separator.

For removal of water from steam supplied to engines, turbines, etc. Entering steam and water pass through helical path, which causes a swirling motion of entire mass. Water, which is heavier, is thrown out of steam path by action of centrifugal force. Built of either cast iron or cast steel, depending upon the service. Made in various types of inlet and outlet, to suit pipe connections.



STRATTON STEAM SEPARATOR

Bundy Oil Separator.

For removal of oil from exhaust steam in order to prevent contamination of heating systems or of boilers. Removable multiple baffle plate construction permits withdrawal of plates for cleaning. A record of 20 years establishes the superior efficiency of this type of oil separator.



BUNDY OIL SEPARATOR

Stratton Air Separator.

Water in compressed air is detrimental to efficient operation of sand blast machines, pneumatic tools, etc. These separators are designed for removal of this water from air. Centrifugal force accomplishes the separation. Separator is simple in construction; has no internal moving parts and will operate independently with a minimum of attention. Furnished in cast iron suitable for 200 lb. per sq. in. working air pressure and in various types of inlet and outlet to suit conditions.



STRATTON AIR SEPARATOR

THE NATIONAL PIPE BENDING CO.

Coilers of Pipe and Tubing;

Manufacturers of Feed Water Heaters and Oil Separators

156 to 168 River Street and 81 to 131 Lloyd Street
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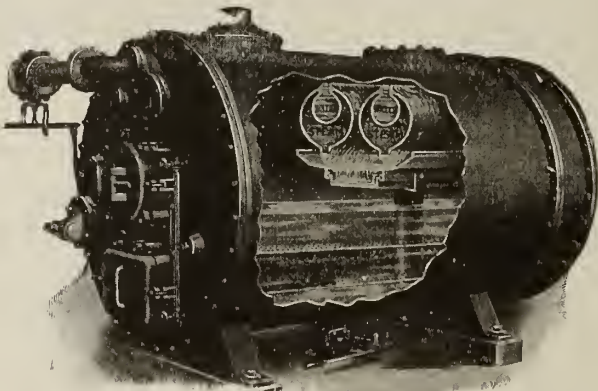
COIL TYPE FEED WATER HEATERS; DIRECT CONTACT OPEN TYPE HEATERS and PURIFIERS; STORAGE HEATERS; STEAM and OIL SEPARATORS.
Coils and Bends of Iron, Brass and Copper Pipe.

National Direct Contact Feed Water Heaters.

CONSTRUCTION AND PRINCIPLE OF OPERATION—Heater consists of a cast iron shell within which are the contact pipes, trays, filter bed, etc.
Shell is either horizontal cylindrical or vertical rectangular, according to conditions, but contact pipes are always horizontal, regardless of shape of shell.
Oil Separator—Forms the back head of the cylindrical type and is of the same diameter as the shell.
Described on following page.

Contact Pipes—Extending from one end of the heater to the other are contact pipes, designed so as to heat the water by surface contact.
Each of these pipes is really a double cast iron pipe, the larger containing steam, while the smaller, which is not concentric, is filled with the cool feed water. The smaller, or water pipe, is closed at the back end, so that the feed water entering the front end completely fills it and the water is warmed by the steam which surrounds it. More water entering the pipe causes some to overflow the port at the top. As it overflows, it follows around the larger pipe as a thin film, which is warmed not only by the hot walls of the steam pipe but also by actual contact with the exhaust steam which fills the heater. When this film or curtain of water, which closely hugs the outside of the larger pipe, reaches the ribs projecting from the bottom, it breaks up into two

sheets of fine spray, and while in this form, mingles with the exhaust steam which passes through it.
Steam Pipe—The larger pipe is filled with steam which can only escape through the port at the bottom. This port extends the full length of the pipe.
Escaping steam must pass through the fine water spray and this intimate and thorough mingling heats the water to practically the temperature of the steam.
Trays—Heated water and condensed exhaust drop from the projecting ribs of the steam pipe to trays, which keep the hot water well spread out while flowing to a large vertical pipe which conducts it to the bottom of the heater.
Upward Filtration—All filtration is upward. The pump draws from above the filter, so that all water must pass upward through the filter material. The advantages of upward filtration are numerous.



NATIONAL HORIZONTAL DIRECT CONTACT HEATER
DATA, NATIONAL DIRECT CONTACT OPEN TYPE HEATERS AND PURIFIERS



SECTION THROUGH NATIONAL DIRECT CONTACT FEED WATER HEATER

HORIZONTAL CYLINDRICAL TYPE					VERTICAL RECTANGULAR TYPE				
Size No.	Heating capacity, lbs. per hour	Dimensions, in.		Shipping weight, lbs.	Size No.	Heating capacity, lbs.	Dimensions, in.		Shipping weight, lbs.
		Diam.	Length				Height	Base	
58 1/2	29325	63 1/2	73 1/2	8000	22	6900	70 1/2	31 x 31	3000
510	34500	63 1/2	82 1/2	9500	22 1/2	8625	70 1/2	31 x 36	3250
512	43125	63 1/2	97	10500	23	10350	70 1/2	31 x 41	3500
515	51750	63 1/2	110	11250	34	13800	70	41 x 31	4450
517	60375	63 1/2	125	12100	35	17250	70	41 x 36	4600
517	69000	63 1/2	140 1/2	13100	46	20700	70	47 x 39	5200
520	86250	63 1/2	167 1/2	15000	47	24150	70	47 x 45	5500
525	86250	78 3/4	90 3/4	16000	48 1/2	23325	70	47 x 53	5800
720	69000	78 3/4	116 3/4	18000	410	34500	78	53 x 47	7000
725	86250	78 3/4	134 1/4	19500	412	43125	78	53 x 53	7400
730	103500	78 3/4	170 3/4	23000	415	51750	78	53 x 59	8250
740	138000	78 3/4	207 1/4	26500	517	60375	84	59 x 59	9500
750	172500	78 3/4	207 1/4	26500	517	60375	84	59 x 59	9500
950	172500	103	133 3/4	32000	520	69000	84	59 x 65	10000
960	207000	103	154 3/4	35000	525	86250	84	59 x 80	12500
975	258750	103	185 1/4	40000					
990	341550	103	215 1/4	45000					
9110	379500	103	216 1/4	45000					

Bottom Blow-off—Heater is provided with a bottom blow-off, which provides a means for washing out sediment and draining the heater. A strong reverse current can be passed through the filter bed, cleaning it and insuring longer life.

Cold Water Supply—Cold water supply is automatically regulated by a balanced valve in the water inlet pipe in proportion to the demands of the boiler feed pump.

Steam Inlet—Exhaust steam enters the heater at the back, first passing through the oil separator, and then enters the steam pipe, the only outlet of which is the port at the bottom.

Surface Blow-off—A trough extending the full width of the heater, just above the water line, serves as a skimmer for the surface blow-off, also as an overflow to the sewer. It is so connected that it automatically drains to the sewer.

Accessibility—Every interior part of the National direct contact feed water heater is easily accessible.

Large doors give access to the trays and filter bed and the removal of blank flanges provides for examining inside of contact pipes.

Drips and Auxiliary Water Supply—On the front of the heater, above the working water level, there is a connection for admitting gravity returns or other condensation which is free from oil. This is in addition to an inlet on the top of the heater which may be used for admitting trapped returns from heating or drying coils.

National Coil Type Feed Water Heater.

Water passes through drawn copper tubing guaranteed to withstand 600 lbs. pressure. This tubing is securely fixed in the cast iron or steel plate shell which is completely filled with the exhaust steam. The water does not come in contact with the steam or the shell.

Particularly adapted for use where water supply is free from oil or those substances which form scale or cause corrosion.



NATIONAL COIL TYPE FEED WATER HEATER

DATA, NATIONAL COIL TYPE FEED WATER HEATER

Type	Diameter shell, in.	Length shell, in.	Capacity, lbs. water per hour	Weight, lbs.
R-3/8	8	24 to 38	300 to 1300	150 to 200
P-1/2	10	31 1/2 to 41 1/2	500 to 2000	275 to 325
L-1/2	12	27 1/2 to 36 1/2	600 to 2200	325 to 375
L-3/4	12	30 1/2 to 45 1/2	800 to 3600	350 to 450
L-1	12	40 1/2 to 57 1/2	1200 to 4400	450 to 575
I-1 1/4	14 3/4	42 1/2 to 57 1/2	1000 to 7000	625 to 750
H-1 1/2	18	47 1/2 to 63 1/2	3000 to 11,000	975 to 1225
G-2	21	49 to 70	4000 to 17,000	1275 to 1675
R-2 1/2	26	52 to 71	7000 to 26,000	1850 to 2335
A-3	29	72 to 91	10,000 to 35,000	2950 to 3300
B-3	35	72 1/2 to 91 1/2	10,000 to 35,000	3800 to 4250
B-4	35	91 1/2 to 152 1/2	15,000 to 75,000	4650 to 6400
D-4	48	73 to 109	25,000 to 80,000	6100 to 7600
B-5	35 3/8	115 1/2 to 177 1/2	25,000 to 70,000	5600 to 7300
D-5	48	77 to 131	20,000 to 110,000	6600 to 9000
E-5	57 1/2	74 to 104	30,000 to 110,000	8900 to 11,000
D-6	48	109 to 190	35,000 to 145,000	8000 to 11,700
E-6	57 1/2	84 to 138	35,000 to 145,000	9800 to 13,300

The capacities in this condensed table are based on raising the temperature of the water from 40° to 206°.

National Storage Heaters.

Constantly and intermittently supplies large quantities of hot water for washing in mills, factories, hotels, apartments, etc.

Uses exhaust steam, thereby saving coal, or live steam if there is not sufficient exhaust.

Consists of a shell or tank containing a heating element made up of a set of removable U-bends of copper tubing.

Heating element is removable for inspection, repairs or substitution of a larger or smaller element. It is placed in the lower part of the shell where the entering water will come in contact with it, resulting in maximum efficiency in the transfer of heat.

The area through the tubes is sufficient for unrestricted flow of steam and condensation.



NATIONAL STORAGE HEATER

CAPACITIES OF NATIONAL STORAGE HEATERS
Capacities of shell only in gallons and with H-18 heating element

Length, in.	Diameter, in.					
	18	21	26	29	35	43
18	18	16				
24	25	22				
30	32	27	36 33			
			46 41	66 61		
36	38	33	55 50	80 74	103 97	
42	45	38	65 58	93 87	120 114	
48	51	44	75 67	107 99	138 130	174 168
					200 192	293 285
54	58	47	84 75	121 112	156 147	226 217
60	65	55	93 83	135 125	174 164	252 241
66			103 92	149 137	191 180	277 266
						406 395
72			112 100	162 150	209 197	303 291
78				176 163	227 213	329 315
84				190 175	245 230	354 340
						519 505
90				262 247	380 364	557 541
96				280 263	406 389	595 578
102					431 413	632 614
						873 855
108					457 438	670 651
114					483 463	708 688
120					509 487	746 724
						1029 1007

National Horizontal Oil Separator.

Insures complete separation of oil and exhaust steam, yet allows steam to pass through freely without friction. Oil is taken out of the current of steam by gravity, impact and change of direction, and baffle plates prevent it from being picked up again and carried along in the current. At the bottom a large drip opening leads from the storage chamber for draining the separator to the sewer.

These separators are made in two pieces to allow inspection and test of baffle plates. Joint is machined and guaranteed perfectly tight.

The steam, when condensed, is perfectly suitable for boiler feed, laundry or dye-house service, ice making or any other similar purpose.



NATIONAL OIL SEPARATOR

PRATT & CADY COMPANY INCORPORATED

SUCCESSOR TO I. B. DAVIS & SON, ESTABLISHED 1872

Feed Water Heaters, Hot Water Service Heaters and Power Pumps

HARTFORD, CONN.

For Branch Houses and Selling Agents, see Page 487

Products.

Manufacturers of HOT WATER SERVICE HEATERS; FEED WATER HEATERS; DUPLEX and TRIPLEX POWER PUMPS.

Hot Water Generators.

For Valves and Cocks, see pages 487-91.

Experience and Co-operative Service.

PRATT & CADY COMPANY, INCORPORATED have purchased the plant and business of I. B. Davis & Son, who have been engaged in the manufacture of feed water heaters since 1872. In continuing the manufacture of this line, they will adhere to the same high standards of material and workmanship which have built up such an enviable reputation during the past 48 years for apparatus bearing the "Davis" name.

Modern improvements, the result of long experience, should be a sufficient guarantee of reliable and co-operative service. Interested persons are cordially invited to submit intricate water heating problems for prompt consideration by the engineering department of this company.

P&C (Davis) Hot Water Service Heater, Type Z.

The P&C hot water service heater, type Z, is a perfect device for heating water for bakeries, bleacheries, breweries, colleges, hospitals, hotels, laundries, print and dye works and all places where hot water is required in quantities at a desired temperature. In this respect its large water capacity makes it invaluable, for it presents a reservoir of hot water which can be drawn on either constantly or at a moment's notice. The body of the shell and heads are of steel and the tubes are of seamless drawn brass, insuring maximum heating qualities.

P&C (Davis) Triplex Power Pump, Type G.

The illustration is an upper guided vertical triplex belt driven power pump.

Uprights, of strong box pattern, with no ribs on outside, can be readily cleaned.

Gearing very powerful, takes strain near center of load. Machine cut teeth render pump practically noiseless in operation.

Bearings, large and of ample strength for severe service. All boxes are babitted and adjustable.

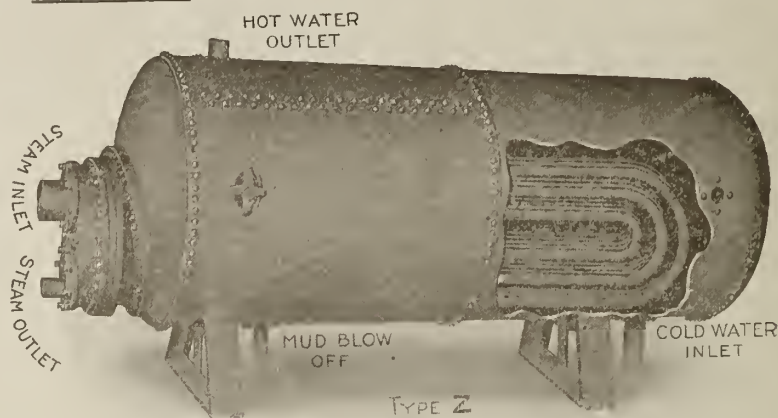
Cast iron cylinders, glands and plungers.

Composition valves.

VALVE CHAMBERS—Both suction and discharge are separate, securely bolted to base of pump, and can be renewed.

SPECIAL CONSTRUCTION—Bronze lined base and glands, bronze plungers, rawhide pinions, etc., to order, at extra price.

CAPACITIES and SIZES—Send for catalogues containing full information.

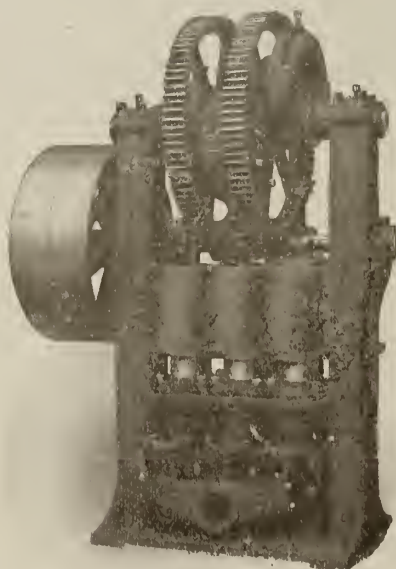


P&C (DAVIS) HOT WATER SERVICE HEATER, TYPE Z

DIMENSION OVER ALL ON CRADLES 6 INCHES HIGH

Cipher	Length, in.	Width, in.	Height on cradles, in.	Storage U. S. gals.	Gals. heated per hour from 50° F. to 180° F. using steam at atmosphere
Zaffer	102	36	42	400	500
Zeal	126	36	42	500	600
Zebra	150	36	42	600	750
Zero	126	42	48	700	1000
Zest	142	42	48	800	1250
Zeta	157	42	48	900	1500
Zinc	175	42	48	1000	2000
Zizel	152	48	54	1100	2500
Zocco	164	48	54	1200	3000
Zone	176	48	54	1300	4000
Zoonic	135	60	66	1500	5000
Zoo	153	60	66	1750	6000
Zephyr	177	60	66	2000	7000
Zuna	225	60	66	2500	8000

NOTE—The above list shows only a few of the many combinations that can be furnished in both larger and smaller sizes.



P&C (DAVIS) TRIPLEX POWER PUMP, TYPE G
Front view

ESTABLISHED 1894

INCORPORATED 1912

STACK HEATER COMPANY

Manufacturers and Designers of Water Heaters and Allied Specialties

33 Sudbury Street
BOSTON MASS.

Products.

STACK AUTOMATIC HOT WATER STORAGE SYSTEMS (Steam and Gas); STACK INSTANTANEOUS WATER HEATERS (Steam and Gas); SAFETY RELIEF VALVES.

Stack Feed Water Heaters, Stack Tank Heaters (Steam and Gas), Thermostats, Non-by-pass Tees.

Service.

Stack expert engineering department wishes to co-operate with engineers. This service is free, and is guaranteed to meet any requirements when recommendations are followed. Stack experience is at the command of engineers whether or not Stack appliances are used.

Construction.

Stack heaters are made of small seamless drawn copper tubes. The ratio of heating surface to volume of water is 3 times that of any other heater.

All waterways are of copper, bronze, or brass. No expansion joints are used, as each tube can expand and contract without stress or strain.

All coils are tested on 600 lbs. water pressure before assembling.

Advantages.

Speed in heating water, and free circulation; efficiency and economy.

Safety—no Stack system has ever blown up or exploded. Built under the same supervision for 25 years.

Tests.

All makes of heaters exhibited at the International Exposition were given a series of actual service tests. Stack heaters showed the greatest speed and efficiency in each test.

A copy of these tests is on file at the executive office, and will be shown architects and engineers interested.

Stack Instantaneous Steam Water Heater with Temperator.

Steam does not mix with water.

Suitable on either exhaust or high pressure steam.

Water at desired temperature, can not scald.

Steam used only while water is being drawn.

No moving parts or expansion joints.

Particularly adapted for wash-up sinks, first aid rooms, hospitals, restaurants, commercial requirements and factory use.

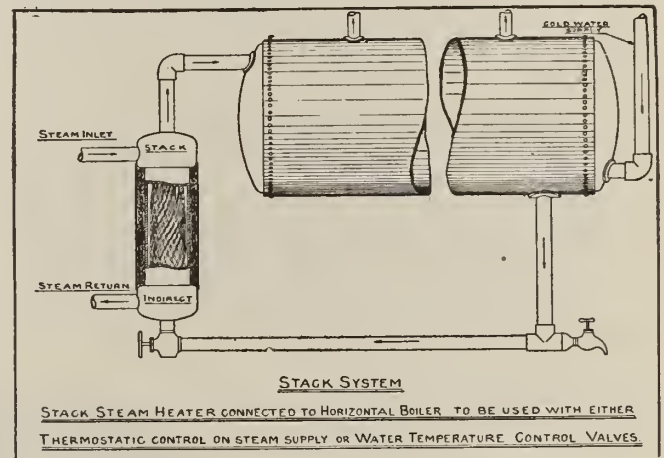


DATA, STACK INSTANTANEOUS STEAM WATER HEATERS

No. of heater	Connections		Gals. min. 5 to 10 lbs., steam	Gals. min. 30 lbs., steam	Length ft.	Diam., in.	Weight, lbs.
	Water, in.	Steam, in.					
IS-12-24	1/2	1	3	4	4	4	40
IS-12-48	1/2	1	6	8	6	4	60
IS-37-24	1/2	1 1/4	9	12	4	5	80
IS-37-36	3/4	1 1/4	12	16	5	5	100
IS-50-36	3/4	1 1/2	15	20	5	7	120
IS-50-48	3/4	2	20	25	6	7	150
IS-50-60	1	2	25	35	7	7	170
IS-100-36	1	2 1/2	30	45	6	12	200
IS-100-48	1	2 1/2	40	60	7	12	240
IS-100-60	1 1/2	2 1/2	50	75	8	12	280
IS-100-72	1 1/2	2 1/2	60	90	9	12	320
IS-150-72	2	2 1/2	100	150	9	16	550
IS-150-144	2	2 1/2	150	225	14	16	700

*Or larger, if required.
Larger sizes on application.

Stack Indirect Heater.



STACK INDIRECT HEATER

No. of heater	Connections		Suitable for storage tank, gals.	Length, in.	Diam., in.	Weight, lbs.
	Water, in.	Steam, in.				
D-6-13	1/2	1	5 to 30	24	3 1/2	13
D-6-24	1/2	1	30- 40	36	3 1/2	20
D-12-24	1	1	40- 60	36	4	30
D-24-24	1	1 1/4	50- 80	36	5	40
D-37-24	1	1 1/4	60- 120	36	6	60
D-50-36	1 1/2	1 1/2	100- 300	44	7	95
D-100-36	2	2 1/2	200- 500	44	12	160
D-150-60	2 1/2	3	1000-1500	72	16	400

Larger sizes on application.

Stack Safety Relief Valve.

A combination faucet and relief valve, which insures, through constant use, that seats are free, and that the boiler pressure reaches the valve.

Does not waterhammer, and can not be tampered with—foolproof.

Order valves set at least 25 lbs. higher than water pressure at outlet.



STACK SAFETY RELIEF VALVE

Stack Gas Water Heater and Storage Systems.

Data and description of systems designed for residences, apartment houses, hotels, etc. is given in SWEET'S ARCHITECTURAL CATALOGUE, Fourteenth Edition, pages 1124-25.

THE WHITLOCK COIL PIPE COMPANY

Manufacturers of Standard Feed Water Heaters and Hot Water Service Heaters
HARTFORD, CONN.

NEW YORK OFFICE, Singer Building, 149 Broadway
SOUTHERN OFFICE, Charlotte, N. C.
BUFFALO OFFICE, White Building

CHICAGO OFFICE, Fisher Building, 343 S. Dearborn Street
PHILADELPHIA OFFICE, 527 Commercial Trust Building
BOSTON OFFICE, 50 Congress Street

Products.

AMERICAN STANDARD FEED WATER HEATERS; AMERICAN BERRYMAN FEED WATER HEATERS; AMERICAN STRAIGHT TUBE FEED WATER HEATERS; WHITLOCK AMERICAN INSTANTANEOUS HEATERS for hot water service; WHITLOCK AMERICAN STORAGE HEATERS; WHITLOCK AMERICAN HOT WATER CONVERTORS; SPECIAL HEATERS.

Also, Pipe Bends; Flanged Piping and Headers for high pressure power plant piping; Coils and Bends of iron, steel, copper and brass pipe and tubing of all descriptions.

Feed Water Heaters.

The necessity for, and the economy of, feed water heaters is so generally acknowledged that a discussion of this feature would be out of place here, and only the description of the distinctive features of the American standard feed water heater will be given.

DURABILITY OF CONSTRUCTION—The American standard feed water heater is particularly adapted to standing up under the severe service to which a closed feed water heater is subjected, when working under full boiler pressure and receiving the impact of each stroke of the feed pumps, by the following outstanding features:

(1) Seamless copper tubing, superior to brass, mechanically, in conductance of heat and in resistance to corrosion and electrolytic action.

(2) All joints brazed, eliminating possibility of leaks; there being no screwed or

flanged joints subject to boiler pressure. See construction of terminal connections of type "A" heaters Figs. 104 and 105, and type "B" heaters Figs. 25A and 25B.

(3) Coils firmly held but allowed to expand and contract freely by means of steel braces and patented swiveling malleable iron clamps.

(4) The best of material is used throughout. Nothing but seamless copper tubing and the best grades of gray iron and tank steel enter into the construction of these heaters.



FIG. 204. TYPE "B" AMERICAN STANDARD FEED WATER HEATER, HORIZONTAL PATTERN

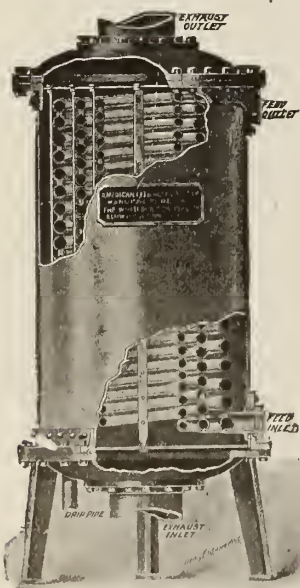


FIG. 18. TYPE "A" AMERICAN STANDARD FEED WATER HEATER

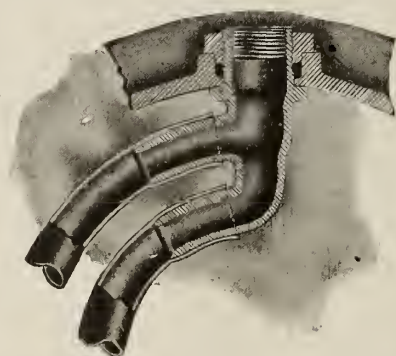


FIG. 104. TYPE "A" MANIFOLD FITTING

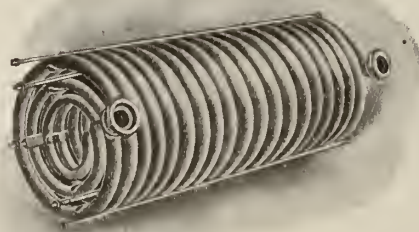


FIG. 105. TYPE "A" COIL ASSEMBLY

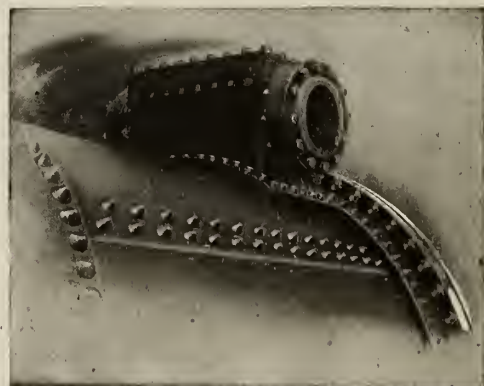


FIG. 25A. TYPE "B" HEADER (PATENTED)

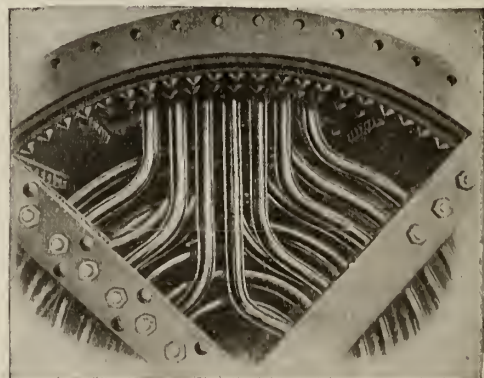


FIG. 25B. TYPE "B" COIL ASSEMBLY

HIGH FEED TEMPERATURE—Particular attention is called to the fact that all of the American standard feed water heaters are guaranteed to heat the rated amount of water (based on 30 lbs. per hour per boiler horsepower) to within 2° of the steam temperature, or to 210° when supplied with sufficient steam at atmospheric pressure. This result is achieved by furnishing a liberal amount of heating surface per rated horsepower, designed and constructed so as to secure the maximum efficiency in heat transmission.

These heaters are therefore not to be considered as "competition" heaters and are not in the same class with the ordinary commercial closed feed heater, which does not heat the water to within less than 7° to 8°, and frequently not to within less than 12° to 13° of the steam temperature. This point is more fully discussed in Bulletin No. 13, a copy of which will be sent on request.

Hot Water Service Heaters.

Under this heading are generally included all heaters for furnishing hot water for toilet service, bath, showers, manufacturing purposes, etc., in fact for every purpose except boiler feed. They may be broadly divided into two classes: instantaneous heaters and storage heaters.

INSTANTANEOUS HEATERS—

In this class the water is heated instantaneously as it passes through the heater, no hot water being held in storage. Used wherever the demand for hot water is fairly uniform or where the steam supply is large and flexible compared with the demand for hot water. They are frequently used in combination with storage tanks, the combination making, in effect, a storage heater.

There are 3 principal styles of this class: the copper coil, Type "AC" (Fig. 15A); the U-bend or Berryman, Type "R" (Fig. 151); and the Straight Tube, Floating Head Type "S" (Fig. 152). The proper type to use in any given case depends, of course, on conditions; and advice and recommendations on this point will be gladly given.



FIG. 15A. TYPE "AC" COPPER COIL HEATER



FIG. 151. TYPE "R" BERRYMAN HEATER



FIG. 152. TYPE "S" STRAIGHT TUBE FLOATING HEAD HEATER

STORAGE HEATERS—In this class a large body of hot water is always held in storage to answer sudden demands; the heating of the water proceeds uniformly

at all times whether hot water is being drawn or not. Used where the demand for hot water is intermittent and the steam supply is not flexible (as exhaust steam) or is limited in amount compared with the demand for hot water.

This company builds so many types of storage heaters that there is no room here for even a short description of the various designs; therefore only the most important, the Type "K," is shown.

Type "K" Service Heaters—These heaters are designed for use in hotels, office buildings, hospitals, laundries, factories, or wherever a large supply of hot water is required to provide for periods of heavy "peak" loads. The hot water builds up gradually between drafts, and is held in storage for sudden demands.

The features of construction are as follows:

- (1) Heating surface placed low in the shell—surrounded by the coldest water—insuring maximum efficiency and full value of storage capacity.
- (2) Individual tubes practically all the same length, preventing "short circuiting" of the steam and producing even distribution of steam.
- (3) Tubes of U-bend construction, minimizing stresses due to expansion and contraction.
- (4) Ends of tubes expanded and beaded over into a heavy cast iron tube sheet, making a perfect joint.
- (5) Heating section easily removable for inspection and cleaning.

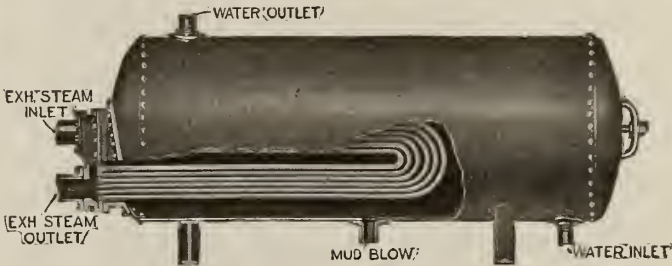


FIG. 14. TYPE "K" WHITLOCK SERVICE HEATER
DIMENSIONS AND CAPACITIES

No.	Diam. of shell, in.	Length of shell, in.	Size water connections, in.	Max. size steam connections, in.	Gals. one filling	Gals. per hour
1	18	60	2	2 1/2	65	150
2	18	72	2	2 1/2	80	200
3	24	60	2	3	118	250
4	24	72	2	3	141	300
5	24	84	2	3	164	350
6	30	60	3	3	185	400
7	30	72	3	3 1/2	220	500
8	30	84	3	3 1/2	255	550
9	30	96	3	3 1/2	290	600
10	36	84	3	3 1/2	365	750
11	36	96	3	4	420	800
12	36	108	3	4	475	900
13	36	120	3	4	525	1000
14	42	96	4	5	575	1250
15	42	120	4	5	720	1500
16	42	144	4	5	860	1750
17	42	168	4	6	1000	2000
18	48	120	4	6	950	2000
19	48	144	4 1/2	6	1140	2400
20	48	192	4 1/2	8	1480	2800
21	60	120	4 1/2	8	1420	2800
22	60	144	5	8	1660	3200
23	60	192	5	8	2250	3200

Manhole, 11 by 15 in.
Capacities given are based on heating the water from 40° to 180° Fahr. and using exhaust steam at atmospheric pressure. For other temperature ranges and steam pressures see Bulletin 27. Cradles are furnished when required at no extra expense. Companion flanges for steam connections when 3 in. or larger.

Special Heaters.

This company also designs and builds all kinds of special steam actuated heaters, such as oil heaters, air heaters, oil coolers, air coolers, evaporators, condensers, etc. Specifications and estimates on such apparatus will be submitted on request.

This company has developed a number of installation diagrams for piping layouts showing some of the more important types of installations in which Whitlock heaters are used, a few of which are shown on this page.

A complete set will be sent to architects or consulting engineers on request.

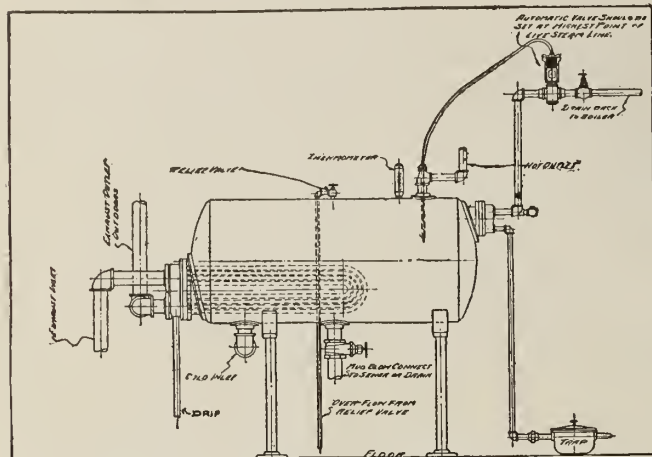


FIG. 113. WHITLOCK AMERICAN TYPE "K" STORAGE HEATER
INSTALLED FOR LAUNDRY SERVICE

Particularly adapted for laundry service on account of the varying draft of hot water and the fact that the steam condensing power of the heat must be constant in order to thoroughly utilize the exhaust steam from engine.

Diagram shows piping for the auxiliary live steam heating section. Supply of steam to this section is automatically controlled as shown.

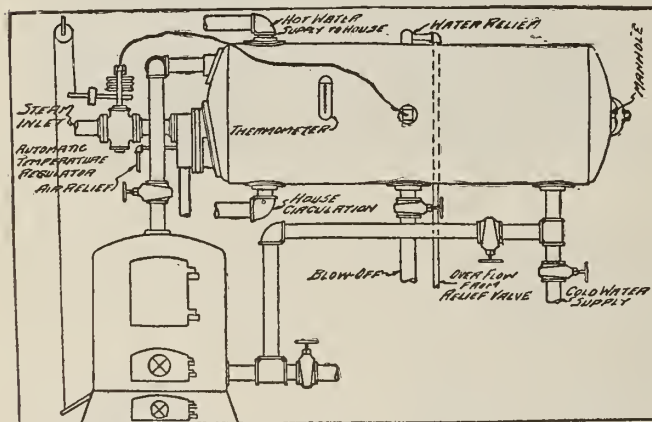


FIG. 160A. WHITLOCK AMERICAN TYPE "K" STORAGE HEATER WORKING IN CONNECTION WITH A COAL BURNING AUXILIARY HEATER

In this type of installation steam is supplied to the Type "K" heater from the main heating boilers during the heating season; and at times when no steam is carried on the main heating boilers, the auxiliary coal burning heater is fired

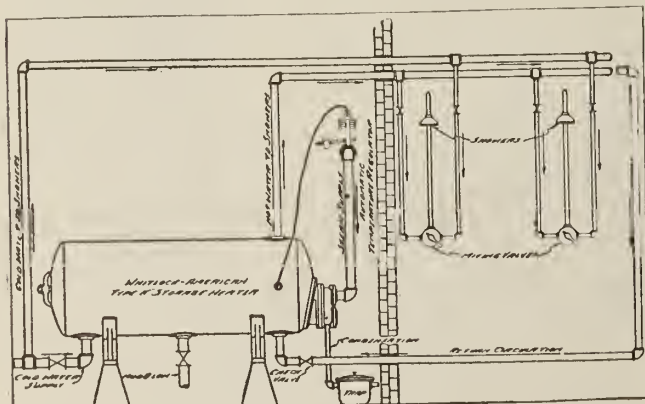


FIG. 174. WHITLOCK AMERICAN TYPE "K" STORAGE HEATER INSTALLED TO HEAT WATER FOR SHOWER SERVICE IN Y. M. C. A.'S OR GYMNASIUMS

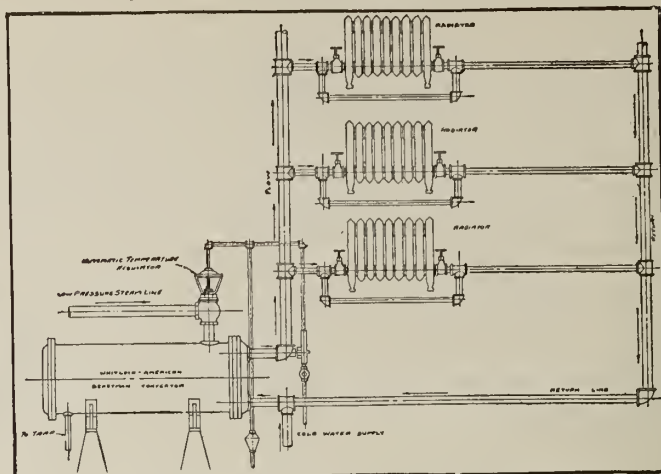


FIG. 145. WHITLOCK AMERICAN TYPE "R" CONVERTOR
SUPPLYING HOT WATER TO A HOT WATER HEATING
SYSTEM OPERATING BY GRAVITY CIRCULATOR

This system has a number of advantages over direct steam heating which are too numerous to mention here.

Bulletins on the subject sent on request

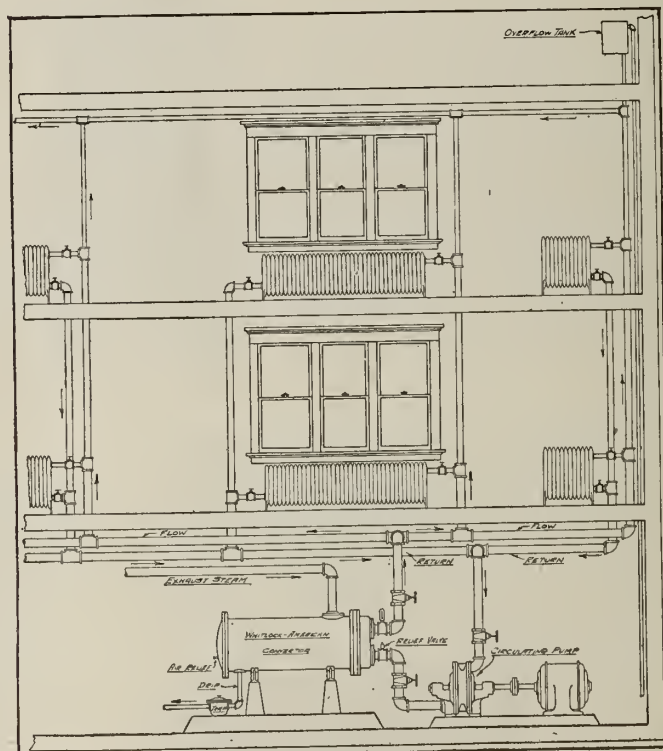


FIG. 206 OR 208. WHITLOCK AMERICAN TYPE "R" CONVERTOR
SUPPLYING HOT WATER TO A HOT WATER HEATING
SYSTEM OPERATING BY FORCED CIRCULATION

This system has a number of advantages over direct steam heating which are too numerous to mention here.

Bulletins on the subject sent on request

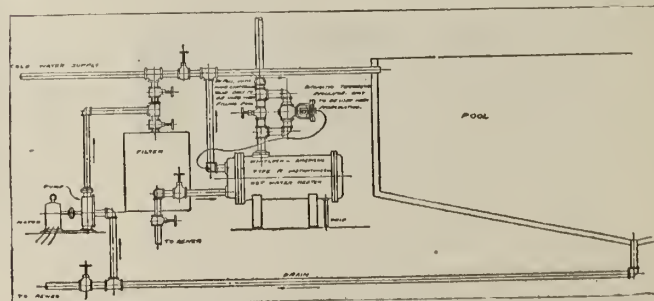


Fig. 207. WHITLOCK AMERICAN TYPE "R" INSTANTANEOUS HEATER CONNECTED TO HEAT A SWIMMING POOL BY THE RE-CIRCULATION METHOD

AMERICAN WATER SOFTENER CO.

Mechanical Filtration and Water Softening Plants

PHILADELPHIA, PA.

Products and Services.

WATER SOFTENING PLANTS of both Sodium Zeolite (Decalso) and Lime and Soda Types; complete FILTRATION SYSTEMS; PRESSURE and GRAVITY FILTERS.

Plants for removing iron from well and other waters, for neutralizing acidity, for the elimination of tastes and odors and for the removal of organic matter and discolorations; Water Sterilizing Apparatus; Mechanical Filter Equipment and Appurtenances; Subsidence Basins and Plants for applying coagulants and reagents to waters which are to be clarified, purified or softened.

This company will make a Scientific Investigation of any Water Supply and will Recommend and Install Plants particularly designed to meet local conditions and guaranteed to give satisfactory results.

All plants installed by this company are guaranteed to be free from infringement of patents.

Decalso (Sodium Zeolite) Water Softeners.

Especially adapted to those cases where water *absolutely free from hardness* is essential. Made in both the closed pressure and open gravity types.

Decalso is a water softening material used in place of the ordinary filtering medium through which the hard water is passed in the quantity and for the period of time for which the particular plant is designed, the salts of lime and magnesia in the hard water being absorbed and replaced by sodium from the Decalso. When the available sodium is given up, Decalso is exhausted and is then regenerated or recharged with sodium by washing with a solution of common salt.

Regeneration is accomplished by breaking up the Decalso bed by reversal of current of water or with air or both in combination, followed by the salt solution and finally rinsing with water to remove any excess salt.

In appearance and general scheme of operation, Decalso water softeners are practically identical with standard filters described elsewhere on this page.

DISTINCTIVE FEATURES—No sludge is produced.

Can be regenerated and washed within 1 hour.

No manipulation or adjustment of chemical valves.

Minimum salt and wash water required for regeneration.

Activity retained for a long time; frequent renewals not required.

Softens water very rapidly, thus meeting peak loads and fluctuations with minimum size plant. Automatic and natural compensation for variations in the hardness of the raw water.

Lime and Soda Water Softeners.

Designed for the removal of scale-forming mineral matter from boiler feed waters and for softening very hard waters where 3 to 5 grains of hardness per gallon in the treated water is permissible.

Constructed of steel, concrete or wood and equipped with excelsior or sand filters according to conditions.

Full information on request.

Pressure and Gravity Filters.

PRESSURE FILTERS—Vertical or horizontal, both equipped for simple reverse current wash, for sectional washing or for mechanical or air agitation.

Will sustain any desired test or working pressure.

Water may be applied by gravity or pumped directly through them into piping systems, tanks, reservoirs or standpipes. Any number of pressure filters may be connected together in battery form. Filtering sand will last from 5 to 7 years without changing.

Made of steel or cast iron. Sizes and capacities given in tables below.

GRAVITY FILTERS—Built round or rectangular, of wood, steel, concrete or masonry and equipped for washing with or without mechanical or air agitation or for sectional washing.

Similar in operation to the pressure type.

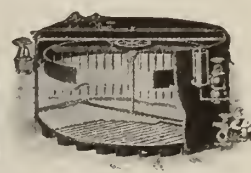
Sizes and capacities given in table below.



VERTICAL
PRESSURE
FILTER OR
DECALSO
SOFTENER



HORIZONTAL PRES-
SURE FILTER



OPEN GRAVITY FILTER
OR DECALSO SOFTENER

SIZES AND CAPACITIES OF VERTICAL PRESSURE FILTERS OR DECALSO SOFTENERS

Diam., in.	Inlet and outlet pipes, in.	Waste pipe, in.	Capacity per hour, U. S. gals.	Approximate ship- ping weight, lbs.			Effective filtering area, sq. ft.	Test pressure per sq. in.
				Case	Parts	Filtering material		
24	1½	2	360-540	850	300	1200	3.14	Stock filters are made to stand 125 lbs. test. Filters to stand 150 or 200 lbs. test are special.
30	1½	2	600-900	1500	300	1650	4.90	
36	1½	2	840-1260	1575	425	2800	7.06	
42	2	2½	1120-1560	1625	650	3400	8.72	
48	2	2½	1140-1740	1700	700	3848	9.62	
48	2½	3	1500-2220	2025	850	5450	12.56	
50	2½	3	1620-2460	2350	875	5700	13.63	
60	2½	3	2340-3540	3300	950	7800	19.63	
72	3	4	3360-5040	4000	1300	10000	28.27	
78	3	4	3960-5940	5000	1300	12000	33.18	
84	4	5	4680-6900	5700	2000	13600	38.48	Stock filters are made to stand 100 lbs. test. Filters to stand 150 or 200 lbs. test are special.
96	4	5	6000-9000	9350	2000	17700	50.26	

Above capacities are conservative. Use minimum capacities for muddy waters. Where maximum capacities are exceeded, resistance will increase, filter will require washing more frequently, and filtered water will not be of as good quality.

SIZES AND CAPACITIES OF HORIZONTAL PRESSURE FILTERS

Diam., ft.	Length over all, ft.	Inlet and outlet pipes, in.	Waste pipe, in.	Capacity per hour, U. S. gals.	Approximate ship- ping weight, lbs.			Test pressure per sq. in.
					Case	Parts	Filtering material	
8	10	6	8	9600-14400	9000	3500	33000	Stock filters, 100 lbs.
8	12	6	8	11400-17400	10800	4000	39600	
8	14	6	8	13500-20100	12600	4500	46200	
8	20	8	10	19200-28800	18000	6500	66000	
8	25	8	10	24000-36000	22500	7000	82500	
8	30	8	10	28800-43200	27000	7500	99000	

Minimum capacities are recommended for turbid waters.

SIZES AND CAPACITIES OF OPEN GRAVITY FILTERS OR DECALSO SOFTENERS

Diam., ft.	Height, ft.	Inlet and outlet pipes, in.	Waste pipe, in.	Capacity per hour, U. S. gals.	Approximate ship- ping weight, lbs.			Area, sq. ft.
					Tank	Parts	Filter bed	
6	7	3	6	3420	1350	1200	11300	28.27
8	7	4	6	6120	1750	2250	20000	50.26
10	7	4	8	9600	2250	3300	31200	78.54
12	7	5	10	13800	2800	5500	45200	113.10
14	7	6	10	18840	3450	6500	61200	153.94
15	7	6	10	21600	4000	8300	70400	176.71
17	7	8	12	27780	4600	11000	90400	226.98

Capacities given are minimum for turbid waters and will be exceeded from 50% to 100% in filtering waters carrying small quantities of sediment.

E. B. BADGER & SONS CO.

Spray Equipment Water Cooling Systems and Air Washers

BOSTON, MASS.

NEW YORK OFFICE, 101 Park Avenue

CHICAGO OFFICE, 616 South Michigan Avenue

Products.

WATER COOLING SYSTEMS; AIR WASHERS; SPRAY PONDS.

Air Conditioning Apparatus; Air Coolers; Smoke Washers; Odor Condensers; Gas Scrubbers; Humidifiers; Spray, Sewage and Aerating Nozzles; Spray Equipment for acid plants.

For Expansion Joints, see page 433.

Water Cooling Systems.

These systems are adapted to cooling condensing water from stills, evaporators, etc., for reuse and are especially useful where water is scarce. When cooling water for steam power plants they are guaranteed to cool the water sufficiently to afford an average vacuum better than 28 in. based on modern condensing equipment and good operating conditions. Systems can be operated at 6 lbs. pressure or less and will cool to or below atmospheric temperature.

NOZZLE—As a result of extensive experience with spray plants, this company has developed a nozzle scientifically designed for spraying large volumes of water at low pressures with highest efficiency. Each of these spray nozzles is fitted with the improved turbine center. The design of this center is such that a rapid rotating motion is imparted to liquid passing through it, producing a strong centrifugal action and causing liquid to break up into fine spray as it leaves nozzle. At 5 lbs. pressure spray issues in the form of an inverted solid cone composed of particles that, while fine, will settle within the spray pond limit. At 7 lbs. pressure liquid is broken up into a mist producing the greatest cooling possible at low pressures. Note the large opening through center and the short, free water passageways. The former prevents clogging, the latter increases cooling efficiency of the nozzle as well as its capacity. The inside of shell and vanes is finished smooth, and all water passages are made as large as possible to reduce friction loss of water passing through nozzle.

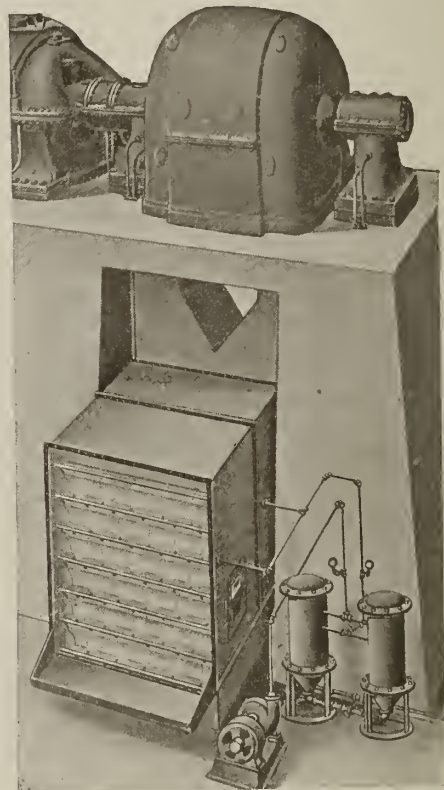
There are no moving parts to wear out, all parts of the nozzle being stationary and only water rotating. Liability to clog is reduced to a minimum by providing a large waterway through nozzle. Ordinarily made of high grade bronze but other metals can be used when necessary for spraying acids, alkalis, etc.

STRAINERS—Efficiency of spraying for most processes depends on the fineness of

spray. Fine spray is made possible only by an efficient straining device. The company's duplex strainers have incorporated in them the latest developments in strainer construction, permitting ease of cleaning, reversal of flow, removal of solid matter without stopping operation and are designed to prevent clogging due to electrolytic action. This high development makes possible the use of sprays where it would otherwise be impracticable.

Air Washers.

Adapted to cooling and cleaning air for ventilation of turbogenerators, transformers, and other electrical and mechanical equipment; wherever cool, clean air of even temperature and humidity is required for successful operation of processes. These washers cool air to its wet bulb temperature, removing 98% of suspended dust. Compact in design they require little space.



AIR WASHER



NOZZLE



COOLING POND

THE BLACKBURN-SMITH CORPORATION

Manufacturers of Feed Water Filter and Grease Extractor

TELEPHONE:
BRYANT 1364

105 West 40th Street
NEW YORK, N. Y.

Products.

THE BLACKBURN-SMITH FEED WATER FILTER and GREASE EXTRACTOR.

The Blackburn-Smith Sewage Ejector System.

Blackburn-Smith Feed Water Filter and Grease Extractor.

This filter removes oil, grease, etc., from condensed exhaust steam, not removed by line separators or by separators, skimmers, etc., incorporated in open heaters. As it is installed at the last point before water enters the boilers it also removes all dirt, slime, etc., which the feed water receives from any source whatever.

The elimination of floating impurities means clean heating surfaces of the boiler, thus securing efficient heat transmission, and protection against overheating of the boiler. The safe re-use of condensation after filtration saves coal and water, and the clean hot water prevents straining the boilers by excessive expansion and contraction.

Construction and Operating Principle.

The filter chest is partitioned into two chambers, water entering through the inlet to the upper or filtering chamber and passing to the lower or outlet chamber through the filtering cartridges set in the partition, and then through the outlet to the feed line. The number of cartridges varies with the size of the unit, and each consists of two concentric perforated brass cylinders covered with terry cloth. The water passes through the cartridges with little friction; but as foreign matter accumulates on the filtering material, resistance shown by the readings of pressure gages indicates cleaning time. The spare set of outer cylinders and cloths is to be substituted for the foul set when the pressure difference reaches a certain maximum.

The construction advantages are as follows: two successive and uniform filtrations through separated

cloths which are not bunched in places and stretched thin in others; small easily handled cartridges that involve little cleaning expense and no incentive for neglect; easily installed in existing plants, as valves and by-pass are wholly within the filter and in straight line with the feed pipe.

The Twin Unit.

For the filtration of very dirty raw water or condensation in plants operating continuously or with heavy peak load, a twin unit should be used. This consists of two complete filter bodies controlled by a single set of inlet and outlet valves. In this way, one side is kept in service while the other is being cleaned, and no impurities get past during cleaning periods.

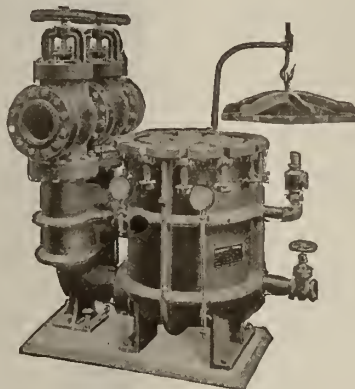
Sizes, Capacities and Dimensions.

The capacities given are only approximate. A twin unit may be selected so that either side alone will carry normal load while the other side is being cleaned and both sides thrown in during peak periods to obtain 100% overload capacity.

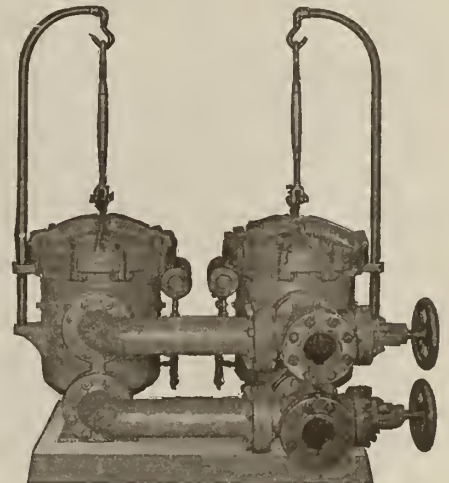
Our free engineering advice, based on information from clients, is desirable for proper selection of the unit needed.

Further Particulars.

Further particulars are given in our book "Feed Water Filtration," which will be sent on request.



SINGLE UNIT



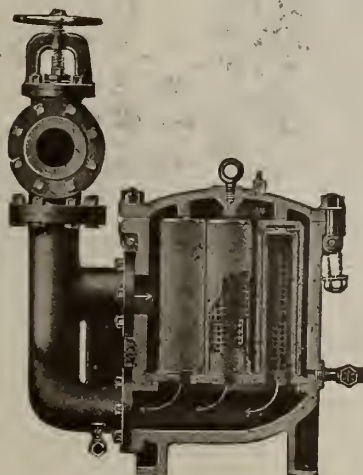
TWIN UNIT

THE BLACKBURN-SMITH FEED WATER FILTER AND GREASE EXTRACTOR

Size	Capacity, lbs. per hour		Size of inlet and outlet, ins.	No. of cartridges in single unit or each side of twin unit	Space occupied					
					Single unit			Twin unit		
	Single unit, or one side of twin unit	Both sides of twin unit operating together			Length, ins.	Height, ins.	Depth, ins.	Length, ins.	Height, ins.	Depth, ins.
No. 1	8,050	.....	1½	*4	14	22	17	.....	.....	.....
No. 2	15,750	.....	2	3	16	30	24	.....	.....	.....
No. 3	21,000	.....	2½	3	20	30	25	.....	.....	.....
No. 4	35,000	70,000	3	6	21	41	31	54	30	30
No. 6	70,000	140,000	4	8	27	48	35	60	36	36
No. 7	100,000	200,000	5	8	30	52	36	66	42	42
No. 8	150,000	300,000	6	11	33	60	42	90	48	48

*Cartridges of No. 1 filter are smaller in diameter than in other sizes.

All units designed for 200 lbs. working pressure, and are subject to a hydrostatic test of 300 lbs. per sq. in.



SECTION OF FILTER BODY

L. M. BOOTH CO.

Water Softeners and Water Filters
Engineers and Contractors for Water Purification

MAIN OFFICE AND FACTORY

194 Market Street
NEWARK, N. J.

CABLE ADDRESS:

"BOOTHRO, NEW YORK"

NEW YORK OFFICE, 3 PARK ROW

Products and Services.

WATER SOFTENERS—Automatic, continuous, hot or cold water; the chemicals used are ordinary lime and commercial soda ash.

Engineering Departments—Mechanical and Chemical—for consultation concerning water conditions.

Application.

Wherever water requires softening or purifying, a Booth water softener will provide a constant supply of soft, pure water for all purposes.

Feed water is purified before it enters the steam boilers, so that no scale can be formed.

Types and Sizes.

Softeners can be of any size. The chemical tanks and regulators are usually located at ground level, but in small softeners all the machinery is placed on top of the main tank.

For domestic service we offer a special type of softener.

No Power Required.

As ordinarily installed on a flat concrete foundation at ground level, Booth water softeners deliver water to feed water heaters without repumping.

The feed of chemicals to the water is controlled automatically by the inflowing water. No outside power or hand labor is required for mixing chemicals. The water to be purified furnishes all necessary power.

Special Construction.

For requirements which can not readily be met by standard softeners, special equipment is built to suit the needs. Concrete tanks, especially in softeners for municipal water supplies, are frequently employed.

Plans and specifications furnished to purchasers who prefer to build concrete tanks to be equipped with Booth machinery.

Cost of Operation and Results.

The cost of chemicals depends entirely upon the character and amount of impurities in the water. Labor required is small.

Results, as well as material and workmanship, fully guaranteed.

Prices.

Approximate prices for 2 common sizes are:

1000 gals. per hour Type "F-T", \$1500.00.

10000 gals. per hour Type "F-8", \$4000.00.

Experience.

This company is the pioneer of continuous water softening in America.

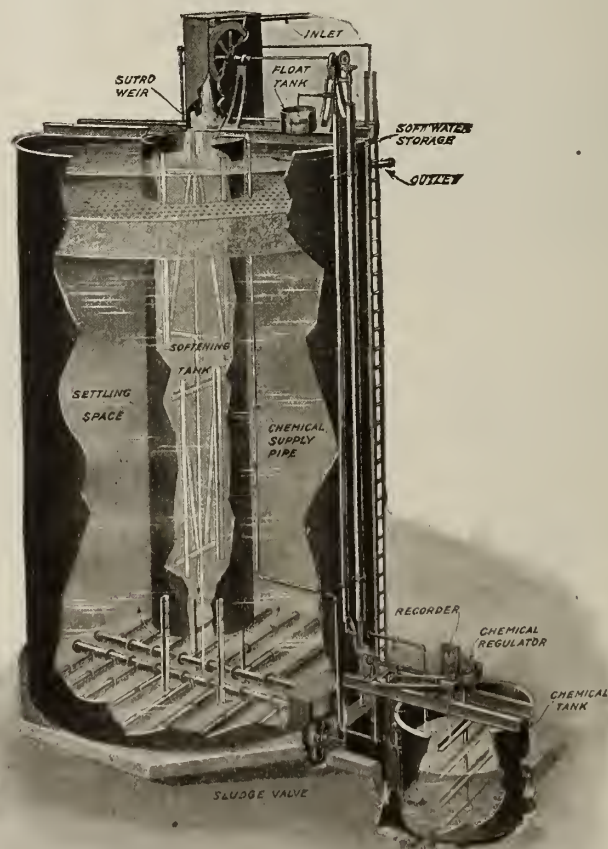
A Booth water softener will keep boilers free from scale. It is backed by men who have had longer experience in practical water softening than any similar organization in America.

An inquiry will bring conclusive demonstration of the rare ability of these men to solve any bad water problem.

Preliminary Investigation.

A careful advance survey of all conditions surrounding the supply and use of the water is desirable.

When sufficient data can not be obtained by correspondence, an engineer is sent to gather the information. The chemical engineering department is at your service.



BOOTH WATER SOFTENER, TYPE F-8

EDWIN BURHORN CO.

Cooling Towers and Steel Plate Construction

25 West Broadway
NEW YORK, N. Y.

Products and Services.

COOLING TOWERS: "BURHORN" and "PACKERS" TYPES.

Tanks for all purposes, Stacks, Breechings, Hoppers, Penstocks, Coal Bunkers, and other Steel Plate Constructions; Gray Iron Castings, including Stoker Parts, Grate Bars, Retorts, etc.; Brass Castings, Steel Castings; Engineers, Manufacturers and Contractors.

"Burhorn" Cooling Towers.

The tower is provided at the top with a main trough, the two sides of which are notched at frequent intervals for discharge of the water into a series of distributing troughs below.

COOLING SURFACE—The cooling surface is made up of units of proper size and number to suit the capacity of the tower. Each unit consists of a series of parallel troughs notched on the two sides, resting on a similar series of parallel angle pieces running at right angles. The angle pieces stiffen the troughs so that they will maintain their level when full of water and will also bear the weight of a man.

This system erected level, causes the water to seek its level in the troughs regardless of how it enters from above, and the water then naturally leaves the troughs through the notches throughout their entire length uniformly.

The trough decks are arranged in series, one directly below the other, alternately at right angles. This method counteracts the tendency of the wind to blow the water to leeward side of tower, so that no matter in which direction the wind may blow, the water is always broken up into fine particles, and the maximum water surface is exposed to the surrounding air. This arrangement guarantees efficiency in cooling, and economy of water for make-up purposes.

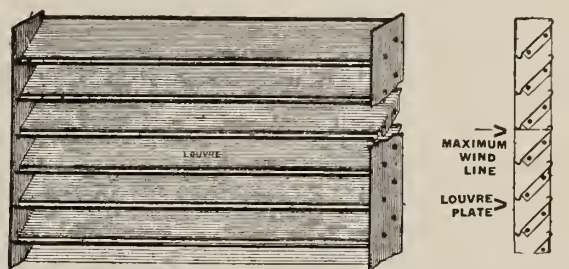
LOUVRE SYSTEM—All four sides of the tower are fitted with a patented system of heavy galvanized louvres, fitted with troughs so arranged that any water that may lodge in the louvres is returned to the tower system as shown in illustration.

CONSTRUCTION—The steel frame of the tower is made up of 6 by 6 by $\frac{3}{8}$ in. corner posts fitting into cast



iron base plates, thoroughly braced and tied together with angles which support the steel channels carrying the cooling surface.

The steel frame is thoroughly painted before shipment and the various parts of the trough deck system are thoroughly dipped in a special protecting compound, insuring long life to the apparatus.



Isometric View
"BURHORN" LOUVRE SYSTEM, PATENTED

WINTER BY-PASS—Purchaser of towers receives right to use, without royalty, patented winter by-pass system, which consists of a branch pipe, controlled by valve, running to lowest deck of the tower. When the temperature is below freezing the by-pass should be used. Sufficient cooling under these conditions will be obtained and there will be no possibility of damage from ice formation in the tower.

FOUNDATION—The tower is a complete unit. The purchaser will furnish the necessary foundation and the supply pipe to the distributing header at the top of the tower and the discharge pipe from the collecting pan. Foundation plans furnished on request.

ECONOMY—The saving in the use of this cooling tower can be estimated approximately by comparing the cost of the make-up water (1% for every 10° the water is cooled) with the cost of water necessary without the cooling tower.

PATENTS—The important features of these cooling towers are covered by patents, but no extra price is added for same.

TESTS—The following tests show cooling results under summer conditions for refrigerating apparatus.

TYPICAL TEST ON A "BURHORN" COOLING TOWER

Date	Time	Water temperature, deg.		Air temperature, deg.		Direction of wind
		To tower	From tower	Wet bulb	Dry bulb	
July 10	4:00 P. M.	87	70	68	84	N. W.
July 11	3:30 P. M.	78	68	65	88	W.
	4:00 P. M.	78	65	64	85	W.
	4:15 P. M.	74	66	64	84	W.
July 14	11:30 A. M.	73	65	62	78	N. W.
	1:45 P. M.	76	69	67	81	heavy wind
	4:45 P. M.	77	70	67	82	N. W.
July 15	7:30 A. M.	75	68	64	71	wind slight
July 17	3:15 P. M.	79	73	70	81	S. W.
	4:15 P. M.	79	73	70	86	slight
						W.
						S. E.
						S. E.

Co-operative Service.

Further information, estimates, etc., gladly furnished on request.

GRAVER CORPORATION

(WM. GRAVER TANK WORKS)

Water Softening and Purifying Apparatus

EAST CHICAGO, IND.

SALES OFFICES AND RAILROAD DEPARTMENT: Steger Building, CHICAGO, ILL.

BRANCH OFFICES

FORT WORTH, TEX.

DENVER COLO.

Products.

Designers and builders of WATER SOFTENING, PURIFYING, STERILIZING and FILTRATION PLANTS for municipal, industrial and domestic supplies; COMBINED WATER SOFTENER and HEATER.

Swimming Pool Filters, and Filtering Sand.

For Steel Tanks, General Plate Construction, and Oil Refining Equipment, see page 622.

Graver Water Softening and Purifying Apparatus.

Prevents formation of scale in boiler tubes; provides clear, soft water for every industrial purpose. Softeners remove all harmful ingredients in solution. Filters remove objectionable ingredients in suspension. Saving in time, labor and material quickly pays cost of installation.

Graver Water Softeners and Filters.

Automatically remove soluble hardening ingredients and suspended matter from water. Operate continuously, softening chemical solution being fed in direct proportion to water flow.

Structural form that of cylindrical steel tank, through center of which runs a cylindrical softening chamber open at top and bottom. Raw water and softening solution of lime and soda ash enters softener at top of inner chamber. Mixture and reaction occur in downtake; hardening ingredients and sediment settle in tank and clear, softened water rises in outer shell, from which it is withdrawn.

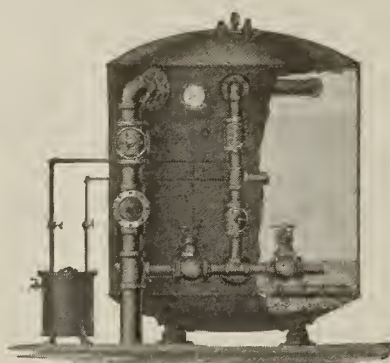
Where there is an unusual amount of suspended matter a filter is built around the central column.

Readily adaptable to the hot water softening process wherever conditions justify treatment of hot water.

Quantity storage of softened water by increasing tank height.

Softening process simple and reliable. The softening chemical compounded according to the individual needs of the customer, after careful investigation by Graver water purification department, is kept in solution by mechanical agitation in a mixing tank. Mixing device mounted on tower top or placed on ground, according to the needs of customer. Sludge is disposed of by opening valve in the outer tank and washing into sewer.

GRAVER "TYPE K" WATER SOFTENER—Revolv-



VERTICAL TYPE GRAVER WATER FILTER—SECTIONAL VIEW



MIXING AND CONTROLLING APPARATUS—GRAVER INSTALLATION

Located on the outer top completely inclosed by waterproof housing

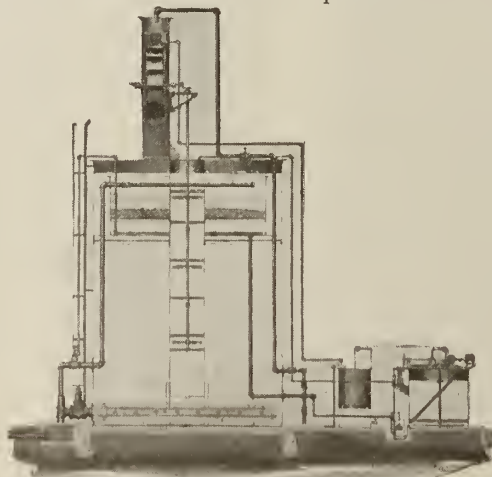
ing vanes in the downtake aid reaction. Vanes driven by water wheel operated by raw water flowing into downtake. In "Type K" automatic chemical feeder is of slightly different design. However, "Type K," as well as the other Graver apparatus, may be altered to meet individual conditions.

Graver Water Filters.

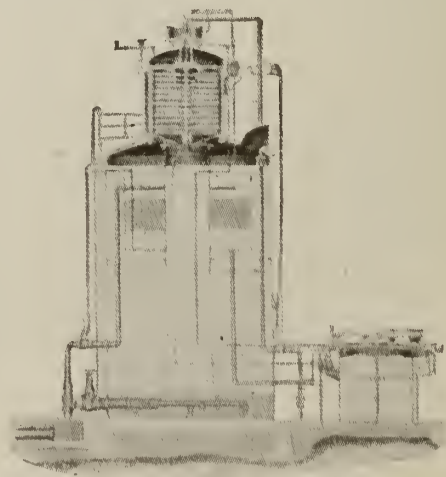
Vertical or horizontal types, pressure or gravity feed. Coagulant introduced by pressure of raw water. Thorough cleaning obtained by reversing the flow of water through the filtration medium of silica, sand or crushed quartz. Operate with equal efficiency singly or in batteries.

Graver Combined Water Softener and Heater.

Particularly adaptable for treatment of boiler feed waters, where exhaust steam is available; greater reduction in incrusting solids; also eliminates use of independent feed water heater.



GRAVER "TYPE K" WATER SOFTENER
Ground operated with quartz filter



GRAVER COMBINED WATER SOFTENER AND HEATER

B. FRANKLIN HART, JR., & CO.

Engineering Specialists
Water—Steam—Fuel Oil
50 Church Street
NEW YORK, N. Y.

Products.

The HART COOLING TOWER; FUEL OIL BOILER INSTALLATIONS; STAR SAFETY WATER TUBE BOILER.

Cooling Towers.

Plants using water for cooling purposes, whether for steam, or ammonia condensers, or in stills, evaporators and vacuum pans, or for cooling oil, chocolate (moulds) and other liquid or semiliquid materials, or for jacketing in combustion engines, *are made independent regarding water supply*, by the installation of a *cooling tower* by means of which the same water is used over and over again.

SAVING IN COST OF WATER AND COAL—It is unnecessary to purchase water from city mains, or to go to the expense of driving a well (which in many cases is a failure). Again available water may be so hot in summer as to make efficient vacuum conditions impossible and as a result additional fuel is necessary to operate. Or water may carry sand and grit in suspension that score and destroy pump cylinders.

SERVICE—Towers are rated in capacity to cool in gallons per minute—from 10 gals. upward. Complete equipment installed including substructure piping and pumps, or material furnished with detailed plans and specifications, so that purchasers may erect quickly and cheaply.

ORIGINAL FEATURES—Sectional cooling surfaces arranged in staggered decks with openings spaced so that a chimney effect is produced throughout the interior portions making them equally efficient with those exposed to the outside air currents. Water distribution through cones insuring perfect results no matter what proportion of water is used. Spray prevention that does not exclude the air necessary for rapid evaporation and consequent cooling.

STEAM POWER PLANTS—Modern turbine installations and compound condensing units require high vacuum conditions and these can not

be obtained without plenty of cold water. The Hart cooling tower furnishes this with practically no operating expense.

Our Slogan.

"Let us solve your cooling problem."

This has been our slogan for about 15 years, and we have solved many apparently hard ones. Our engineering staff is at your disposal, and a request from you will bring one of them to the job without charge or obligation.

Fuel Oil Burning.

This company is prepared to furnish plans, specifications, advice and superintendence in connection with fuel oil burning for power plants, including equipment and storage. Large oilproof reservoirs of reinforced concrete designed and guaranteed against fire hazard. The superior and even calorific value, and low cost of recently available petroleum in its natural state make fuel oil the steam maker of the present and future. Its use cuts fire-room operating expense in half, and wipes out the entire cost of handling coal and ashes.

A survey of present boiler operation costs and an estimate of the saving that will follow the use of oil will be made promptly on request. When burning oil the fire-room labor is cut in half and the cost of handling coal and ashes is cut out entirely. No worry about fuel supply.

Star Safety Water Tube Boiler.

For steam and hot water heating and for medium pressure power plants. No brickwork. Minimum space. Standard type for burning hard coal, gas or fuel oil and for soft coal where some smoke is not objectionable.

The down-draft type for soft coal without smoke. Internally fired. Straight tubes. Large storage capacity. Dry steam. Large heating surface, perfect safety. "Maximum steam disengaging surface combined with minimum space requirements and both in a boiler that is self-contained."



ICE PLANT, NEW YORK CITY



POWER PLANT, DETROIT, MICH.



STAR WATER TUBE BOILER

INTERNATIONAL FILTER CO.

Water Softening and Filtration Plants

NEW YORK OFFICE:
233 Broadway

42 South Dearborn Street
CHICAGO, ILL.

Products.

WATER SOFTENING PLANTS for industrial and municipal supplies and hotels, hospitals and similar institutions. Water Treatment for ice making, special industrial uses and boiler feed.

FILTRATION PLANTS for all purposes: domestic, industrial and municipal.

Swimming Pool Filters, Deoiling Filters; Syrup, Extract and Milk Filters, and Filtering Sand.

International Water Softeners.

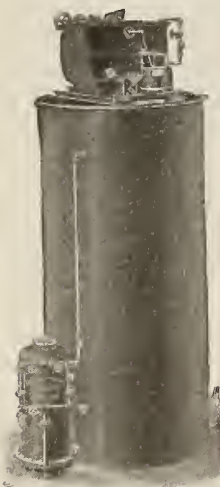
JUNIOR SIZES (BULLETIN J-63)—Continuous and automatic in operation. Capacities 250 to 5,000 gals. per hour.

STYLE V, VARIABLE FLOW (BULLETIN V-63)—Continuous type designed to deliver softened water at any rate demanded up to full capacity. Sizes 5,000 to 100,000 gals. per hour.

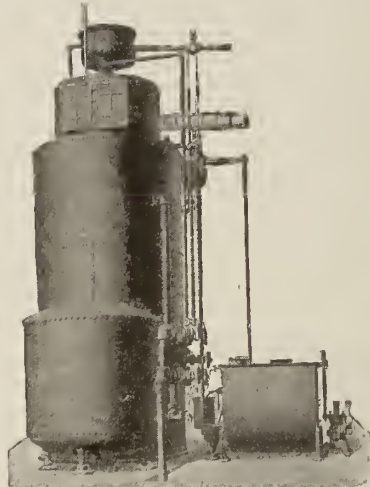
STYLE H, HOT-FLOW (BULLETIN H-63)—Combines the exhaust steam feed water heater and softener for steam plant boiler feed.

For plants of 250 boiler horsepower or more, where space is limited and ample exhaust steam is available for heating the water.

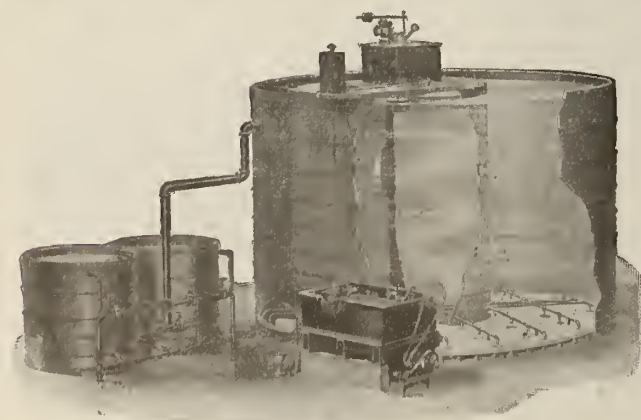
STYLE I, INTERMITTENT (BULLETIN I-63)---



JUNIOR SOFTENER



HOT-FLOW SOFTENER



STYLE V SOFTENER

International Disk Filters.

Bulletin 31. For putting the "finishing touch" on water already comparatively clean. Upward filtration through compressed cotton fiber or cloth; disks replaceable when clogged. For drinking water supplies, ice plants in hotels and institutions; also for refiltering water coming from sand, quartz or charcoal filters. Capacities 75 to 600 gals. per hour.



DISK FILTER

International Sand Filters.

PRESSURE TYPE (BULLETIN 22)—*Style C*—Cast iron filters, 12- to 24-in. sizes; capacities 140 to 600 gals. per hour.

Style I—Built of steel, 30- to 60-in. sizes; capacities 900 to 3,600 gals. per hour.

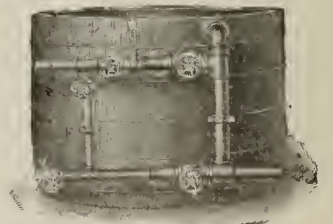
Style L—Built of steel, 48- to 96-in. sizes; capacities 2,000 to 9,000 gals. per hour.

Style H—Horizontal filters built of steel for any working pressure required. Capacities of single units up to 30,000 gals. per hour.

OPEN TYPE (BULLETIN WG-32)—*Style G*—Open or gravity type; wood tank construction. Capacities of single units up to 30,000 gals. per hour.



STYLE I FILTER



GRAVITY FILTER



HORIZONTAL PRESSURE FILTER



BATTERY, STYLE L FILTERS

Proposals.

Complete proposals furnished. Give:

(1) Maximum capacity required gals. per hour; (2) source of supply; (3) at what pressure and how water will be delivered to apparatus; (4) copy of water analysis (or send 1-gal. sample in glass bottle); (5) floor space and headroom; (6) for what purpose purified water will be used.

JEWELL POLAR COMPANY

Manufacturers of Water Stills

TELEPHONE:
HARRISON 2190

565-567 West Van Buren Street
CHICAGO, ILL.

Products.

APPARATUS for DISTILLING, FILTERING, STERILIZING, AERATING, SOFTENING and STORING WATER: JEWELL POLAR STILLS; JEWELL POLAR FILTERS, Pressure or Gravity Type.

Jewell Polar Stills.

USES—Jewell Polar stills offer a simple and economical means for providing distilled water for any particular purpose.

MATERIAL—Jewell Polar stills are made of heavy cold rolled copper and brass with pure block tin interiors.

NOTABLE FEATURES—The valuable, exclusive features of these stills, which are recognized by chemists and engineers, are the result of over forty years' experience in all branches of water purification.

All gases and odors are automatically removed before raw water enters evaporator.

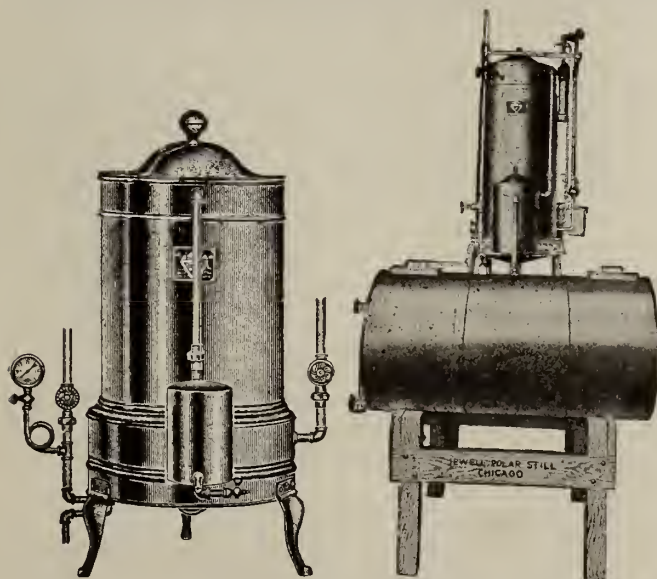
There are no condensing tubes to get "limed up" or "leaky."

All parts are easily accessible and interchangeable. Steam coil easily removed for cleaning.

Large plants may be operated in single or double effect. They conform to any building or piping arrangements.

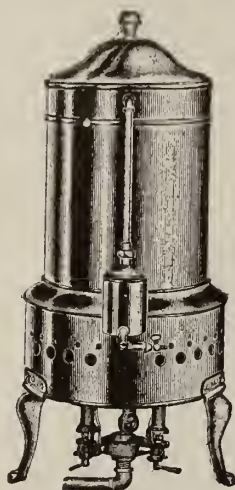
Industrial Water Distilling Plants.

Steam operated. Standard stock sizes 15 to 1000 gals. per hour. Larger plants designed and built on order. Compact, automatic and dependable installations with or without storage tanks. Write for list of users.

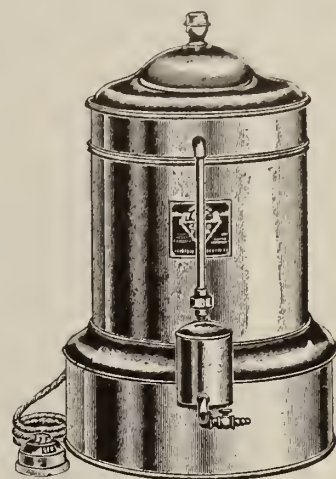


STEAM LABORATORY STILL,
COPPER
Sizes, 2, 5 and 10 gals. per hour

JEWELL POLAR STILL WITH
STORAGE TANK
Sizes 0 to 7



GAS LABORATORY
STILL, COPPER
Sizes: 1, 2 and 3 gals.
per hour.



ELECTRICALLY OPERATED
LABORATORY STILL
Sizes: 1, 2 and 3 gals. per hour

Drinking Systems.

Jewell Polar stills are being adopted by mills, factories, hotels, clubs, etc., to provide unquestionable water for drinking purposes. They remove all gases and odors. Washed and sterilized air aerates vapor within the still insuring perfect aeration.

Over 350 vessels are equipped with Jewell Polar stills. They may be installed in connection with any circulation and refrigerating system.

Filters.

Jewell Polar filters, pressure or gravity type, in all capacities, are the standard of the world.

Data Required for Quotations; Catalogue.

In writing for quotations, please state amount of distilled water required per hour, or day of 10 or 24 hours; purpose water is to be used for. If laboratory type, whether steam, gas or electrically operated. If steam is available, state average pressure.

Send for complete catalogue on distilling equipment.

Some Prominent Users.

Bethlehem Steel Co., Sparrow's Point, Md.
Allegheny Steel Co., Brackenridge, Pa.
Becker Steel Co. of America, Charleston, W. Va.
Standard Oil Co., Whiting, Ind.
General Motors Corporation, Saginaw, Mich.
Pennsylvania Salt Mfg. Co., Wyandotte, Mich.
Battle Creek Sanitarium, Battle Creek, Mich.
Chicago & Eastern Illinois R.R. Co., Chicago, Ill.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Indiana Harbor, Ind.
French Lick Springs Hotel, French Lick, Ind.
Pickands, Mather & Co., Cleveland, Ohio
Pittsburgh Steamship Co., Cleveland, Ohio
Canadian Consolidated Rubber Co., Port Dalhousie, Ont.
Western Block Co., Lockport, N. Y.
University of Minnesota, Minneapolis, Minn.

NORWOOD ENGINEERING COMPANY
Water Filters and Water Purification Plants
FLORENCE, MASS.

Products.

GRAVITY and PRESSURE FILTERS for domestic water supply.

SWIMMING POOL FILTERS for purifying and maintaining pure water in swimming pools.

MUNICIPAL WATER PURIFICATION PLANTS.

Wilson Pressure Filters for Domestic Water Supply.

These filters are built of cast iron in 5 sizes. They are operated by means of one lever operating a 3- or 5-way brass plug valve.

Filters are connected direct to supply pipe entering the building, thereby filtering all water used throughout the building. Where it is necessary to filter larger

water discharge line, which show the friction loss taking place in the filters; also with a coagulant feeding arrangement for feeding a small amount of sulphate of alumina into the raw water for removing bacteria.

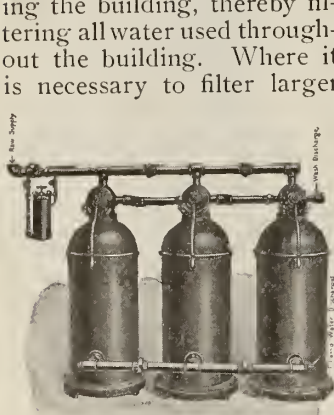
Norwood Swimming Pool Filters.

Swimming pool filters are generally of the pressure type and are installed for the purpose of keeping the pool in a clean and sanitary condition at all times. This is obtained by means of a circulating pump having connection to the outlet of the pool, which pumps the water from the pool through the filters back to the pool again. The size of the filters is governed by the size of the pool. Best results are obtained when filters are installed of sufficient size to recirculate and refilter the pool in a period of 10 hours or less. These filters are built of cast iron up to 30 in. in diameter, and of heavy steel plate construction in all sizes above 30 in.

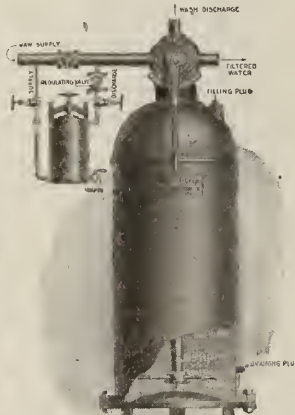
The Norwood 3-unit filter system is conceded by architects and engineers to be the most effective system known. Each filter is washed with filtered pool water by means of the circulating pump, thereby insuring the correct amount of wash water to thoroughly disintegrate the sand bed and clean it of all impurities.

The rate of filtration for swimming pool filters should not exceed 4 gals. for each square foot of filtering area per minute.

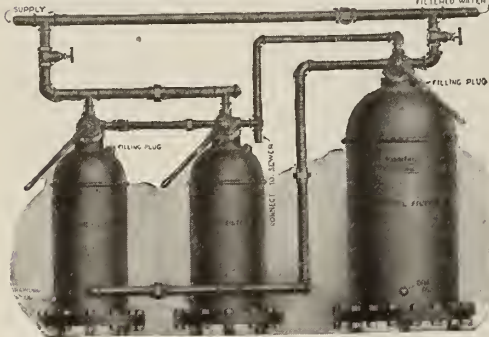
Each filtering outfit includes coagulant feeders, loss of head gages, sight glass tubes, and all accessories necessary to make the plant complete.



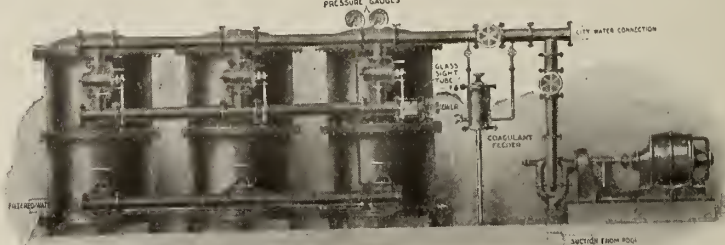
Battery of 3 Filters with Coagulant Feeder



Single Unit Wilson Filter with Coagulant Feeder



Combination Sand and Charcoal Filter
PRESSURE FILTERS FOR DOMESTIC
WATER SUPPLY



TYPICAL BATTERY OF THREE SWIMMING POOL FILTERS
With pump and motor for refiltration of swimming pools

Diameter	Height	Filtering area, sq. ft.	Capacity, gals. per min.	Size of connections	Shipping weight, lbs.
12"	44"	.7854	2 to 4	3/4"	500
15"	48"	1.22	3 to 6	1"	700
18"	56"	1.76	4 to 8	1 1/2"	1500
21"	62"	2.18	5 to 10	2"	2200
24"	57"	3.14	6 to 15	2 1/2"	3700

Diameter of filters	Capacity in gals. per min. for 3 filters (4 gals. per min. per sq. ft.)	Floor space	Weight of 3 units complete, lbs.
15"	15	5' 0" x 2' 0"	2,000
18"	20	5' 9" x 2' 0"	4,600
21"	30	6' 6" x 2' 6"	6,720
24"	38	8' 0" x 3' 0"	11,250
30"	60	9' 0" x 3' 6"	14,800
36"	85	11' 0" x 4' 6"	11,700
42"	115	12' 6" x 4' 9"	14,800
48"	150	14' 0" x 5' 6"	18,700

quantities of water than given in the accompanying table, filters are connected in a battery of 2 or more units—preferably 3 units, as shown in illustration above.

Where the water supply contains a large amount of color in solution, as well as objectionable odors, it is desirable to use a charcoal filter in connection with the sand filters, the water first passing through the sand filters and then through the charcoal filter—the latter filter having a chemical action on the water, thereby removing all color, as well as odor.

When desired, filters are equipped with pressure gages connected to the raw supply line and filtered

Municipal Water Purification Plants.

This company manufactures and installs filtration plants of both pressure and gravity types for municipal water purification systems. As each is an engineering problem in itself, estimates and other information will be furnished on request.

Co-operative Service.

The NORWOOD ENGINEERING COMPANY is prepared to make an investigation and study of any water problem in filtration work, and make such recommendations as will insure a satisfactory installation.

PITTSBURGH FILTER & ENGINEERING CO.

PITTSBURGH, PA.

BRANCH OFFICES: NEW YORK, N. Y., KANSAS CITY, MO.
WORKS: OIL CITY PA.

Products.

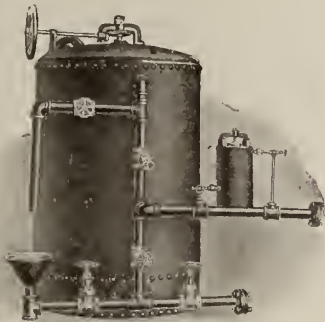
Manufacturers of PRESSURE FILTERS; GRAVITY FILTERS; SWIMMING POOL FILTERS; WATER SOFTENING PLANTS.

Feed Water Heaters; Equipment for Purification Plants; Gages, Operating Tables, Controllers, Chemical Feed, Hypo Feeding Devices, Sample Tables, etc.

For Oil Engines, see page 710.

Pressure Filters.

VERTICAL TYPES—The standard vertical type is most desirable for smaller quantities of water, such as required by hotels, laundries, boiler plants, mills, etc., rendering the most turbid waters clear and sparkling. Built of steel, in capacities of from 6,000 to 150,000 gals. per day; strainers of bronze screen; alum feed cup is furnished for supply pipe, and the best grade of filtering sand supplied. Either with or without agitator, as may be desired; but the agitator is recommended where water to be filtered carries a great amount of suspended matter.



STANDARD PRESSURE FILTER, VERTICAL TYPE

A line of vertical cast iron filters, without stirring devices, is especially adaptable to waters that do not carry a continually large amount of heavy clay in suspension. They range in size from 14 to 78 in., and in capacities from 5,000 to 200,000 gals. per day.

HORIZONTAL TYPE—Capacities range from 200,000 gals. per day up. Diameter of all sizes is 8 ft., the length varying with the capacity. Equipped with the manifold screen system as used in the gravity filters, and furnished with a central wash trough. Either with or without the air system of agitating, as may be desired.

DATA STANDARD PRESSURE FILTERS, VERTICAL TYPE

No.	Size		Space	Connections			U.S. gallons capacity			Weight, lbs.	
	Diam., in.	Height, ft.		Inlet and outlet, in.	Wash, in.		Minute	Hour	Day 24 hrs.	Filter and connections	Filtering material
A			Floor room required, ft.								
1	20	4 1/2	2 x 3	1 1/4	1 1/4	4 1/2	270	6,500	800	600	
2	24	4 1/2	2 1/2 x 3 1/2	1 1/4	1 1/2	6	360	8,500	1,000	800	
3	30	4 1/2	3 x 4	1 1/4	2	10	600	14,500	1,500	1,200	
4	36	5 1/2	3 1/2 x 4	1 1/2	2	14	850	20,500	2,000	1,800	
5	42	6	4 x 4 1/2	1 1/2	2 1/2	19	1,140	27,500	2,400	2,600	
6	48	6	4 x 5	2	3	25	1,500	36,000	2,600	3,000	
7	54	7 1/2	4 1/2 x 5 1/2	2	3	32	1,900	46,000	3,400	4,000	
8	60	7	5 x 6	2 1/2	4	40	2,400	58,000	4,200	5,000	
9	72	7 1/2	6 x 7 1/2	3	5	56	3,350	80,000	5,400	7,000	
10	84	8	7 1/2 x 8 1/2	4	6	77	4,600	110,000	7,200	9,600	
11	96	8	8 x 10	4	6	100	6,000	144,000	9,600	12,500	

Test: 100 lbs. per sq. in.

Gravity Filters.

Built in sizes from 5 to 20 ft. in diameter, of wood or steel, and are most suitable for small cities, hospitals, public institutions, paper mills, etc. They are equipped

with the manifold screen system and screens. The design of these screens and system of placing them are the result of exhaustive experiments to determine the most thorough and economical use of water for washing purposes, and to secure the nearest perfect draft on all parts of the bed in filtering.

Filters are furnished with the standard rake agitator operated by gears and belts, or with the system of air agitation.



WOOD TANK GRAVITY FILTER, AIR WASH

DATA, STANDARD GRAVITY FILTERS, WOOD OR STEEL

No.	Size		Connections			U. S. gallons capacity			Weight, lbs.	
	Diam., ft.	Height, ft.	Inlet, in.	Outlet, in.	Wash, in.	Minute	Hour	Day 24 hrs.	Filter and connections	Filtering material
C										
1	5	8	2 1/2	2 1/2	4	40	2,400	58,000	4,500	7,200
2	6	8	3	3	6	56	3,350	80,000	5,500	9,800
3	7	8	3	3	6	77	4,600	110,000	6,500	13,200
4	8	8	4	4	6	100	6,000	144,000	7,500	17,500
5	10	8	5	5	8	156	9,400	225,000	9,000	27,000
6	12	8	5	5	8	225	13,500	325,000	13,000	39,000
7	15	8	6	6	8	350	21,000	500,000	18,000	60,000
8	17 1/2	8	8	8	10	480	28,800	690,000	24,000	84,000
9	20	8	10	10	12	628	37,600	900,000	30,000	109,000

Concrete filters built to sizes required.

Swimming Pool Filters.

A special line of filters is manufactured for swimming pool work for both private and public institutions. Prices furnished on application.

Water Softeners.

Both the intermittent and continuous process plants, for either hot or cold water; of steel, wood, or concrete; of any capacity from a few thousand gallons a day to millions of gallons.

Municipal Filter Plants.

The PITTSBURGH FILTER & ENGINEERING CO. are prepared to build complete, or equip, plants of any desired capacity, in the shortest time, and at lowest cost consistent with good workmanship and material. They are ready to assume the entire responsibility and deliver a completed plant, ready for daily operation, and one producing the purest water obtainable.

Long and varied experience enables this company to design plants to meet any peculiar local condition, and at the least cost for installation and operation.

THE PERMUTIT COMPANY

Water Rectification

440 Fourth Avenue
NEW YORK, N. Y.

TELEPHONE:
MADISON SQUARE 965

BRANCH OFFICES

PHILADELPHIA, PA., 311 Widener Building
BUFFALO, N. Y., 304 Brisbane Building
SYRACUSE, N. Y., 414 Douglas Street
PITTSBURGH, PA., 921 Union Arcade Building
CHICAGO, ILL., 208 South La Salle Street

KANSAS CITY, MO., 401 Lathrop Building
MINNEAPOLIS, MINN., 1046 McKnight Building
CHATTANOOGA, TENN., C. C. HARDING, Hotel Patten
JACKSONVILLE, FLA., P. O. Box 604
LOS ANGELES, CAL., 404 Wright-Callender Building

AGENTS

BOSTON, MASS., STARKWEATHER and BROADHURST, 53 State Street
ST. LOUIS, MO., REEVES & SKINNER MACHINERY Co., 2211 Olive Street
HAMILTON, ONTARIO, CANADA, W. J. WESTAWAY, Main and McNabs Streets

Products.

"PERMUTIT" ZEOLITE, LIME-SODA and HEATER WATER SOFTENERS, FILTERS and APPARATUS for the Removal of Iron, Manganese and other Mineral and Organic Matter, Color, Odor, objectionable Gases and Tastes. Patented in the United States, Canada and all other countries.

Permutit
TRADE MARK

Zeolite Water Softeners.

DESCRIPTION—The mechanical parts of a "Permutit" zeolite water softener are somewhat similar to a sand filter. The filtering medium, however, instead of being sand, is a synthetic exchange silicate, insoluble in water, which has the remarkable property of absorbing all calcium and magnesium from the water as it passes through the softener. The operation is entirely automatic—it requires no skilled attention. When the guaranteed amount of perfectly softened water has been realized, the "Permutit" is easily regenerated or restored to its original efficiency by introducing a solution of common salt. This solution remains in contact with the "Permutit" a few hours, and is partially recovered for further use. There is no sludge of any character to contend with. The cost of operation is extremely low, because appa-

rus is supplied, which reclaims a large portion of the salt, previously used.

OPERATION—"Permutit" zeolite water softeners, as conditions demand, are either of the pressure or gravity type. They are designed to deliver water in any desired capacity and to operate over any working period. The cycle of their operation permits of regeneration without interfering with the required output of softened water.

Changes in hardness of water are automatically taken care of. No attention is required throughout the day's run. A few minutes before and after regeneration is all the operating time required. A "Permutit" softener may be installed under any pressure. The loss of head through the softener is about 3 lbs.

ADVANTAGES—Water softened by "Permutit" is ideal for industrial and domestic purposes.

Among the results obtained, the following may be mentioned:

In Boiler Houses—Entire prevention of scale, sludge and mud.

Elimination of the burning out of tubes due to scale and mud.
Elimination of expensive boiler cleaning, due to scale and mud.
Important fuel saving, 10% to 20% and upwards.

In Washrooms, Laundries, etc.—Soap saving averaging more than 50%.

An even greater saving in soda.
Appreciable saving in fuel.

Great improvement in the quality of the work.

In Dye Houses—Important saving in dye stuffs.

Certainty of absolute matching of shades.
Elimination of claims due to faulty dyeing.
Improvement in feel and luster of finished goods.

Wool-Scouring—Very large soap saving.

Even greater savings in soda and alkali.
Important reduction in time and mechanical operation.
Valuable improvement in feel and quality of wool.

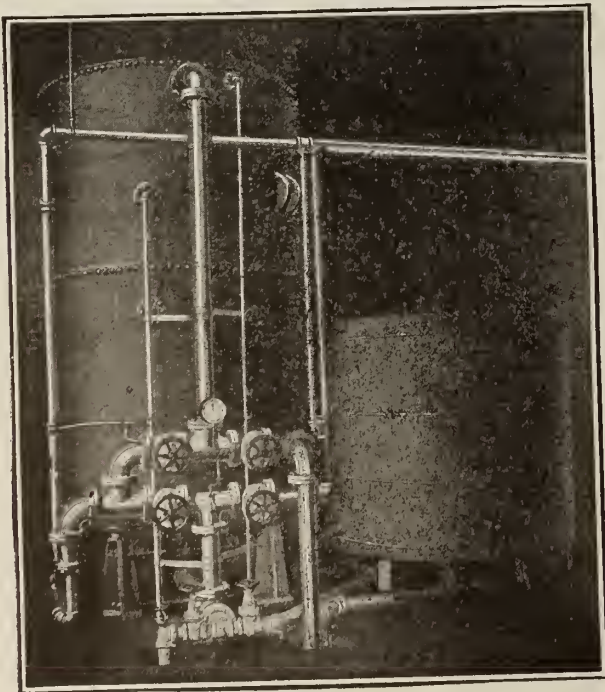
Bleaching—Pure whites, without spots.
Greatly increased tensile strength and softness.
Dependable uniformity of results.

Important saving in time.
Appreciable economy of bleaching agents.

Finishing—Very great savings in soap.
Important economy in time.
Improvement in feel and luster.
Uniform results.

"Permutit" softeners are small and compact.

GUARANTEE—"Permutit" softeners are guaranteed to deliver for the manufacturing use of the purchaser 100% of the stipulated capacity, as neutral, clear water of zero hardness. It is furthermore guaranteed that scale, sludge or mud will not form or deposit in boilers or their connections when fed with the softened water.



A TYPICAL INSTALLATION OF A "PERMUTIT" ZEOLITE WATER SOFTENER

Lime-Soda Softeners.

These are built in continuous and intermittent types. A competent staff of engineers and chemists is available for studying local conditions regulating the choice of types that will adequately satisfy the requirements of any particular installation. Special and standard apparatus is built for any capacity.

APPLICATION—"Permutit" lime-soda water softeners are applied for softening boiler feed water and water required for industrial and municipal purposes.

TYPES AND SIZES—Either wood or steel equipment is available and the chemical feed can be operated from either the ground level or from the top of tanks.

DESIGN—Special attention is given to the necessity of providing sufficient time for re-actions and settling to produce maximum reduction of the hardness with accompanying minimum use of chemicals; accurate proportionate feed of chemicals is provided for, by various types of chemical feeding devices which are selected in accordance with the demand of local conditions; perfect filtration is provided by filters whose types and sizes are carefully selected to accomplish the desired results; control apparatus is provided to maintain constant flow of water through this system during periods of operation, under which conditions accurate chemical feeding is assured; sludge is removed by various types of equipment, depending on the size and duty of the softener, preference being given, when possible, to either a conical bottom sludge removal system or a mechanically operated revolving sludge removal pipe. Both insure positive sludge removal without clogging up.

Heater Lime-Soda Softeners (Hot Process).

The "Permutit" heater softener is built to satisfy varying conditions and for any capacity. It can be used in connection with feed water heaters now installed.

APPLICATION—The "Permutit" heater softener is principally used for softening boiler feed water and for special industrial water requirements.

TYPES AND SIZES—The heater softener is built for any capacity; its type consists normally of a steel settling tank over which is located the heater, so providing for flow of the heated water to the settling tank by gravity.

A positive acting simple chemical feed is provided to accurately control the feeding of chemicals in correct proportion to the flow of water through the system. The chemical feeding device is actuated by a prime mover which does not come in contact with the chemicals—a decidedly advantageous feature.

Adequate provision is made for proper re-action and settling time. Sludge is disposed of usually by means of a conical bottom controlled by a quick opening, wedge type, sludge valve. Control apparatus is furnished to provide proper flow of water through this system, to prevent flooding and to guarantee desired operating conditions. Filtration equipment is furnished to provide treated water containing no flocculent precipitate.

Filters and Filtration Equipment.

Industrial sizes of "Permutit" filters, both pressure and gravity types, and filtration equipment for industrial and municipal requirements, are available in any size and in many types. Chemical dosing apparatus required in filtration is available in any size and type indicated by local requirements.

FILTER TYPES AND SIZES—For industrial or boiler feed purposes, either steel pressure filters, or wood and steel gravity filters, are built in standard types and sizes. Special equipment is available to satisfy special requirements.



A 3,000,000-GALLON "PERMUTIT" FILTRATION PLANT

Design—Shells of filters are conservatively designed and carefully constructed. The company has perfected excellent filter operating facilities and strainer systems, which, with careful selection of the filtering medium, guarantee maximum beneficial results.

Application—These filters are suitable for clarifying boiler feed and industrial waters for practically any purpose.

Operation—The maintenance and operation of these filters are minimum, since the least possible amount of labor is required to properly operate them, and special designing has developed equipment that requires minimum wash water.

FILTRATION EQUIPMENT—Either wood, steel, or concrete filter units and filtration equipment are offered to satisfy local demands together with the desired control and chemical apparatus. A careful investigation and survey is made of the site and controlling conditions, to guarantee the application of types and sizes of equipment that will most accurately and economically fulfil the desired requirements.

Iron and Manganese Removal Plants.

"Permutit" iron and manganese removal plants are provided in any capacity and the choice of the type of plant is governed by the quantity of the water to be treated, the amount and the character of its iron content and local conditions. Mechanical and chemical equipment are used singly or in combination; use being made of "Permutit" aerators, chemical feeding devices, settling tanks, and iron removal oxidized filters, etc. A special zeolite is frequently applied for this service.

APPLICATION—These plants are furnished to provide "iron free" water, for boiler feed, industrial and municipal purposes.

CONSTRUCTION—On account of the widely varying conditions incident to the removal of iron and manganese and similar minerals from water, it is impossible to develop thoroughly standard equipment, but the competent staff of chemists and engineers of THE PERMUTIT COMPANY approach and solve such problems in a successful way by properly handling them as individual cases.

Literature.

Complete descriptions, illustrations of and information on, "Permutit" water rectifying apparatus are available. Data will be cheerfully furnished relative to design and operation of the plants.

Service.

A competent staff of water rectification engineers and sanitary experts is always available for consultation. Inquiries are welcomed and will receive prompt and careful attention.

ROBERTS FILTER MANUFACTURING CO.

MAIN OFFICE AND WORKS
DARBY, PA.

Products and Services.

ROBERTS' GRAVITY FILTERS.
ROBERTS' PRESSURE FILTERS.
This company constructs FILTRATION PLANTS for the purification of the entire water supply of a city, the largest industrial establishments, hospitals, hotels, apartment houses, residences, or for any purposes for which pure water is required, guaranteeing to render any *water fit for whatever use* it is intended.

Roberts' Gravity Filters.

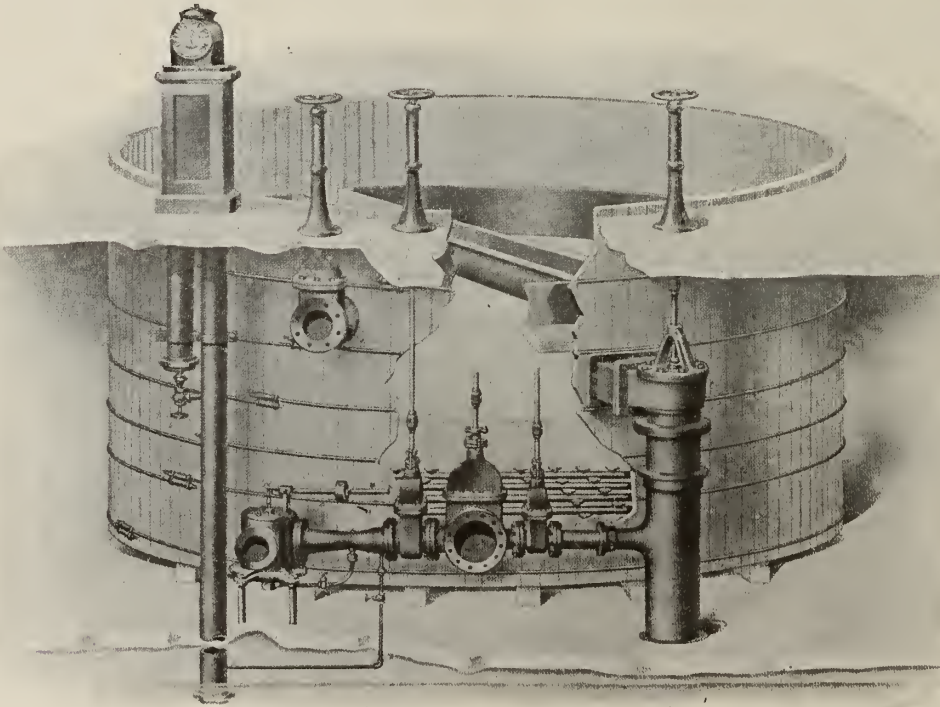
Built rectangular or circular and work practically independent of pumps supplying filtered water to consumers, as they deliver into a basin or reservoir. Rate of filtration is therefore constantly uniform, and effects maximum bacterial removal. All functions controlled by hand wheels (as shown in wood tank illustration) or by operating tables, illustrated in connection with concrete gravity filter.

Roberts' wood tank gravity filters are made from 6 to 17 ft. in diameter, completely equipped as per illustration. They can often be installed in present buildings. This type is also made in steel.

Standard rates of filtration based on 2 gals. for each sq. ft. of filtering area per minute.



OPERATING TABLE CONTROLLING CONCRETE GRAVITY FILTER



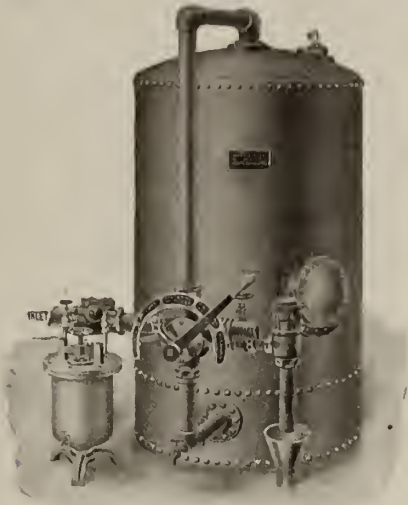
ROBERTS STANDARD WOOD TANK GRAVITY FILTER, HIGH RATE WASH TYPE

Diameter, ft.	Details of strainer systems subdivided into			Pipe sizes					Capacities—2 to 3 gals. rate			Approximate shipping weight	
	Manifold, in.	Laterals, in.	Strainers	Influent, in.	Effluent, in.	Wash, in.	Waste, in.	Rewash, in.	Minute	Hour	24 hours	Tank and parts, lbs.	Sand and gravel, tons
6	4 black w. i.	1½ galv. w. i.	Orifice	4	3	4	6	3	56- 84	3260- 5040	77640- 120960	6000	7
6	6 black w. i.	1½ galv. w. i.	Orifice	4	4	6	10	3	100-150	6000- 8000	144000- 272000	8000	9½
11	8 black w. i.	1½ galv. w. i.	Orifice	6	6	8	10	4	190-285	11400-17100	160000- 610000	10000	17
12	6 c. i. semi-cir	1½ galv. w. i.	Orifice	6	6	8	10	4	230-345	13800-20700	335000- 500000	13000	20
13	8 c. i. semi-cir	1½ galv. w. i.	Orifice	6	6	8	10	4	266-399	16000-24000	385000- 575000	14500	23
14	8 c. i. semi-cir	1½ galv. w. i.	Orifice	8	6	10	12	4	310-460	18600-27600	450000- 660000	16000	31
15	10 c. i. semi-cir	1½ galv. w. i.	Orifice	8	6	10	12	4	350-530	21000-32000	500000- 750000	16500	38½
16	8 c. i. semi-cir	1½ galv. w. i.	Orifice	8	8	10	14	4	400-600	24000-36600	580000- 860000	17500	40
17	8 c. i. semi-cir	1½ galv. w. i.	Orifice	8	8	10	14	4	450-680	27000-40000	650000-1000000	18000	41

Roberts' Vertical Filters.

Built of cast iron or steel. Equipped with the Roberts' single control valve, coagulant tank, sight glass and baffle plate.

Made in sizes varying from 12 to 96 in. diameter.



ROBERTS' VERTICAL FILTER

Roberts' Horizontal Pressure Filter.

Extensively used in large manufacturing establishments, also for the filtration of city water supplies where conditions warrant their use. This type is made in sizes as per schedule below.

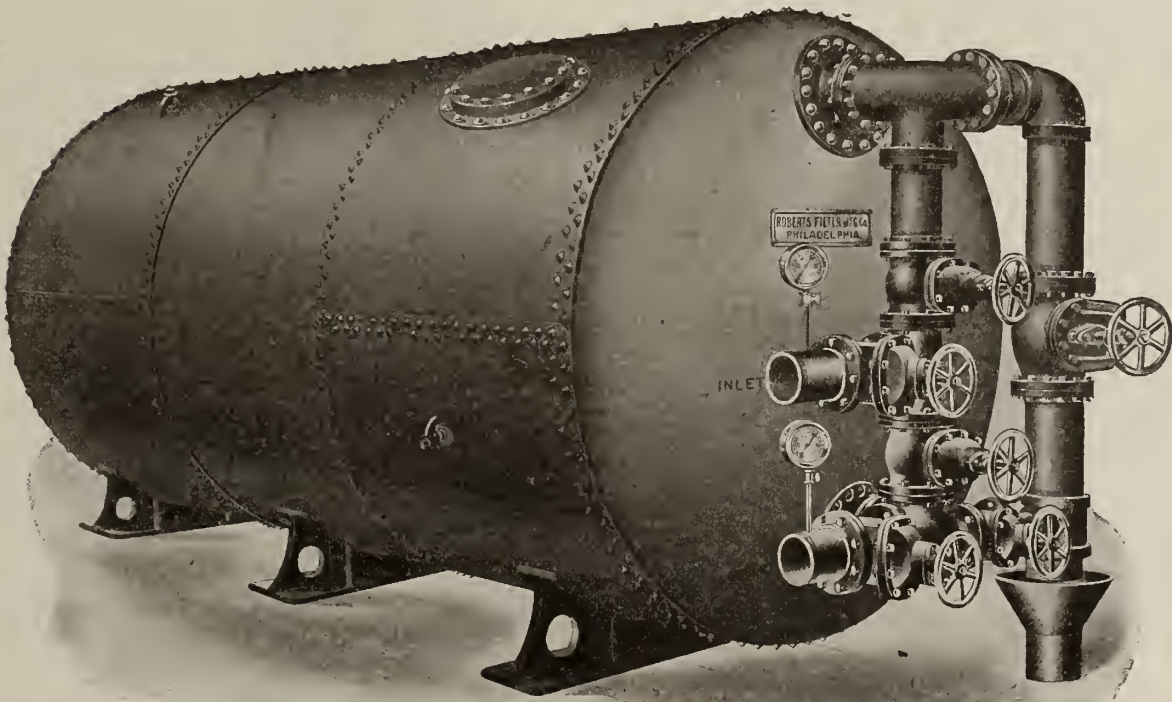
They are constructed to sustain an internal hydrostatic test pressure of 100 lbs. per sq. in., an additional charge being made for filters to sustain pressures above 100 lbs.

Built of first quality homogeneous mild steel. Heads are in one piece and are dished to a radius of 8 ft. Filters are supported on their foundations by either heavy cast iron or concrete cradles.

Co-operative Service and Catalogue.

To those who contemplate the installation of filtration plants, the benefit of our knowledge and experience is extended. Recommendations made gratuitously, plans prepared and estimates submitted. When conditions justify it, one of the engineering force will be sent to look over water works systems and collect full data as to conditions and requirements, that intelligent suggestions may be made, and detailed plans, close estimates and a comprehensive proposition submitted.

Complete catalogue on request.



ROBERTS' HORIZONTAL PRESSURE FILTER

All external piping is standard pipe with cast iron flanged and screwed fittings. Gate valves are of the double wedge type, with iron body and brass trimmings, and the globe valve in waste pipe is of special pattern.

Cylinder is provided with a manhole, also with handholes on either side just above the screen or strainer system, one near the front and one near the back to facilitate removal of filtering material should it become necessary to empty the cylinder, and one on either side, at the top near front and back heads

Diameter, ft.	Length, ft.	Inlet and outlet pipes, in.	Waste pipe, in.	Capacity in U. S. gallons			Approximate shipping weight, lbs.			Test pressure per sq. in., lbs.
				Minute	Hour	24 hours	Case	Parts	Filtering material	
8	10	6	6	160-240	9,600-14,400	230,400-345,600	9,000	5,500	33,000	100
8	12	6	6	190-280	11,400-16,800	273,600-403,200	10,800	6,100	39,600	100
8	14	6	8	230-340	13,800-20,400	331,200-489,600	12,600	6,800	46,200	100
8	16	6	8	250-360	15,000-21,600	360,000-518,400	14,400	7,500	52,800	100
8	18	6	8	290-430	17,400-25,800	417,600-619,200	16,200	8,100	59,400	100
8	20	6	8	320-480	19,200-28,800	460,800-691,200	18,000	8,800	66,000	100
8	25	8	10	400-600	24,000-36,000	576,000-864,000	22,500	11,000	86,000	100
8	30	8	10	480-720	28,800-43,200	691,200-1,000,000	27,000	12,500	106,000	100

THE REFINITE COMPANY

Manufacturer of Water Softeners

Refinite Building
OMAHA, NEBR.

DISTRICT OFFICES

NEW YORK, N. Y., 9 East 40th Street
ATLANTA, GA., 320 Hurt Building
MINNEAPOLIS, MINN., 703 Plymouth Building
DETROIT, MICH., 502 Lincoln Building
KANSAS CITY, MO., 611 Grand Avenue Temple
SALT LAKE CITY, UTAH, 209 Walker Building
SAN FRANCISCO, CAL., 419 Call Building
CLEVELAND, OHIO, 129 Arcade Building

CHICAGO, ILL., 908 South Michigan Avenue
CINCINNATI, OHIO, 410 Traction Building
PUEBLO, COLO., Thatcher Building
LOS ANGELES, CAL., 303 Story Building
TORONTO, CAN., 23 Scott Street
BUFFALO, N. Y., 411 Liberty Building
SPOKANE, WASH., 1015 National Bank Building
DENVER, COLO., 513 Mercantile Building

Product.

REFINITE WATER SOFTENERS.



TRADE-MARK

Services.

THE REFINITE COMPANY manufactures and sells a water softening system using the natural water softening mineral, Refinite. The factory, where the mineral is processed and prepared for use in this system, is located at Ardmore, S. D., near the mines from which the mineral is taken. General offices occupy the four-story Refinite Building at Omaha, Nebr. District offices are maintained in 16 cities in the United States and Canada.

From each district office sales engineers and erectors are available to furnish information, make calls on the trade and render engineering and other services that may be desired as well as to install and put into operation systems ordered.

Inquiries directed to the nearest office are thus given the most prompt and careful attention.

Principal Uses.

Refinite water softeners are built in different sizes to suit the various needs. They are in operation the country over. The principal users are textile mills, laundries, institutions, hospitals, hotels, beauty parlors, barber shops, steam power and central heating plants, machinestops, apartment buildings and private homes.

Description.

Refinite is nature's own water softening mineral. It is flinty and porous and is insoluble in water. As it comes from the ground it is known as "ardmoreite" and is classified as a natural zeolite. Refinite is the registered name for the mineral after it has been prepared for use in the Refinite system. THE REFINITE COMPANY owns or controls all of the known beds of "ardmoreite."

The Refinite water softener is designed to use Refinite mineral. It is the only system in which this mineral is used.

Construction.

The softener consists of a steel tank or container, provided with proper water inlet and outlet openings together with the necessary piping and valves for controlling the flow of water; water meter and a brine tank. It attaches to the cold water supply line.

Within the container is a bed of Refinite mineral. The mineral is supported by a layer of gravel resting on a soft water collector system. As the water to be softened passes through this bed, the lime and magnesia

salts present are taken up and retained by the mineral, sodium being released in exchange. This natural exchange action automatically ceases when all of the hardness is taken up. The water thus softened is neutral and desirable for any use.

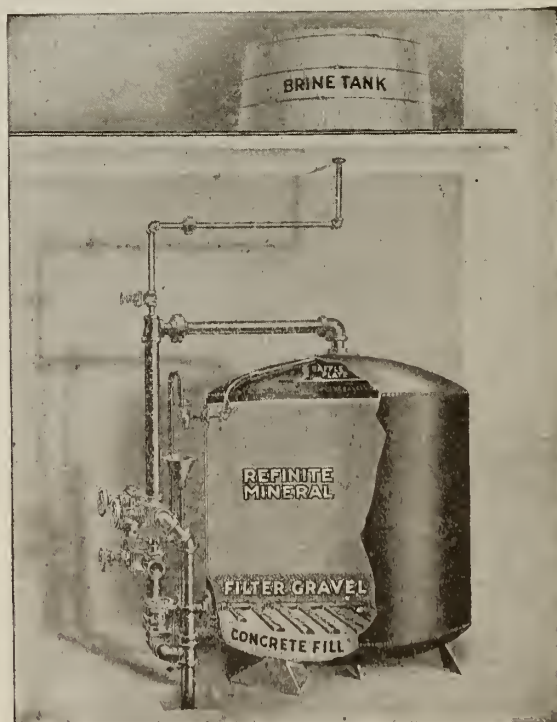
After the bed of Refinite has softened its rated capacity of water, its exchange properties are restored by simply allowing a brine solution (common salt water) to stand in the container overnight.

Installation.

The Refinite water softener is quickly installed, occupies very little space for the volume of water handled; requires no expert supervision, practically no attention; is extremely low of operation cost, reasonable in price.

Each Refinite system is built and installed to give absolute satisfaction, to accomplish definite results at a definite cost, and each sale is conditioned upon the apparatus fulfilling these guarantees. To make these individual guarantees, the company must know the character and degree of hardness of the water and the amount to be softened in a 10-hour period.

Analyses of water are made without charge.



SECTIONAL VIEW OF REFINITE WATER SOFTENER

WM. B. SCAIFE & SONS CO.

FOUNDED 1802

Water Filters and Water Softening Systems

Executive Offices, Laboratory and Works
OAKMONT, PA.

NEW YORK OFFICE, 26 Cortlandt
Street

PITTSBURGH OFFICE, First National Bank
Building

CHICAGO OFFICE, 38 South Dearborn
Street

Products.

Manufacturers of SCAIFE PATENTED WATER FILTERS of any capacity for residences, public buildings, factories and municipalities, including PATENTED SAND and CHARCOAL FILTERS, TANDEM PATENTED STEEL PRESSURE FILTERS, Vertical and Horizontal.

SCAIFE and WE-FU-GO WATER SOFTENING SYSTEMS for boiler feed water, for domestic use and for every industrial purpose.

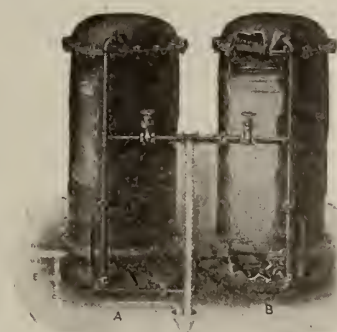
Mechanical Gravity Filters and Re-filtering Systems for swimming pools; Structural Steel Work, Stacks, Steel Tanks, Range Boilers, High Pressure Cylinders, Special Steel Containers.

Double Combination Sand and Charcoal Filters.

Scaife patented cast iron sand and charcoal filters are specially constructed and adapted for private residences, small apartments, etc., where the entire supply is to be filtered.

Made of cast iron for maximum working pressure of 100 lbs. per sq. in. The water, when double filtered, is first passed through quartz-filled cylinder and then through the other filter, which contains pure animal charcoal.

The charcoal filter never comes in direct contact with the impure water from the supply; therefore it is a perfect sanitary filter without the use of chemicals.



DOUBLE COMBINATION CAST IRON
SAND AND CHARCOAL FILTERS

DATA, DOUBLE COMBINATION SAND AND CHARCOAL FILTERS

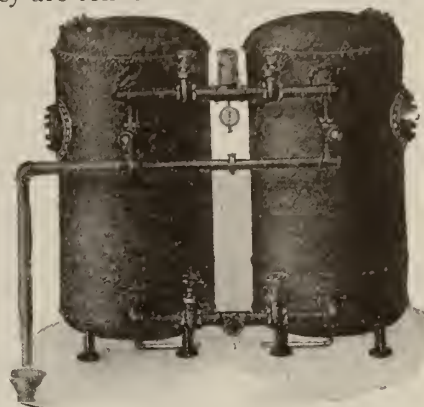
Cat. No.	2 units, diam. of unit	Height	Filter area, single unit in sq. ft.	Floor space		Size supply pipe	Capacity per hour based on 2, 3 and 4 gals. per sq. ft. per min.			Approx. shipping weight, lbs.
				Length	Width		2 gals.	3 gals.	4 gals.	
55	16"	4' 0"	1.40	4' 2"	2' 6"	1"	165	250	335	1700
66	20"	4' 0"	2.18	4' 6"	2' 10"	1"	260	390	520	2800
77	24"	4' 6"	3.14	4' 10"	3' 2"	1 1/4"	375	565	750	4200

DATA, SCAIFE VERTICAL, TANDEM, STEEL QUARTZ PRESSURE FILTERS

Cat. No.	2 units, diam. of unit	Total filter area (2 filters) in sq. ft.	Floor space		Height	Capacity per hour based on 2, 3 and 4 gals. per sq. ft. per min.			Capacity per 24 hrs.			Approx. shipping weight, lbs.	Weight when full of water, lbs.	Pipe sizes		
			Length	Width		2 gals.	3 gals.	4 gals.	2 gals.	3 gals.	4 gals.			Inlet	Out-let	Sewer
88	30"	9.8	7'	4' 6"	6' 6"	1180	1770	2360	28320	42480	56640	6000	10800	3"	3"	3"
99	36"	14.1	8'	5' 0"	6' 6"	1680	2520	3360	40320	60480	80640	7800	14800	3"	3"	3"
100	42"	19.2	9'	5' 8"	7' 4"	2300	3450	4600	55200	82800	110400	10500	20500	4"	4"	4"
111	48"	25.1	10'	6' 2"	7' 4"	3000	4500	6000	72000	108000	144000	12400	25400	4"	4"	4"
122	54"	31.8	11'	6' 8"	7' 4"	3800	5700	7600	91200	136800	182400	16300	33000	4"	4"	4"
133	60"	39.2	12'	7' 2"	7' 6"	4700	7050	9400	112800	169200	225600	19400	40000	4"	4"	4"
155	72"	56.4	14'	8' 3"	8' 0"	6760	10140	13520	162240	243360	324480	27200	56800	6"	6"	6"
177	84"	76.8	16'	9' 3"	8' 0"	9200	13800	18400	220800	331200	441600	36000	76400	6"	6"	6"
199	96"	100.4	18'	10' 4"	8' 0"	12040	18060	24080	288960	433440	577920	42100	94800	6"	6"	6"

Tandem Patented Steel Quartz Pressure Filters.

Furnished either in single units or in pairs. When operated in pairs they are connected tandem so that each filter is cleaned with filtered water, one filter furnishing the water for cleaning the other. They are equipped with efficient strainers of special form to insure thorough washing by reversing the flow of water. Built for any required working pressure and with filtering material varied to meet any special requirement.



TANDEM STEEL QUARTZ PRESSURE
FILTERS

Water Softening and Purifying Systems.

The siphon continuous system is an automatic system not dependent upon moving mechanical devices for reagent introduction. The water enters the receiving tank, to which is connected a siphon and to the long leg of which smaller siphons connect from the solution tanks. Reagents introduced during the period of siphon discharge. This system can be modified to meet special conditions.

In addition to this type of apparatus 3 other standard continuous systems are built; also the We-Fu-Go intermittent softening and filtering system, and special systems are designed where required. Water softening and purifying apparatus must be designed to meet the particular water supply and operating conditions of each case. Estimates submitted when full data is supplied.



SIPHON CONTINUOUS WATER
SOFTENING SYSTEM

SPRAY ENGINEERING COMPANY

93 Federal Street
BOSTON, MASS.

Products.

"SPRACO" SYSTEMS for Cooling Condensing Water; AIR WASHERS; GAS SCRUBBERS; "SPRACO" NOZZLES for Highway Construction and Maintenance; "SPRACO" PNEUMATIC PAINTING EQUIPMENT; PAINT GUNS.

Humidifiers; Park and Lawn Sprinklers and complete Irrigation Systems; Sewage Nozzles; Aerating Nozzles; Flow Meters; Mixing Nozzles; High Temperature Cement Sprayers.



"Spraco" System for Cooling Condensing Water.

GENERAL DESCRIPTION—Wherever water has to be cooled for condensers, water jackets, evaporators or transformers, a "Spraco" system, in connection with a properly designed cooling pond, will be found to be the most efficient, the simplest and most economical to operate. It costs much less to install than any other system of cooling water; and where there is an existing pond, cost is limited to the "Spraco" system itself, consisting of nozzles, special equipment and piping.

In a "Spraco" system the hot water is cooled by spraying it into the air, so that, when it falls into the basin or pond, its temperature is sufficiently reduced to permit of it being used over again, thus affording, at small expense, an abundant supply of cold water independently of where the plant may be located. This feature is frequently of great value, as a plant can be located where it is convenient to a fuel supply or distributing center, and without considering a condensing water supply, which can be furnished by a "Spraco" system at comparatively small expense. It also affords a simple remedy by which many power plants, now handicapped with hot condensing water, can reduce their operating expense. An earthen pond of inexpensive construction often meets all requirements; and where ground space is limited, a "Spraco" system can be installed, with satisfactory results, on the roof of a building.

ECONOMY—With the "Spraco" system it is possible to obtain an average vacuum of 28 in. the year round in almost all parts of the United States. The great cooling capacity of the "Spraco" systems has led to their adoption by many of the largest power plants.

The yearly saving effected by the "Spraco" cooling system will generally pay a 50% return on its cost.

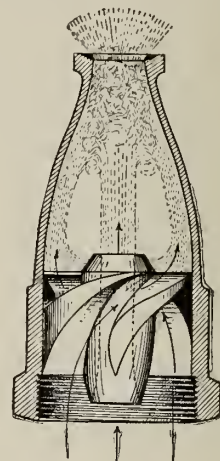
POWER REQUIREMENTS—By reason of improvement in the "Spraco" nozzles, the power to operate sprays has been reduced fully 50% of what was formerly thought necessary. Under ordinary conditions, power necessary to operate sprays will average less than 1½% of the power generated by engine, whereas the average cooling tower will require for operation about 3% of power generated. It should be noted that spray creates a circulation of air, thus saving the power required to operate fans for this purpose.

WATER LOSS—The average yearly loss of water with this system will approximate less than 1½% of condensing water used. As boiler feed will average about 2% of condensing water, it is apparent that the addition of condensed steam to pond supply, where jet condensers are used, will more than make up water losses.

COOLING CAPACITY—The results obtained by the "Spraco" system, given on this page, show the cooling which can be obtained and the resulting vacuum. Under average hot weather conditions, temperature of cooled water will approximate temperature of the air, and in hottest summer hours will be from 2° to 6° Fahr. lower than surrounding air.

"SPRACO" NOZZLES—"Spraco" nozzles are provided with removable turbine centers having large passageways. Centers are held stationary in the nozzles, so that there are no moving parts to wear out, and the water, in passing through, is given a rapid rotating motion.

A high grade of bronze, smooth finished, is used for both shell and center, and ample metal is provided at all wearing points, assuring long life.



SECTIONAL VIEW OF
"SPRACO" NOZZLE

RESULTS OF TESTS ON A TYPICAL SPRING DAY

Time of day	Temperature of air	Relative humidity	Temperature of water		Vacuum obtained, inches mercury	Average barometer, inches mercury
			Before spraying	After spraying		
7 A.M.	56°F.	79%	99°F.	82°F.	28.3	30.35
8	59°F.		100°F.	85°F.	28.3	
9	62°F.		101°F.	86°F.	28.2	
10	64°F.		103°F.	88°F.	28.15	
11	66°F.		104°F.	88°F.	28.15	
12	68°F.		104°F.	90°F.	28.05	
1 P.M.	70°F.		104°F.	87°F.	28.	
2	72°F.		104°F.	88°F.	28.05	
3	74°F.		104°F.	88°F.	28.05	
4	73°F.		104°F.	88°F.	28.05	
5	70°F.		105°F.	88°F.	28.05	



2500 H.P. "SPRACO" COOLING POND



ROOF "SPRACO" SYSTEM, BOSTON ICE CO., BOSTON, MASS.

CO-OPERATIVE SERVICE—The SPRAY ENGINEERING COMPANY is prepared to accept the responsibility for design and construction of an entire “Spraco” system, including pond, where desired, and to guarantee results. Their engineering force has had extensive experience in all details of power plant design, and has installed many hundreds of cooling systems in nearly every state of the Union and 15 foreign countries.

“Spraco” Air Washing and Cooling Equipment for Steam Turbine Generators and other Electrical Machinery.

With the advent of the modern, horizontal, high speed generators, the matter of the proper ventilation of same has become of great importance. The heat losses per unit of surface, or of active weight, are relatively much larger than in the older machines, making forced ventilation essential. The amount of air required varies with the size and type of the generator, some of the later and larger models using less air per kv-a on account of their higher efficiency.

The necessity of properly conditioning the ventilating air is now recognized by engineers as secondary only in importance to the securing of an ample supply of air. The air should be cleansed of all dirt, cooled, and humidified. To accomplish this in an efficient manner, a water-spray type of air washer and cooler has been found to be the best device. The SPRAY ENGINEERING COMPANY, pioneers in the design and manufacture of washers essentially for power plant service, has developed and perfected the well-known Spraco air washing and cooling equipments, used almost universally in this country and abroad.

The gain in efficiency and capacity, the saving in maintenance, and the longer life of a generator which

result from the use of “Spraco” equipment for cooling and cleaning air for such generators, have all a large monetary value. It makes the installation of an equipment of this kind inevitable in all progressive and up-to-date power plants.

TESTS—Following are the results of tests made in various parts of the country and at different times of the year :

TESTS MADE ON AIR WASHERS, GIVING ACTUAL THERMOMETER READINGS

Air entering washer	Air leaving washer	Wet bulb temp.	Degrees cooled	Place	Date
63.8°F.	49.3°F.	49.2°F.	14.5°F.	Penn.	November, 1914
70.0°F.	59.0°F.	59.0°F.	11.0°F.	Penn.	October, 1914
75.1°F.	58.5°F.	58.4°F.	16.6°F.	Mass.	June, 1914
93.0°F.	73.75°F.	73.75°F.	19.25°F.	Tex.	September, 1914

Gas Scrubbers.

The “Spraco” nozzles give highly satisfactory results in connection with furnace gas scrubbers, as the mistlike spray takes out everything which is held in suspension in the gases.

“Spraco” Nozzles for Highway Construction.

“Spraco” nozzles spray at the rate of ¼ to 1½ gals. per sq. yd., coating stone evenly. Require little power, do not clog, and are quickly taken apart and reassembled. The cost of a bituminous-bound, macadamized road (two 3-in. layers of No. 1 rock, with double spraying and heavy bituminous binder) can be cut 20%.

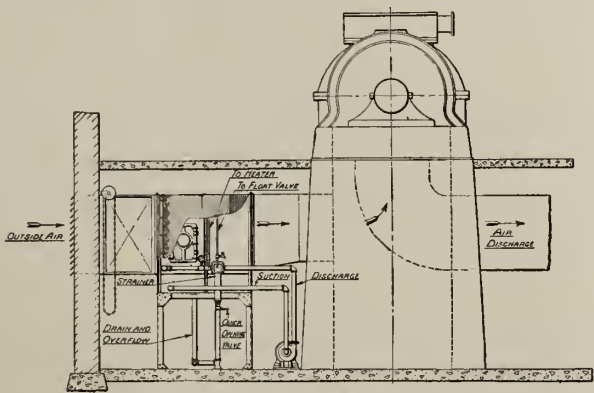


SPRAYING BITUMINOUS BINDER WITH “SPRACO” NOZZLES

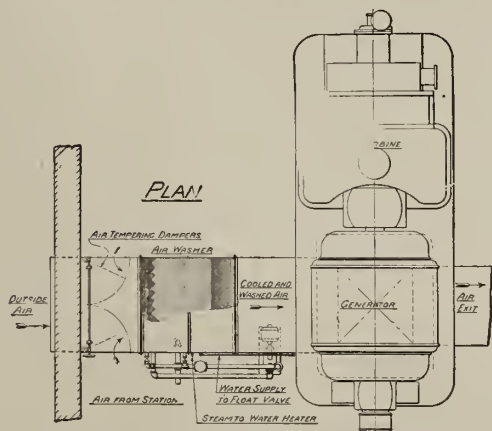
“Spraco” Pneumatic Painting Equipment.

The modern method of applying paint and other coatings is by the use of compressed air. It gives better results than the hand brush method, and saves both time and labor. The “Spraco” pneumatic painting equipment is compact, portable, and adapted for either shop or field use.

SOME OF THE ADVANTAGES—One workman can do the work of 3 to 12 painters using brushes, depending upon the nature of the work. Uniformly finished coatings free from streaks and brush marks are produced. Rough, irregular and inaccessible surfaces are readily coated. Either a lighter or heavier coating can be obtained than is possible with hand brushes. Standard guns are capable of handling all classes of liquid coatings by using interchangeable caps and nose pieces. The gun and control head may be blown free from paint or cleaned without taking apart. The gun may be mounted on an extension pole for painting surfaces beyond the reach of the operator.



ELEVATION



PLAN

ELEVATION AND PLAN OF AIR WASHER LAYOUT FOR TURBO-GENERATOR

THE STAR BRASS WORKS

Cooling Systems and Spray Nozzles

3115 Carroll Avenue
CHICAGO, ILL.

Products.

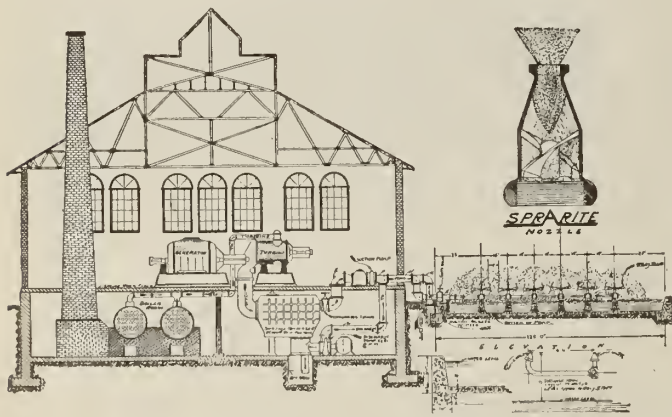
"SPRARITE" NOZZLES for cooling ponds for condensing water.

Special Spray Heads for Gas Washers, Humidifying, Air Washing, Air Blow Valves, Whitewashing, Painting and Spraying Machinery, Siphons, Ejectors, etc.

Spray Cooling.

With the development of steam turbines and condensing apparatus for condensing exhaust steam, an important question is the type, design, and selection of cooling equipment for cooling circulating water. Artificial cooling of condensing water may be accomplished in three ways, i. e., by the use of natural or forced draft cooling towers, and by means of spray ponds. The spray system has shown such remarkable cooling capacity that it has been adopted by more than 250 power and industrial plants using "Sprarite" equipment.

Spray cooling for the present purpose can be best illustrated by reference to the accompanying diagram. It consists in placing the spray nozzles in suitable arrangement on one or more lateral mains over the pond, through which the water is sprayed falling into the confines of the pond. The water thus sprayed comes into intimate contact with the air in finely broken up particles, thus reducing its temperature, the cooling resulting from the agents of evaporation, radiation and convection.



SPRAY COOLING INSTALLATION
In connection with surface condensing equipment

"Sprarite" Nozzles.

Cooling water by means of sprays can be best accomplished by the use of the low pressure "Sprarite" nozzles, which are made in various sizes as indicated in the following table. Nos. 6, 7 and 8 nozzles will be found suitable for any spray cooling installation, while the smaller sizes are adapted for special spray nozzle applications fully covered in the company's literature.

The selection of spray nozzles for any cooling system is of vital



importance as, no matter how well the system might otherwise be planned, its final cooling capacity will be no better than the spray nozzles used. "Sprarite" nozzles

operate under low pressure, 4 to 6 lbs. being sufficient. As will be noted from an examination of the accompanying illustration of "Sprarite" nozzle, it is very simple in construction, consisting of but two parts, body and core, and has no moving parts. The inlet water passes through two helical channels, meets before reaching discharge orifice, and is discharged in a beautiful, full mass formation of equal density throughout its entire area. A typical spray nozzle installation is also shown herewith.



INSTALLATION AT
SOUTHERN RAILWAY
AND LIGHT CO.,
NATCHEZ, MISS.

CONSTRUCTION—"Sprarite" nozzles are constructed entirely of brass, finished to glasslike smoothness inside and out, while the metal is of ample thickness at all wearing points to give life-long service.

SIZES AND CAPACITIES OF "SPRARITE" NOZZLES

[No.	Supply pipe, ins.	Diam. of orifice, ins.	Capacity in gallons per minute at different pressures, lbs. per sq. in.					
			5	6	7	8	9	10
2	3/4	1/4	2.90	3.14	3.38	3.62	3.86	4.10
3	1	5/8	5.87	6.34	6.81	7.28	7.75	8.32
4	1 1/4	3/8	8.5	9.19	9.88	10.87	11.28	11.95
5	1 1/2	1/2	14.26	15.44	16.62	17.80	18.98	20.16
6	2	3/4	32.0	34.6	37.2	39.8	42.4	45.3
7	2 1/2	1	56.8	61.4	66.0	70.6	75.2	80.2
8	3	1 1/4	83.6	92.9	101.3	109.6	117.9	125.5

Capacities of smaller or larger sizes at any pressure furnished on request.

Results Obtained.

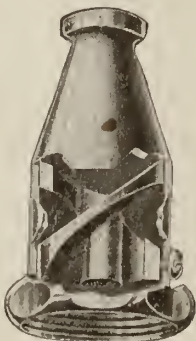
To give the prospective purchaser an idea of some cooling results that can be procured with the "Sprarite" nozzle, the following table is presented. This company is prepared to furnish the spray nozzles only, or the system complete, including everything above the pond, and guarantee results.

TABLE OF 12°, 16° AND 20° REDUCTION

Lbs. pressure	Before spraying	After spraying	Dry bulb	Wet bulb	Humidity
12° REDUCTION					
5	75.0°	63.0°	60°	50°	50%
6	83.5°	71.5°	70°	61°	60%
7	93.8°	81.8°	80°	73°	70%
16° REDUCTION					
5	90.7°	74.7°	70°	59°	50%
6	100.1°	84.1°	80°	70°	60%
7	109.0°	93.0°	90°	82°	70%
20° REDUCTION					
5	95.4°	75.4°	70°	59°	50%
6	104.8°	84.8°	80°	70°	60%
7	114.0°	94.0°	90°	82°	70%

Bulletins.

Bulletins Nos. 4 and 5 cover fully various spray nozzle applications, copies of which will be cheerfully furnished.



"SPRARITE" NOZZLE

WALLACE & TIERNAN CO., INC.

Chlorine Control Apparatus for Water and Sewage Purification and Equipment for Gas Control

MAIN OFFICE AND FACTORY

349 Broadway

NEW YORK, N. Y.

BRANCH SALES OFFICES

ATLANTA, GA., 618 Hurt Building

CHICAGO, ILL., 466 People's Gas Building

DALLAS, TEX., 507 Scollard Building

SAN FRANCISCO, CAL., 709 Mechanics Institute Building

BRITISH OFFICE: UNITED WATER SOFTENERS, LTD., 20-22 Lincoln's Inn Fields, LONDON, W. C. 2, ENGLAND

CANADIAN REPRESENTATIVES: GENERAL SUPPLY COMPANY OF CANADA, LTD., OTTAWA, MONTREAL, TORONTO, WINNIPEG, VANCOUVER

KANSAS CITY, MO., 707 Commerce Building

PHILADELPHIA, PA., 1035 Commercial Trust Building

PITTSBURGH, PA., 1404 Oliver Building

Products.

CHLORINE CONTROL APPARATUS and APPLIANCES for water and sewage purification.

Chlorine Solution Injectors, Chlorine Solution Pumps, Special Automatic Valves for application of chemical solutions.

Special Apparatus for Water Purification, Measurement, Control, etc. Chlorine Apparatus for Industrial Use, Bleaching, etc.

Apparatus to manufacture Dakin's Hypochlorite Solution from Liquid Chlorine.

Special Apparatus to Apply, Control, Measure and Proportion Gases.

Consultants in problems of Gas Control.

Scientific Instruments and Special Apparatus for Sanitary and Industrial Research Work; Portable Bacteriological Testing Apparatus; Air Sampling Apparatus.

General Use.

W. & T. chlorine control apparatus and appliances are used to introduce liquid chlorine into water or sewage to effect bacteriological purification and destroy typhoid and other water-borne disease germs. Used extensively by municipalities and by industrial plants.

About Chlorine.

Pure chlorine compressed in cylinders is now recognized as the most efficient sterilizing agent for water and sewage. In its liquid state it replaces chloride of lime so largely used in the past for this purpose.

Liquid chlorine has come into general use in the field of water and sewage purification through the development by this company of suitable apparatus for its control and application.

There are now hundreds of installations of W. & T. apparatus treating



TRADE-MARK

water supplies, ranging from a few thousand gallons per day up to installations with a total capacity of one billion gallons per day, as installed by WALLACE & TIERNAN CO., INC., for the City of New York.

Types and Capacities of Equipment.

W. & T. equipment is made for either manual or automatic control, applying the chlorine to the water as a gas, or in solution with water. Wherever applicable, the solution feed type of equipment is recommended.

There are 20 different types of W. & T. equipment, with capacities ranging from 1/100 lb. of chlorine per day, upwards.

All W. & T. equipment is constructed on the unit system, and is so designed that it can be operated by the ordinary water works operator. A complete stock of parts is kept on hand for distribution from either the factory or the branch offices.

Operation and Cost.

Liquid chlorine, when controlled by W. & T. equipment becomes so efficient that the water supply of any city or town can be protected against water-borne diseases at a cost of from 17¢ to 50¢ per million gals.

Sewage and Trade Wastes.

Liquid chlorine is used extensively in the sterilization of sewage and trade wastes. It is particularly recommended where sewage is discharged into streams used as water supplies.

Liquid chlorine is the most effective sterilizing agent for tannery wastes, where the destruction of specific organisms, such as the anthrax spore, is required by law.

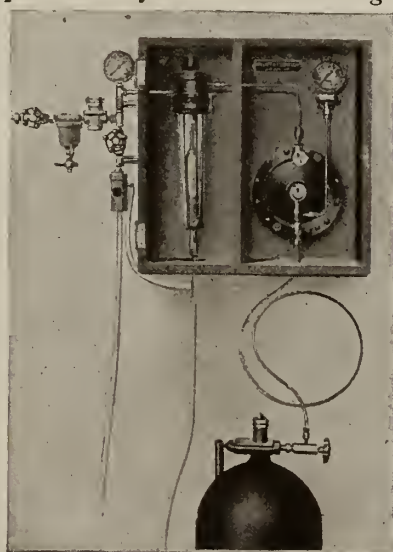
Liquid chlorine controlled by W. & T. equipment is applicable to any problem of sterilization or disinfection, bleaching or industrial use.

Co-operative Service.

A large staff of technically trained experts are available for consulting on all problems of gas control. Quotations and recommendations on equipment will be made on receipt of details. Send for information blank.

Literature.

A full set of technical publications describing the various phases of chlorination and W. & T. equipment is available, and will be sent on request.



W. & T. MANUAL CONTROL
CHLORINATOR
Solution Feed Type MSA

THE AMERICAN PULLEY COMPANY

MAIN OFFICE AND WORKS
4200 Wissahickon Avenue
PHILADELPHIA, PA.

BRANCH OFFICES

NEW YORK, N. Y., 33-35 Greene Street
SEATTLE, WASH., 536 First Avenue, S.
BOSTON, MASS., 165 Pearl Street

CHICAGO, ILL., 114-116 South Clinton Street
SAN FRANCISCO, CAL., 14 Natoma Street
LOS ANGELES, CAL., Sunset Terminal Warehouse

National distribution through supply houses from parent stocks in larger cities

Products.

Manufacturers of AMERICAN STEEL SPLIT PULLEY; AMERICAN STEEL SPLIT PULLEY with CORK INSERTS.

American Pressed Metal Sash Pulleys.
Reels, Spools, Beams, Stampings, and Pressed Metal Shapes.

Special Features of Belt Pulleys.

- (1) Simplicity of design and construction.
- (2) Ease of installation on shafting.
- (3) No key seating or set screws.
- (4) Well balanced and run true.
- (5) Stand greater strains than pulleys having much more weight.
- (6) Transmit maximum power with minimum belt slip.
- (7) Minimum air resistance effects enormous saving in power.
- (8) Recommended for rim speeds up to 6000 ft. per minute.



(9) 40% to 60% lighter than cast iron pulley designed for equal service.

(10) Guaranteed for double belt duty under any conditions not demanding a special pulley.

Construction.

Rim made from two or more channel sections. Mounted side by side forming in-turned rim flanges which stiffen rim at center where it is subjected to greatest strain from belt pull. This construction forms groove, running centrally around face of pulley (an exclusive feature) which prevents air cushioning by acting as an air escape. Rim has safety beaded edges.

Ends of arms milled to exact length and riveted to internal rim flange; *not* riveted through face of pulley. These flat "A" braced arms (edge on) cut, instead of fan, the air, thereby effecting power economy.

Furnished with crown or straight face.

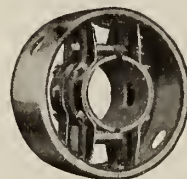
Information.

Over 275 dealers carry American Steel Split Pulleys in stock.

Prices on application.



SIX-ARM PULLEY
7- to 42-in. diameter, inclusive



SMALL DIAMETER
PULLEY
3-, 4-, 5- and 6-in.
diameter.



EIGHT-ARM PULLEY
44- to 72-in. diameter, inclusive, with faces narrower than 16 in.



SPECIAL HEAVY DUTY
PULLEY

For any especially severe service where nothing but a special will stand up



DOUBLE AND TRIPLE-ARM PULLEY
12- to 120-in. diameter, inclusive, when width of face is too great for safety with single arms



PULLEY WITH CORK
INSERTS

For use where an almost positive drive is required, insuring an absolute minimum of belt slip

CHARLES BOND COMPANY

Manufacturers of Power Transmission Equipment

617-619 Arch Street
PHILADELPHIA, PA.

Product.

FLEXIBLE INSULATED COUPLINGS.

Construction of Grundy Patent Flexible Insulated Coupling.

This coupling is constructed of three pieces only, the two outer flanges being of cast iron and the center disk of non-conducting material, with lugs on each side for transmitting the power to the outside flanges.

The central disk is made of specially selected leather or hard fiber, with lugs securely cemented and riveted to each side of the disk.

The larger sizes, Nos. 12 to 30 inclusive, have lugs cemented and bolted on and reinforced with steel plate as shown in illustration.

The disks supply the insulation while the lugs on each side transmit the power to outside flanges. The leather lugs are cut on a bias, tapering towards the disk; the cast iron driving flanges being machined with a corresponding taper, have a tendency to draw the flanges close to the disk, and to cause the leather lugs to receive and transmit the power at their strongest points.

The close connection made possible by this style of coupling reduces to a minimum the leverage, which is so objectionable on the old style pin couplings.

Scope of Use.

The Grundy coupling is specially adapted for connecting motors to pumps, machine tools, sewing machines, woodworking machinery, printing machinery, fans, blowers, shafting to angle drives, etc.

In the matter of neatness and utility, it is an ideal connection for use between dynamo and gas engine cranks or similar machinery.

It is a simple device for connecting the two ends of shafting where it is difficult to get the bearings in perfect alignment, or where they are liable to get out of adjustment.

Distinctive Features.

The Grundy coupling will transmit more horsepower than any other flexible coupling of equal diameter.

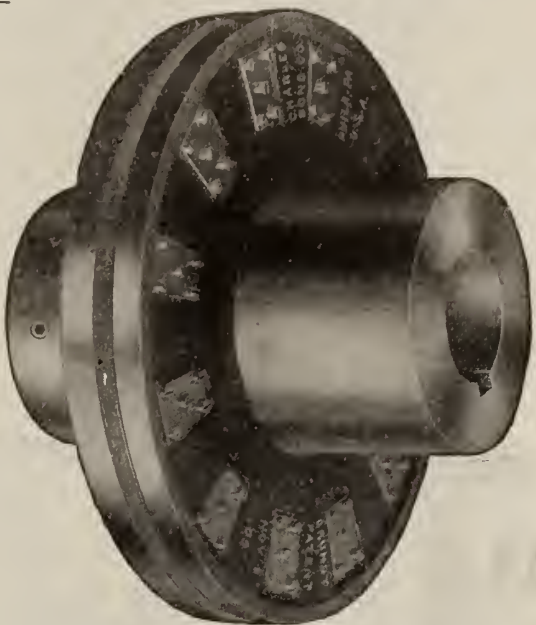
While maintaining a positive and silent drive, it is free from objectionable hammer action features.

It is perfectly balanced and adapted for revolving at high speeds. Can be run in either direction: is close connected; easy of access and practically free from repairs. Has been tested out under severe conditions. There are no loose cylinders, rings, threaded pins or bolts to give trouble.

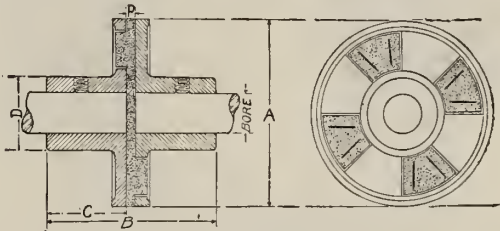
The driving disk, being of non-conducting material, acts as a thorough insulator. As there are only three pieces to the entire coupling, there are no complicated parts to get out of order. It can be either set screwed or key seated, or both. It is a safety coupling, there being no projections to cause danger.

Guaranteed to give less trouble and to outwear anything else of its character on the market.

Where it is not possible to get perfect alignment of shafts, this coupling will adjust itself to circumstances, and can be used whether insulation is required or not.



GRUNDY PATENT FLEXIBLE INSULATED COUPLING



DETAILS OF THE GRUNDY PATENT FLEXIBLE INSULATED COUPLING

DATA

No.	3	4	5	6	7	8	9	10½	12	14	16	18	21	24	30
A, ins.	3	4	5	6	7	8	9	10½	12	14	16	18	21	24	30
*B, ins.															
C, ins.	1½	2	2½	3	3½	4	4½	5½	6½	7½	8½	9½	10½	13	14½
D, ins.	1½	1½	2½	3	3½	4	4½	5½	6½	7½	8½	9½	10½	13	14½
P, ins.	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½
**Max. Bore, ins.	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½
H. p. at 100 r. p. m.	3	4	5	6	8	10	12	15	20	25	30	35	45	55	70
No. of lugs	3	4	4	4	4	4	4	6	7	8	9	10	12	12	16
Approx. wgt., lbs.	1½	4½	8	12	15	25	35	50	100	150	235	350	575	750	1500

*For standard sizes, the dimensions of "B" are twice "C" plus "P," but the length of hubs can be changed to suit conditions.

**Maximum capacity under steady load.

When small horsepower and large bores are required, couplings from No. 4 to No. 12 inclusive can be made with larger hubs, but are furnished only when details are given.

Horsepower shown above is for steady load and not for intermittent or bump loads. When Grundy couplings are to be used with gas engines, air compressors, A. C. electric motors, etc., it is advisable to get this company's recommendations.

Information Required When Making Inquiries.

Give the following information when making inquiries regarding the Grundy coupling:

Horsepower required; revolutions per minute; diameter of driving shaft and size of keyway; diameter of receiving shaft and size of keyway; whether couplings are to be set screwed; whether conditions under which the coupling is to operate are dry or subject to moisture; whether load is constant (if not, write fully regarding intermittent character of same); description of connection for which coupling is to be used.

BOND FOUNDRY AND MACHINE COMPANY

Manufacturers of Power Transmission Machinery

MANHEIM, PA.

AFFILIATED COMPANIES

BOND ENGINEERING WORKS, LIMITED, Toronto, Can. CHRISTIANA MACHINE CO., Christiana, Pa.
CHARLES BOND CO., 617-19 Arch Street, Philadelphia, Pa. J. & G. RICH CO., Sixth and Arch Streets, Philadelphia, Pa.

Products.

POWER TRANSMISSION EQUIPMENT:

Drop Shaft Hangers.
Ball and Socket Ring Oiling Hanger Bearings.
Post Hangers.
Pillow Blocks.
Bracket Shaft Hangers.
Flat Boxes.
Clamp Boxes.
Post Boxes.
Post Bearings.
Post Journals.



Floor Stands.
Girder Clamps.
Clutch Couplings.
Compression Couplings "Spiro."
Plate Couplings.
Clamp Couplings.
Safety Set Collars.
Friction Clutches.
Truck Casters, Stationary and Swivel.

Catalogue.

Catalogue 38 S sent on request.



FIG. 1. BOND PATENT UNIVERSAL DROP HANGER

A good rigid hanger, with provisions for free movement in bearing for shaft to revolve. Metal is equally distributed in order that there will be sufficient amount where the greatest strain takes place.

Hanger has all the typical Bond features—Universal adjustment, babbitted and reamed bearings, case hardened steel set screws, hanger yoke cast separate and interchangeable with any drop or type of hanger for the same size shaft, etc.

Bolts supporting yoke are integral with the frame proper, thus strengthening the hanger at one of the most important points that carry the load of the line shaft.

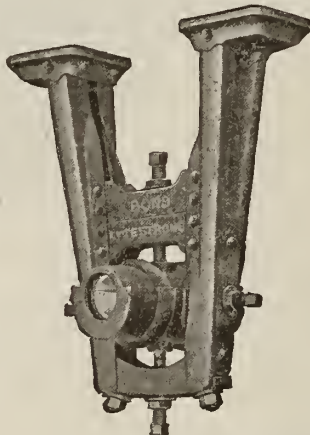


FIG. 17. BOND SCIENTIFIC "LYESTRONG" STEEL SHAFT HANGER

Folded into shape from sheet metal, without breaking the fiber, insuring greatest strength and rigidity.

One-half the weight of cast iron hangers.

Every possible strain that a hanger may be subjected to is well provided for. Can be converted into floor stand by simply inverting the bearing.

Bearings used identical with those used in Bond cast iron hanger.

Belt shifter arm is malleable iron and can be attached very quickly to hanger, and makes a very simple and neat countershaft hanger.

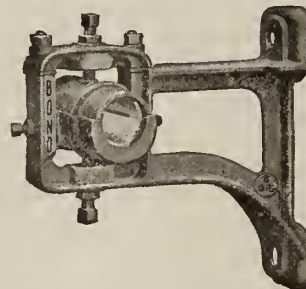


FIG. 7. BOND UNIVERSAL BRACKET HANGER

Bearings babbitted and reamed. Fitted with ring oiling bearings, ball and socket adjustment

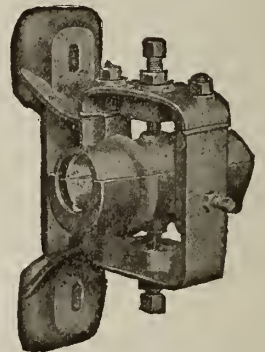


FIG. 4. BOND UNIVERSAL POST HANGER

Bearings babbitted and reamed. Fitted with ring oiling bearings, ball and socket adjustment



FIG. 5. BOND UNIVERSAL PILLOW BLOCK

Bearings babbitted and reamed. Fitted with ring oiling bearings, ball and socket adjustment

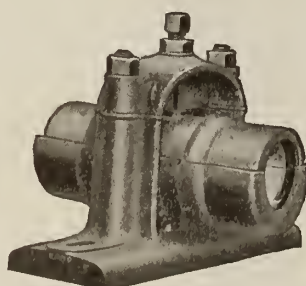


FIG. 6. BOND PEDESTAL PILLOW BLOCK

Bearings babbitted and reamed. Fitted with ring oiling bearings, ball and socket adjustment



FIG. 2. BOND BALL AND SOCKET RING OILING HANGER BEARING

Three component parts: top, bottom and oil reservoir. Top and bottom carefully babbitted and correctly reamed, making a true bearing surface throughout. Oil reservoir and bottom designed with ball and socket feature insure perfect alignment of shaft. Oil reservoir constructed to prevent leakage of oil. Tempered spring steel rings used for lubricating shaft, diameters of which are sufficiently larger than the shaft to allow them to revolve freely and constantly in oil so that shaft is kept well and evenly lubricated at all times. Each end of bearing provided with carefully designed scrapers or wipers to remove surplus oil and return it to reservoir, preventing leakage or dripping. Reservoir, when properly filled, will amply lubricate shaft from 4 to 6 months without refilling.



FIG. 24. BOND CLAMP BOX
Suits ordinary requirements and majority of conditions



FIG. 25. BOND FLAT BOX
Babbitted and reamed. Substantial, inexpensive bearing



FIG. 30. BOND VERTICAL CLAMP BOX

Babbitted and reamed.
Provided with grease or oil reservoir at top and arranged with parting cover to prevent accumulation of dirt or grit



FIG. 29. BOND SPLIT POST JOURNAL BEARING (ANGLE BOX)

Bearings babbitted and reamed.
An exceptionally good bearing for light work. Adapted for conveyor work on account of angle of the split in bearing and position of oil cup



FIG. 31. BOND SOLID JOURNAL OR POST BEARING (DOLLY BOX)

Babbitted and reamed
Oil receptacle is placed at an angle so that it can be used as a pillow block or as a post bearing on upright posts or posts placed at any angle.



FIG. 26. BOND RIGID RING OILING POST BOX

Designed on same principle as rigid ring oiling pillow block, and used as substitute for universal post hanger, where it is essential to bring shafting close to post



FIG. 19. BOND RIGID RING OILING PILLOW BLOCK

Designed on same principle as ring oiling ball and socket bearing used in Bond Universal hangers, with oil reservoir constructed as a rigid base for bearing

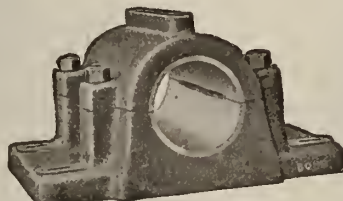


FIG. 22. BOND EXTRA HEAVY RIGID PILLOW BLOCK

For exceptionally heavy work, such as engine shafts, heavy elevator shafts in mines, etc.

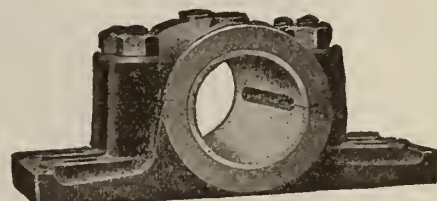


FIG. 23. BOND HEAVY RIGID PILLOW BLOCK (PACIFIC TYPE)

Meets the requirements of sawmill trade. A special feature of this type is that it interlocks the length and width of bearing.
Drilled and tapped for grease cups



FIG. 42. BOND PATENT "SPIRO" SINGLE FLANGE COMPRESSION COUPLING

Has enormous gripping power. Sleeve "A" is tapered from center towards each end. Outer shell "B" and inner shell "C" are bored tapered to correspond with taper on sleeve. There is also a spiral slot cut the entire length of sleeve.

When sleeve is placed in position to connect two shafts, shells are placed on sleeve and bolts are used to draw up the two shells over sleeve.

By this method of one taper drawing over the other, and the special method of cutting a spiral slot in the sleeve, the coupling exerts an enormous gripping power on shaft, for the reason that every square inch of bearing surface of inner diameter of sleeve comes in direct contact with the shaft



FIG. 43. BOND PATENT "SPIRO" DOUBLE FLANGE COMPRESSION COUPLING

For large shafts (sizes 2 1/2 in. and above). Sleeve is of identically the same construction as in Fig. 42, with the exception that it is heavier and of larger proportions to suit larger shaft diameters.

Each of the two shells is constructed with two flanges cast on one hub with tapered bores similar to shells on single flange coupling.

Method of using bolts is different. A short and then a long bolt is used alternately. Short bolt extends from inside flange of one shell to inside flange of other shell, or, the flanges nearest to center of coupling.

Long bolt extends from outer flange of one shell to outer flange of the other. By this method, every bolt does the duty for which it is intended, making coupling very powerful for large shafts.

This type of coupling eliminates the expense of key seating the shaft, also the cost of keys



FIG. 45. BOND CLAMP COUPLING

A key seated coupling and requires key seating of the shaft.
Main feature is the clamping device, making coupling in halves, thus it can very readily be bolted to the ends of the shafts when in place



FIG. 39. Type A



FIG. 56. Type B

BOND GIRDER CLAMPS

Hangers can not be attached to iron girders without the use of a girder clamp of a similar construction to those illustrated above. A full line of patterns takes care of these conditions

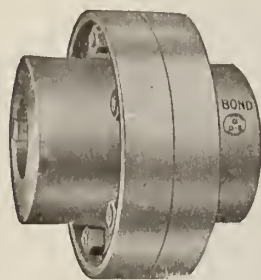


FIG. 44. BOND PLATE COUPLING

Used where key seated couplings are required, with shaft key seated to suit

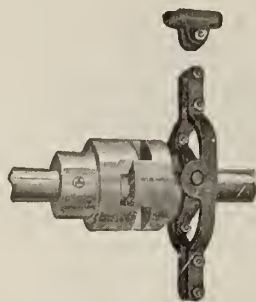


FIG. 40. BOND SQUARE JAW CLUTCH COUPLING

Used for connecting and disconnecting shafts. One-half of coupling is fastened to shaft with a key and other half slides on a feather key.

Finished all over. Jaws accurately planed to prevent backlash and to insure equal bearing pressure on each



FIG. 51. BOND DOUBLE FLANGE SOLID SET COLLAR

A collar of good mechanical construction at a moderate price. Both faces machined and edges carefully rounded. Countersunk to provide for low head set screw to assure safety



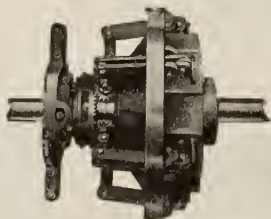
Fig. 47. Holscrew Type Fig. 48. Standard Type
BOND SOLID SAFETY SET COLLARS

Two types, one with low head set screw and countersunk, the other with hollow set screws, both insuring safety. Collars are machined all over



Fig. 49. Holscrew Type Fig. 50. Standard Type
BOND SPLIT SAFETY COLLARS

Have interlocking devices which bring parting line beyond center line of shaft, forming 3-point contact on shaft, making each half a collar in itself



BOND FRICTION CLUTCH
(Patented July 15, 1919)

Economical and practical in operation. Has the distinctive feature of a single adjustment on a multiple of friction shoes.

Friction shoes are brought in contact with friction drum by sturdy steel levers, giving a powerful grip. When clutch is disengaged, arrangement of levers makes a positive release.

No springs or other delicate mechanism are employed in the construction. Built with a minimum of working parts. Simple in construction, and powerful and easy in operation



BOND STATIONARY TRUCK CASTER

All casters are well proportioned; wheels turn freely on cold rolled steel axles



BOND STATIONARY TRUCK CASTER

Rough uneven floors or heavy loads have no effect on these casters, as they are built to stand the wear



BOND ANTIFRICTION SWIVEL TRUCK CASTER

Designed to meet the universal demand for a swivel wheel of good mechanical construction at a moderate price.

The plate swivels on hardened steel balls, swiveling easily under heavy loads.

The ball race is protected with a deep flange, making it dustproof

THE BROWN CLUTCH CO.

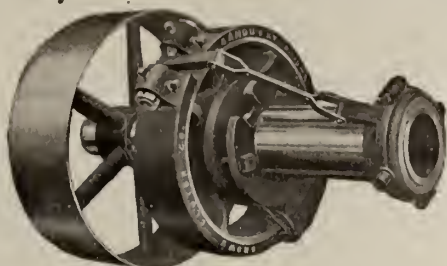
1500 Camp Street
SANDUSKY, OHIO

Products.

BROWN FRICTION CLUTCHES; FRICTION SHAFT COUPLINGS; HOISTS; PULLEYS.

Friction Clutch Pulleys.

Friction clutch pulleys are manufactured up to 150 h.p. The company designs special styles of clutch pulleys, and is able to furnish one for every case where a pulley is necessitated.



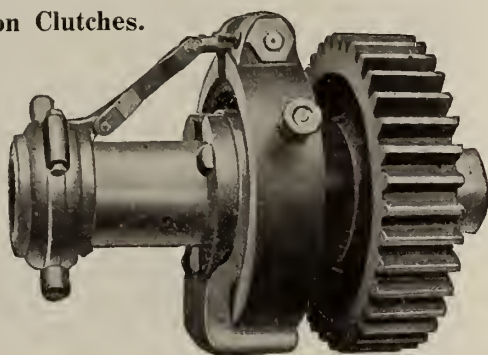
LINE SHAFT CLUTCH

Brown Friction Clutches.

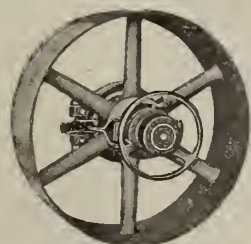
LINE SHAFT CLUTCHES — These clutches are so constructed that they are easily secured to the shaft with keys, and are controlled by one lever.

They are furnished complete with either oil or grease cups and a shifting lever.

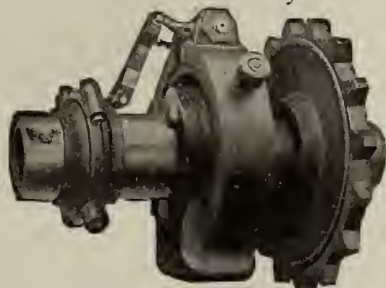
SHORT SHAFT CLUTCHES—Designed expressly for gas engines, where the crank shaft extends beyond the



LINE SHAFT CLUTCH WITH GEAR



SHORT SHAFT CLUTCH



LINE SHAFT CLUTCH SPROCKET WHEEL

flywheel a sufficient length to carry the belt pulley.

Finished Cast Iron Pulleys.

A vast variety of finished cast iron pulleys, bored, turned, and balanced with set screws or key seats, are manufactured so as to fill requirements of all kinds from stock.



NO. 0 CLUTCH PULLEY
For 10 h. p. and under

Specifications of Conveyor Hoists.

CAPACITY—1500 lbs. at 100 ft. per minute on single rope. Shipping weight, 1300 lbs.

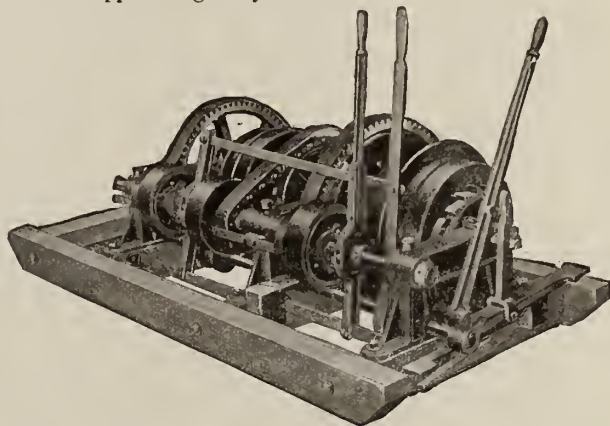
DRUMS—Conveyor drum back geared 4 to 1; 14-in. diameter with 16-in. flanges 3 in. apart. Equipped with hand friction band brake. Is controlled by two 10 h.p. clutches on jack shaft operated by one lever making it a reversible drum. Conveyor drum operates about one-third faster than hoisting drum, requiring 5 h.p. engine. Should be driven about 400 r.p.m.

Hoisting drum back geared 6 to 1, controlled by 10 h.p. clutch or jack shaft. Drum is 12-in. diameter with 21-in. flanges 8 in. apart. Capacity 375 ft. of 1/2-in. cable. Equipped with friction band and ratchet brake.

SHAFTING—Main shaft 2-in. diameter, jack shaft 1 3/4-in. diameter. All bearings on main and jack shaft babbit.

DRIVE—Sprocket and chain, belt, or cut gears.

None supplied regularly.

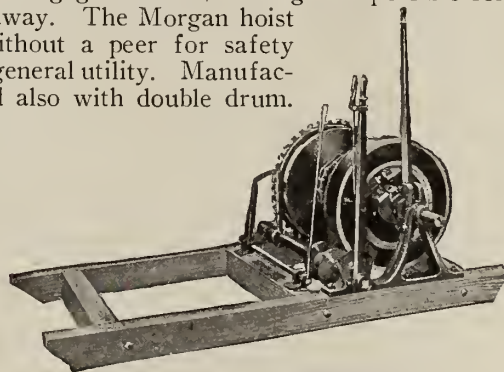


CONVEYOR HOIST

For use on coal docks, in quarries and other places

Morgan Hoists.

Designed to meet the great demand for a hoist to carry heavy loads at high speed. Simple and easy to operate. Load can be stopped at will by releasing dog which engages ratchet, making it impossible for load to get away. The Morgan hoist is without a peer for safety and general utility. Manufactured also with double drum.



MORGAN SINGLE DRUM HOIST

Made in seven types, operated by either motor or gasoline engine drive

Friction Shaft Couplings.

STANDARD FRICTION CLUTCH COUPLINGS—Built upon simple principles of operation and easily manipulated by unskilled mechanics. With this clutch there is absolutely no contact of frictional surface when not engaged.

Information.

When inquiring please furnish particulars regarding horsepower desired with a certain size of clutch. Catalogue "C" will be mailed on request. Information gladly given regarding hoists and clutch pulleys.

CHICAGO PULLEY & SHAFTING CO.

Power Transmitting Machinery

TELEPHONE:
MAIN 1876

40 South Clinton Street
CHICAGO, ILL.

FACTORY, MENOMONEE FALLS, WIS.

Products.

Manufacturers of the "Chicago Line" of POWER TRANSMITTING MACHINERY, which includes:

Roller, Ball and Thrust Bearings.
Pillow, Rigid or Adjustable Blocks.
Take-up and Clamp Boxes.
Wall Brackets.
Beam Clamps.

Safety Set, Solid and Split Collars.

Ball Bearing, Roller Bearing and Babbitted Countershafts.

Flange Plate, Flexible, Friction Clutch, Ribbed Compression, Standard Compression and Spiral and Square Jaw Couplings.

Friction Ball Bearing and Line and Countershaft Clutches.

All Loose (Ball Bearing) Drives.

Wall Box Frames.

Ball Bearing, Roller Bearing and Babbitted Hangers.

Bracket Hangers; Post Hangers.

Ball Bearing Mule Pulley Stands.

Pedestals.

Base and Sole Plates.

Pulleys, including S.K.F. Ball Bearing Loose Pulleys and S.K.F. Ball Bearing Friction Clutch Pulleys.

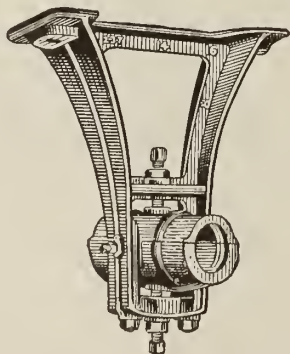
Transmission Rope.

Shafting.

Belt Tighteners (ball bearing).

Hangers.

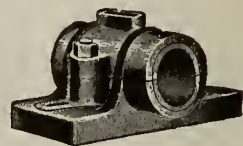
The "Chicago Line" hangers are of great strength, generously babbitted and are of pleasing design; have a duplex system of oiling, wick and ring combined. Roller or ball bearing boxes can be furnished when desired.



"CHICAGO LINE" HANGER

Pillow Blocks.

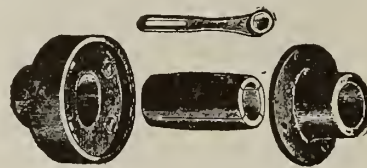
The "Chicago Line" pillow blocks are furnished in rigid or adjustable types with plain bores or the duplex system of oiling. Adjustable pillow block frames can be fitted with ball or roller bearings when desired.



"CHICAGO LINE" PILLOW BLOCK

Couplings.

The "Chicago Line" couplings include the flange plate, compression, ribbed compression, square and spiral jaw as well as other types. The compression types are of the taper sleeve construction that require no keys. Key couplings fitted to shafting when desired.



"CHICAGO LINE" COUPLING

Thrust Bearings.

The "Chicago Line" thrust bearing for real satisfactory and enduring service designed for loads in one direction along the axis of the shaft. Made in all sizes.



"CHICAGO LINE" THRUST BEARINGS

S. K. F. Ball Bearing Loose Pulleys.

Are especially designed for high speed. Simple in construction, accurately machined and will carry a belt at any working load or speed without heating. They are dustproof, clean, noiseless and require but a



S.K.F. BALL BEARING LOOSE PULLEY

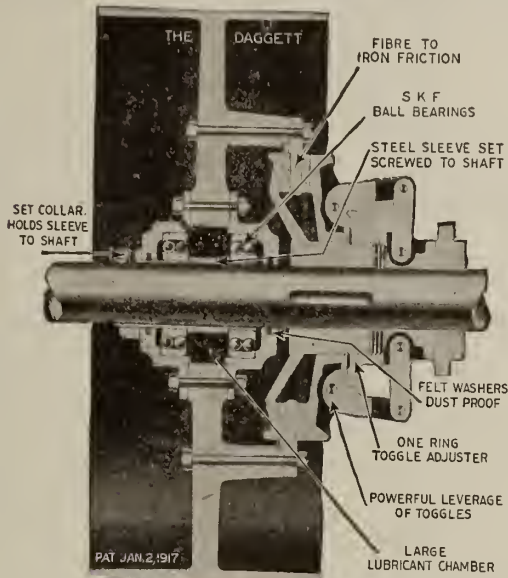
small amount of lubricant a few times a year. Can not wear the shaft.

Every plant has loose pulley troubles. Time, lubricants and bearings represent an annual loss that can be conserved.

S. K. F. Ball Bearing Friction Clutch Pulleys.

A friction clutch pulley designed and guaranteed to carry any belt load at any speed without bearing trouble.

ECONOMY IN DIRECT DRIVES—Drive buffing lathes, emery and disk grinders, fans, punch presses, etc., direct from line shaft and save power, belts, lubricant, time and trouble.



S.K.F. BALL BEARING FRICTION CLUTCH PULLEY

S. K. F. Ball Bearing Countershafts.

The CHICAGO PULLEY & SHAFTING Co. are headquarters for all types of countershafts but recommend at all times ball bearing equipment.

A counter with ball bearing friction clutch pulleys and ball bearing hangers will pay for itself in trouble saved in a very little time, as countershaft troubles are numerous where plain babbitted bearings are used.

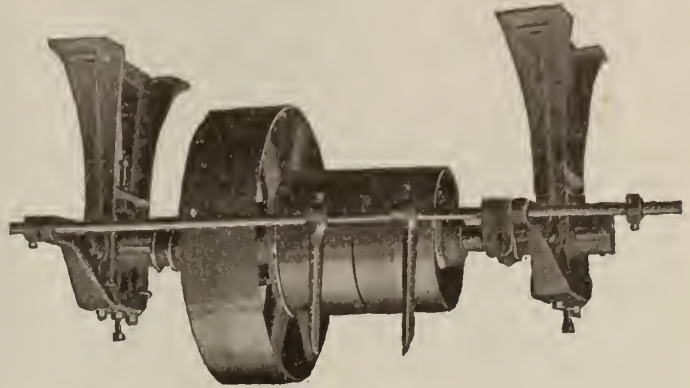


S.K.F. BALL BEARING COUNTERSHAFT

S. K. F. Ball Bearing All Loose Drive Countershafts.

A special countershaft with stationary shaft. Another way to eliminate countershaft troubles. Note shaft is stationary; it does not revolve. The small driven pulley and the large driving pulley are cast as one, and the additional loose pulley is the idler, as is used in all countershaft drives. All pulleys fitted with S.K.F. ball bearings.

These are ideal drives for grinders, buffing lathes, fans, etc.



S.K.F. BALL BEARING ALL LOOSE DRIVE COUNTERSHAFT

Typical Orders.

Following are a few orders typical of those received daily by the CHICAGO PULLEY & SHAFTING Co., from all sections of the country:

Steger & Sons, Steger, Ill.—

1 38- x 6½- x 2½-in. S.K.F. Ball Bearing Type Friction Clutch Pulley.

1 38½- x 7- x 2½-in. S.K.F. Ball Bearing Type Friction Clutch Pulley.

1 34- x 8- x 2½-in. S.K.F. Ball Bearing Type Friction Clutch Pulley.

1 33- x 6- x 2½-in. S.K.F. Ball Bearing Type Friction Clutch Pulley.

1 21- x 3- x 2½-in. S.K.F. Ball Bearing Type Friction Clutch Pulley.

Aluminum Goods Manufacturing Co., Manitowoc, Wis., October 17, 1919—

50 24- x 4- x 2½-in. Ball Bearing Clutch Pulleys with split mechanism (for spinning lathes).

36 28- x 6- x 2½-in. Ball Bearing Clutch Pulleys with split mechanism (for buffing lathes).

Aluminum Goods Manufacturing Co., Manitowoc, Wis., October 3, 1919—

30 Countershafts, S.K.F. Ball Bearing Type (for No. 4 spinning lathes) 12-in. Shifter Forks.

25 Countershafts, S.K.F. Ball Bearing Type (for No. 5 spinning lathes) 12-in. Shifter Forks.

W. D. Gibson Co., Chicago, Ill.—

1 22- x 8- x 2½-in. S.K.F. Clutch Pulley.

1 36- x 8- x 2½-in. S.K.F. Clutch Pulley.

1 26- x 6- x 2½-in. S.K.F. Clutch Pulley.

1 20- x 6- x 2½-in. S.K.F. Clutch Pulley.

1 18- x 6- x 2½-in. S.K.F. Clutch Pulley.

5 16- x 6- x 2½-in. S.K.F. Clutch Pulley.

The Brunswick-Balke-Collender Co., Chicago, Ill.—

10 S.K.F. Complete Countershafts with 8- by 4½-in. tight and loose pulleys. Drive pulley to be 16 by 4½ in.

Chicago Nut Company, Chicago, Ill.—

14 sets, S.K.F. Countershaft, Loose Pulleys.

14 sets, S.K.F. Loose Pulleys, Hangers and Bearings.

2 S.K.F. Loose Pulleys only.

The Abbot Ball Co., Hartford, Conn.—

12 12- x 4- x 1¾-in. Crowned Dagget S.K.F. Ball Bearing Loose Pulleys, angle flange from 11 to 12 in. diameter.

12 12- x 4- x 1¾-in. Crowned Iron Pulleys.

Sprague Canning Machinery Co., Chicago, Ill.—

100 Ball Bearing Clutches 16- x 3¼- x 1½-in.

Badger Tool Company, Beloit, Wis.—

12 No. 4 S.K.F. Ball Bearing Countershafts

18 No. 6 S.K.F. Ball Bearing Countershafts

6 No. 8 S.K.F. Ball Bearing Countershafts.

CONWAY & COMPANY

Manufacturers of Friction Clutches

CINCINNATI, OHIO

Products.

FRICITION CLUTCHES, including Compression, Expansion, High Speed, C. M. T., and Split Types.



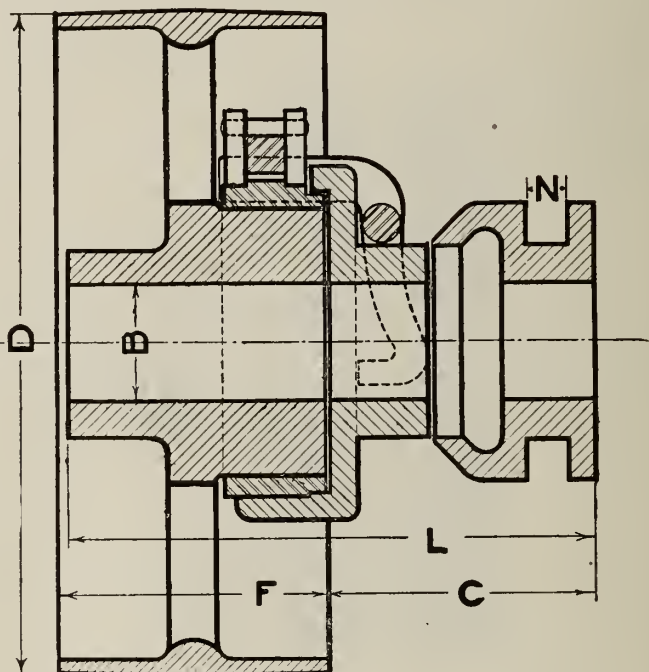
Friction Clutches.

The friction clutch, though many superficial engineers do not know it, is one of the most important machines in the mechanical world. Nor is it a thing that can be thought up the night before and developed the morning after. This company have given themselves entirely to the design, improvement and correction of friction clutches for more than 20 years. The mistakes, shortcomings and experiences that have been encountered would astonish even the most skeptical.

The Conway patent friction clutch is a mechanism, the perfection of which has commanded years of attainment. It is the embodiment of thought and skill. Its original and radical design may not please the eye of the mechanic, who is blinded by his own perverse notion of clutches, but this is principally because these clutches are fully one-half century ahead of the present time.

Conway clutches are made in 3 types, and this extension of their constructive design provides for them adaptability in every field of mechanical service.

Friction clutches are called upon to meet a variety of requirements and conditions. One type of clutch can not possibly do it. These types succeed very satisfactorily. The compression type clutch is subdivided into three styles, the solid, clamp and split.



COMPRESSION CLUTCH PULLEY

Conway clutches are made of the metal most adaptable to conditions.

For excavating machinery, etc., where mechanism is exposed to weather conditions, clutches are made of bronze friction band mounted on cast steel drive plate.

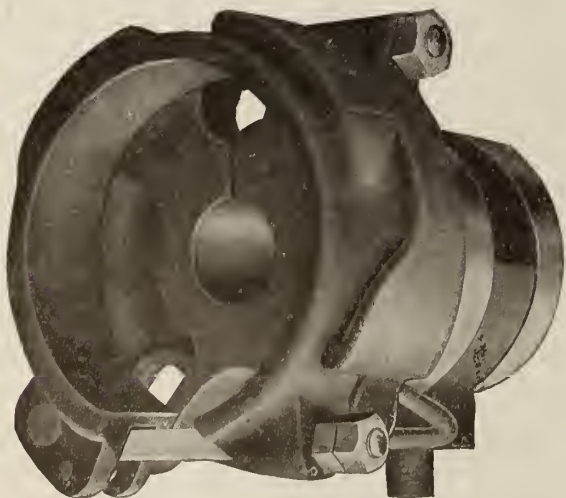
For interior uses and light work these clutches are made of cast iron.

Clutches for all Uses.

CONWAY & COMPANY also build clutches of the expansion, high speed, C. M. T., and split types, which are based on the same fundamental principles shown in the compression clutch above, but differ in design to meet requirements for class of service intended.

Among their many uses are the following: for textile machinery, dough mixers, hammer mills, ice machines, air compressors, rock crushers, mining machinery, bulldozers, clamshell buckets, steam shovels, cranes, hoists, excavators, ditchers, wagon loaders, gas engines, elevators, concrete machinery, conveyors, threshing machines, hay presses, power presses, rolling mills, sugar mills, tractors and machine tools.

Further information will be sent on request.



CLAMP COMPRESSION CLUTCH

THE CORK INSERT COMPANY

166 Federal Street
BOSTON, MASS.

Products.

CORK INSERT PULLEYS: Cast Iron, Paper, Steel, Wood Rim Iron Center, to meet all requirements.

BRAKE FACINGS: Disks for Clutches, Brakes and Slipping Tensions.

Friction Wheels; Cone Clutches; Cork Insert Transmission Belt; Clutch Facings, Disks and Blocks; Friction Washers and other guaranteed Frictional Devices equipped with Cork Inserts for use where great efficiency or uniform tension is necessary.

Advantages.

Cork Insert pulleys are made to any specifications to transmit any power a belt can carry and they are guaranteed to give satisfaction in the places for which they are designed.

They transmit more power than plain pulleys, stop belt slip and maintain efficiency under unfavorable conditions and are not affected by dampness.

They prevent loss from oily belts or dust, and maintain speeds in spite of water, deliver power with slack belts, cut down friction loads and lessen wear on bearings.

They lengthen the life of belts, eliminate use of belt dressing, thus reducing cost of upkeep.

They give uniform speeds, improve quality and quantity of products and save fuel and electric current.

Applications.

Main drives, motors, fans, blowers, air compressors, wood working machinery and all drives where speeds

are high and loads heavy; machine tools, textile and other machinery where output and uniform operation are especially important; pumps, paper mill machinery, dyeing machines, tanning machinery, sugar grinders, stone crushers, cement mill machinery, milling machinery, polishing machinery and all places where conditions are necessarily bad. These are a few typical cases where Cork Inserts are giving the most satisfactory results.

In one form or another, Cork Inserts are adapted to practically every place where it is necessary to obtain the greatest possible frictional efficiency or a uniform tension.

Directions for Ordering.

When ordering Cork Insert pulleys or requesting quotations, give the following information:

Quantity; type of pulley (specify iron, paper, wood rim or steel); solid or split; crown or flat face; diameter; actual width of face; width of belt; bore; length of hub (standard is two-thirds width of face); projection of rim beyond end of hub; width and depth of keyway; number and location of set screws.

If pulley must fit over parts of machine, send sketch or give outside diameter of hub and inside diameter of rim.

Describe drive, stating whether it is from motor, engine or shaft to machine (giving name and size) or shaft; distance between pulley centers; horsepower; speed of driving pulley; whether pulley described is driver or driven; whether drive is horizontal, vertical or diagonal—open, quarter-turn or crossed; if horizontal or diagonal, whether tight side of belt is on top or bottom; and if vertical or diagonal, whether driving pulley is at top or bottom; diameter and face of pulley at other end of drive.

Give material, thickness (single, double or number of ply) and width of belt.

State troublesome conditions, if any.

Co-operative Service.

Transmission problems analyzed, and recommendations for equipment guaranteed to give satisfactory service are made without charge or obligation.

Catalogue illustrating many successful applications and giving detailed reports of tests sent on request.

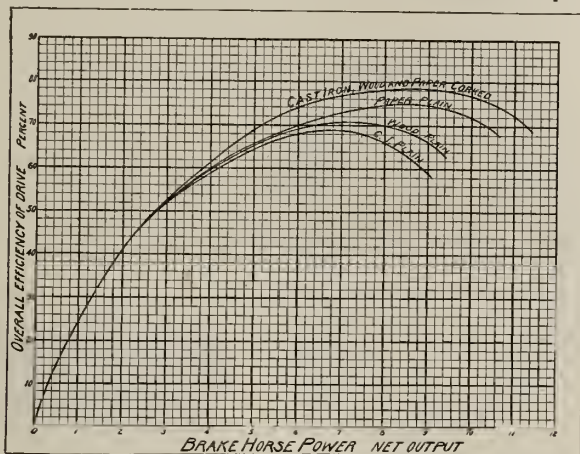
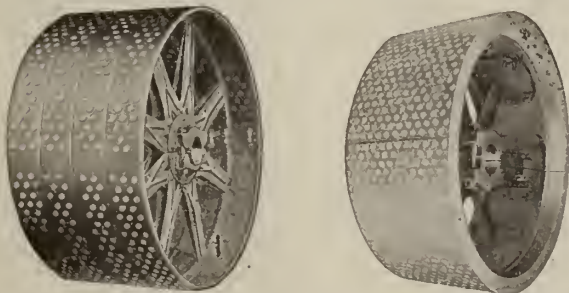
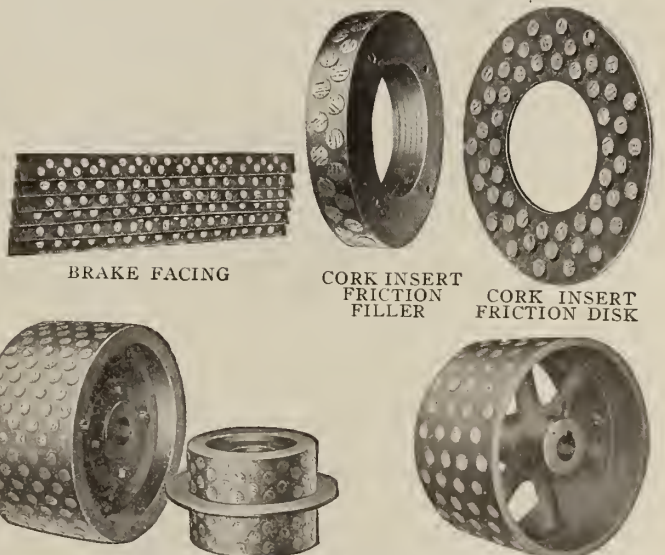


DIAGRAM ILLUSTRATING COMPARATIVE EFFICIENCY OF CORK INSERT PULLEYS AND OTHER TYPES

Compiled from tests made at Lowell Textile School, Lowell, Mass.



CORK INSERT PULLEYS—STEEL, WOOD RIM, PAPER AND CAST IRON
To meet the heaviest requirements of motors, machinery and shafting

DODGE SALES AND ENGINEERING COMPANY

DISTRIBUTER OF THE PRODUCTS OF

DODGE MANUFACTURING COMPANY AND DODGE STEEL PULLEY CORPORATION

Power Transmission Machinery

GENERAL OFFICES
MISHAWAKA, IND.

MANUFACTURING PLANTS
MISHAWAKA, IND.
ONEIDA, N. Y.

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SALES OFFICE NOT CARRYING STOCK
DALLAS, TEX., Great Southern Life Building

Dealers Carry Complete Stocks in All Principal Cities

Products.

DODGE ROPE DRIVING EQUIPMENT; SAFETY COLLARS; KEYLESS COMPRESSION COUPLINGS; ADJUSTABLE BALL and SOCKET DROP HANGERS; BEARINGS; FRICTION CLUTCHES; PULLEYS: "INDEPENDENCE" WOOD SPLIT, "STANDARD" SPLIT IRON, IRON CENTER WOOD RIM, ONEIDA, KEYSTONE and NATIONAL STEEL; SPLIT BUSHINGS; CAST IRON GEARING.

Also, Flywheels, Rope Sheaves, Wood Lagging for Rope Wheels, etc.

Engineers.

Through more than 30 years' experience in meeting transmission problems in every line of industry, Dodge engineers are prepared to give most competent service in the selection and arrangement of transmission equipment for maximum efficiency and economy.

Dodge Rope Driving Equipment.

This company is the originator of the American system of rope driving, and is best equipped to give to every important detail of design and manufacture that careful and experienced attention so necessary to insure successful and economical operation. Equipment for English system rope drives is also manufactured by this company. Dodge literature on rope driving is very complete.

Dodge Safety Collars.

Dodge safety collars are made solid and split for all sizes of shafting, and comply with all the legal requirements as to safety by having set screws and bolts protected. Finished and polished on periphery and faced on ends.



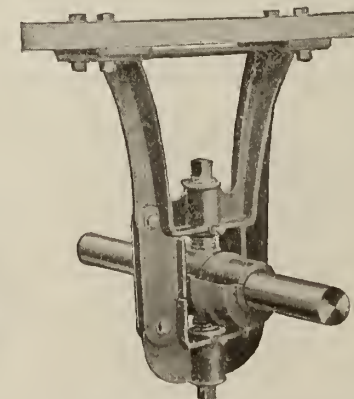
Solid Split
DODGE SAFETY COLLARS

Dodge Keyless Compression Couplings.

The design of the Dodge coupling is excellent and its construction so simple that an ordinary workman can erect it as



DODGE KEYLESS COMPRESSION COUPLINGS



DODGE ADJUSTABLE BALL AND SOCKET DROP HANGERS

satisfactorily as a skilled mechanic or millwright. The only care needed is to tighten all bolts gradually and evenly to insure true running.

Dodge Adjustable Ball and Socket Drop Post Hangers and Bearings.

CAPILLARY TYPE—This bearing is mechanically and scientifically correct in every detail.

The Dodge patent capillary oiler is a wooden block, with alternate saw cuts, through which the oil rises by capillary attraction from reservoir to the shaft. The capillary oiler is a non-agitating oiler. There is not the slightest whipping and churning of the oil. Any sediment precipitates to the bottom of the reservoir and only the good clear oil is brought up to the shaft.

The action of the capillary oiler is definite and positive and can be relied upon absolutely. It can not fail.

RING TYPE—In this bearing the well-known method of oiling by rings is employed, in connection with a bearing of the most superior design and finish.

STANDARD TYPE—This plain oiling type of bearing is exceptionally well made for a bearing of this kind, and is relatively inexpensive.



Capillary Type



Ring Type



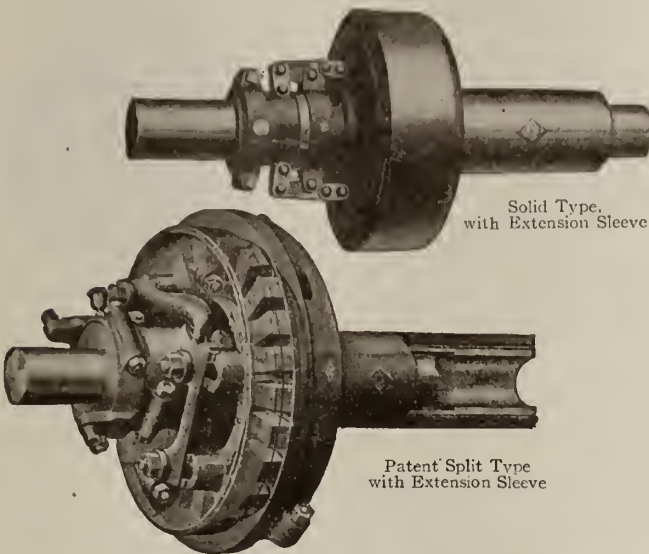
Standard Type

TYPES OF BEARINGS USED IN DODGE HANGERS

Continued on next page

Dodge Friction Clutches.

These clutches are manufactured also in the form of cut-off couplings. All sizes, to meet all conditions of service.



DODGE FRICTION CLUTCHES

Dodge "Independence" Wood Split Pulleys.

Rim machined inside and out. Pulley is accurately balanced, runs true, grips shaft securely and has greater transmitting efficiency than any metal pulley.

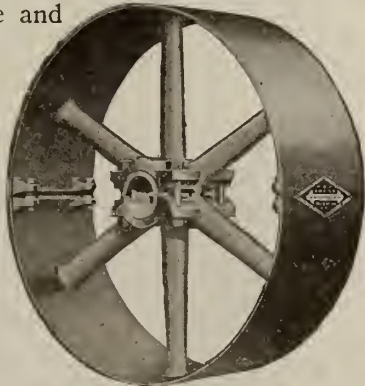
Made in all sizes and carried in large stocks for instant shipment by all branches and by hundreds of leading dealers. Special sizes made and shipped within 24 to 48 hours from receipt of order.



DODGE "INDEPENDENCE" WOOD SPLIT PULLEY

Dodge "Standard" Split Iron Pulley.

Carried in stock. Made with interchangeable metallic bushings.



DODGE "STANDARD" SPLIT IRON PULLEY

Dodge Iron Center Wood Rim Pulley.

For heavy and shock loads, for high and absolute



Split Type—Single Arm



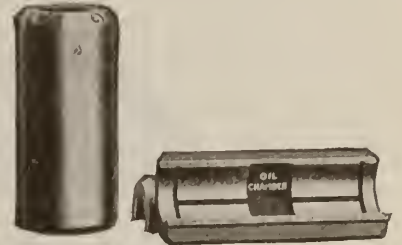
Split Type—Double Arm

DODGE IRON CENTER WOOD RIM PULLEYS

speeds, this pulley is supreme. Rim is machined inside and out. Pulley is carefully balanced and accurately finished in every detail, and is made solid or split.

Split Bushings.

For tight and loose pulleys. Very easily placed upon the shaft with split pulleys, without necessity of taking down shafting or disturbing any equipment.



SPLIT BUSHINGS

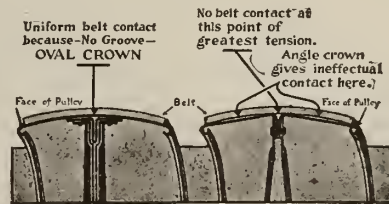
Cast in one piece, bored and turned and then split by fracture, the uneven, ragged edges bring the two halves together to a smooth, accurate fit, held in secure position by compression of the pulley hub.

A large reservoir in center holds lubricating oil. Circular and lengthwise gains distribute oil evenly in bearings, returning it to oil chamber when pulley is not in motion. Oil chamber is filled through a convenient spring oiler.

Oneida Steel Split Pulley.

STRENGTH-WITH LIGHT WEIGHT—The lightest belt pulley made—and the strongest. No revolving superfluous pulley weight. Less weight, less friction in shaft journals—and less power loss.

PERFECT OVAL CROWN—Greatest possible belt grip or adhesion. Transmits maximum power at minimum expense of belt pull or tension. Loose belts mean less bearing friction and saving of belts.



OVAL CROWN VS. ANGLE CROWN

STRONG WINDCUTTING ARMS—Securely riveted to broad bearing of special fishplates. Arms set edgewise, offering little resistance to air.



OTHER PULLEYS

Face overhang. No arm support under belt. Belt tension causes vibration here



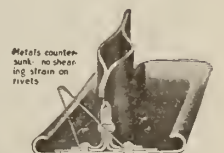
THE ONEIDA

No face overhang. Two sets of arms to support load either side. Strong, rigid construction

RIVETS THAT CAN NOT SHEAR—Metals first stamped male and female—no lateral or shearing strain on rivets.

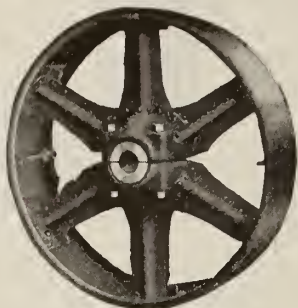
NO SET SCREWS OR KEYWAYS—Pulley held to shaft by compression of hub.

No mutilated shafts, or pulleys running out of true.

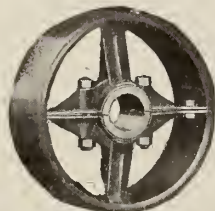


RIVETS COUNTER-SUNK

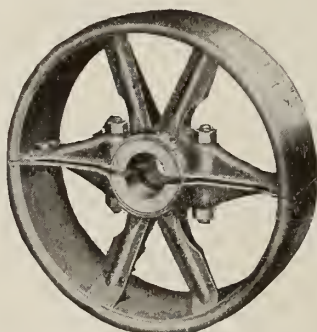
DOUBLE ARMS—Oneida pulleys are built "double arm" or "double spider" in sizes beginning at 8-in. face in the smaller sizes, 10-in. and 12-in. face in medium sizes, and 14-in. face in larger sizes.



ONEIDA PULLEY
Showing double arm construction for wide faces



ONEIDA PULLEY
Sizes, 8 to 11 in. inclusive, in diameter. Takes "G" hub, with standard bore of $3\frac{1}{2}$ in.



ONEIDA PULLEY
Sizes, 12 to 20 in. inclusive, in diameter. Takes "G" hub, with standard bore of $3\frac{1}{2}$ in.



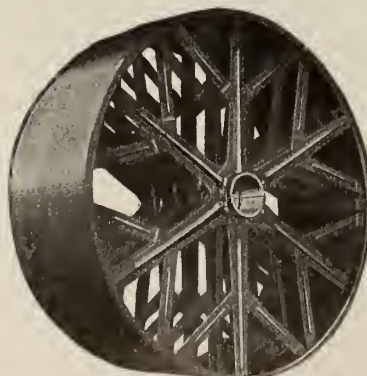
ONEIDA PULLEY
Sizes, over 17 in. in diameter. Standard bore $3\frac{1}{2}$ in. for sizes up to 36 in. Over 36 in. take $4\frac{1}{8}$ -in. bore



ONEIDA PULLEY
40x8 in. and larger, auxiliary arms give added strength

Main Drive Oneidas.

Evidence that Oneida design is basically correct is found in the fact that this is the only steel split pulley that is, or can be, successfully built in sizes up to 14 ft. diameter, for main drive purposes. Oneida main drives of 168 in. diameter, with 40-in. face, are driving as high as 750 h. p., with absolute



ONEIDA MAIN DRIVE PULLEY 14 FT. DIAMETER

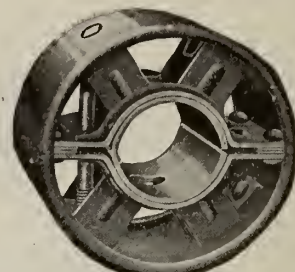
safety and satisfaction. Several thousands of these mammoth Oneida pulleys are in constant use, under a wide variety of conditions.

National Steel Split Pulley.

Made 3, 4 and 5 in. in diameter. Three-in. pulleys have hubs 3 in. long and standard bore of $1\frac{1}{4}$ in.; 4-in. and 5 in. pulleys have standard bore of $1\frac{1}{8}$ in. and hubs 3 in. long.

Interchangeable metal bushings are furnished for all shaft sizes in sixteenths.

One bushing and the socket wrench are supplied free with each pulley. Each pulley (with wrench) is packed separately in a neat pasteboard box, on which is plainly stenciled the size of the pulley.



NATIONAL STEEL SPLIT PULLEY

Keystone Steel Split Pulleys.

A SUBSTANTIAL, GROOVELESS RIM—Made of $\frac{3}{16}$ -in. or $\frac{1}{4}$ -in. steel (according to diameter) the Keystone rim is solid, rigid, substantial.

It has the strongest, thickest rim of any steel pulley.

It will not break under sudden strain or high speed nor bend or dent in transit or handling.

It has no groove or seam in the center of the face to lessen belt adhesion.

It has no beads or turnover edges to catch and hold dirt, lint, sawdust, flour dust, moisture, etc., which might throw the pulley out of balance. Hence, the Keystone is a clean pulley, particularly desirable wherever steam, moisture or dust abounds.

Because of its extraordinary strength, this substantial rim provides long wear and absence of vibration, as well as ideal power saving belt adhesion.

Because a Keystone has no beads, it is placed in a lathe after being carefully trued and the edges of the rim are faced, assuring a true running, well balanced pulley.



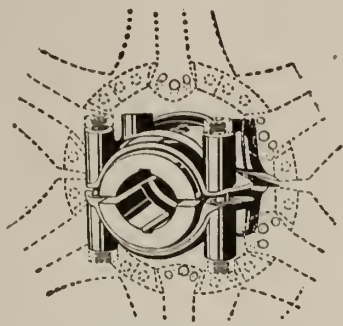
FACING THE EDGES OF A KEYSTONE PULLEY RIM

RIVETS THAT WILL NOT SHEAR—In the Keystone, the metals, through which a rivet passes, are interlocked male and female by countersinking. The "flange" thus formed on the metals takes all the lateral strain. The rivet is called upon merely to hold the metals together. The countersinking of the rim makes rivets come slightly below the face of the rim and therefore not in contact with the belts.



SECTIONAL VIEW SHOWING COUNTERSUNK METALS

STRONG FLEXIBLE HUB—Set screws or keys—that mutilate shafts—are rarely necessary with the Keystone.



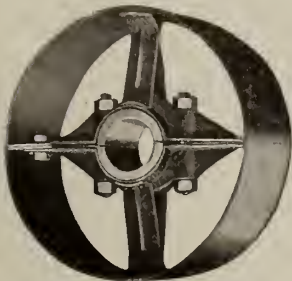
THE KEYSTONE HUB
Interwoven hub and arms with malleable iron reinforcing yoke

The hub is made sufficiently flexible to provide positive, permanent compression on the shaft by the mere tightening of the compression bolts.

This construction provides ample strength with sufficient flexibility for positive compression on the shaft.

BORES AND BUSHINGS—By a simple system of cast iron and compressed steel bushings, Keystone steel pulleys can be made to fit from 24 to 48 different sizes of shafting (according to standard bore) by merely changing the bushing. Supplied in all sizes of shafting in multiples of $\frac{1}{16}$ in. from standard bores to small size shafting.

Every bushing is accurately turned and bored and made to fit into the holes in the hubs of pulleys, virtually keying them in place. Keyseating is not required except in extraordinary cases. A complete set of bushings is furnished free with each pulley. Pulleys having bores larger than standard are subject to extra charge. Keyseating bushing at a nominal extra charge.



4-ARM PULLEY
Pulleys of diameters up to 12 in. and narrow widths of face are made with 4-arm, 2-bolt spider. Standard bore, $3\frac{1}{2}$ in. Made double arm for 8-in. face and over



KEYSTONE STEEL PULLEY
Sizes, 17 to 40 in. in diameter



DESIGN OF KEYSTONE STEEL PULLEY
Sizes, 12 to 17 in. in diameter



SMALL SIZE KEYSTONE STEEL PULLEY

Small size Keystone Steel Pulleys beginning with 8-in. face, medium sizes beginning with 12-in. face, and large sizes beginning with 14-in. face, are made with two or more sets of arms. This gives additional strength and lasting qualities.

Hub and arms are interwoven and in the larger sizes a reinforcing yoke of malleable iron is used inside a sheet steel hub casing.

Since steel has twice the structural strength of cast iron, it is obvious that Keystone steel pulleys may be operated with entire safety at speeds that would be impossible to attain with cast iron pulleys.

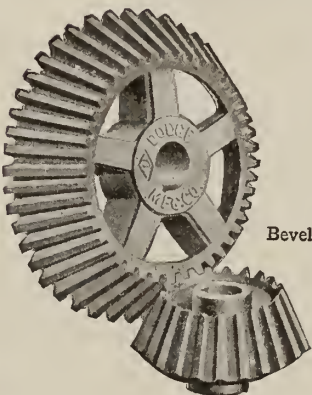


Flanged



Standard

DODGE CAST IRON GEARING



Bevel



Spur



Miter

DODGE TIGHT AND LOOSE PULLEYS

Superiority of Dodge Products.

The Dodge line is the most complete, highly developed and thoroughly standardized line of power transmission machinery.

Besides many other products such as illustrated here, the Dodge line also includes heavy flywheels, rope driving equipment of all kinds, elevating and conveying machinery—in fact, everything for the mechanical transmission of power and the continuous handling of materials.

Prices.

Use standard steel pulley list for Oneida and Keystone Steel Pulleys. Send for catalogue, price list and discounts.

Catalogues.

Complete illustrated catalogues, containing price, part and dimension lists, and valuable engineering data, may be had promptly for the asking.

THE HILL CLUTCH CO.

Power Transmission Machinery

CLEVELAND, OHIO

EASTERN SALES OFFICE: NEW YORK, N. Y., 50 Church Street—Telephone, Cortlandt 8078

Products.

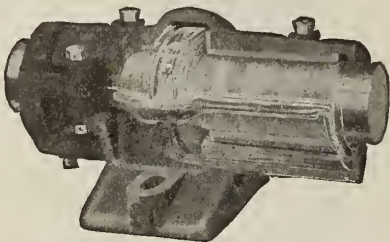
HILL COLLAR OILING BEARINGS; HILL FRICTION CLUTCHES (Smith Type).

Hill Rope Drives, Belt Tighteners, Drop Hangers, Floor Stands, Shafting, Couplings, Cast Iron Pulleys, Rope Sheaves, Gears, Sprockets, Flywheels, Bench Legs, Concrete Inserts, Gray Iron Castings, Special Machinery.



Hill Collar Oiling Bearings.

In the Hill Collar Oiling bearing, instead of depending upon a loose ring or chain for conveying the oil to the journal, a fixed collar is employed, thus providing a positive means of elevating the oil.



SECTIONAL VIEW HILL COLLAR OILING BEARING, CLEVELAND TYPE (Patented)

In the Cleveland Type Hill Collar Oiling bearing, the oil stored in a reservoir in the bottom of the bearing is continuously elevated by a heavy split collar. Metal wipers deflect the oil, which is then distributed along the full length of the journal. Two or three revolutions of the shaft and the bearing is thoroughly lubricated. It is not only in the positive and copious means of oiling that the Collar Oiling bearing excels, for the collar also serves as a thrust collar, and operates in a bath of oil and thrusts against babbitted seats. No outside collars are required, unless the end thrust is extremely severe. All other types of bearings require outside shaft collars, which bear iron against iron with no lubrication.

Hill Collar Oiling bearings are furnished in all forms of ball and socket and rigid mountings.

The Hill Friction Clutch.

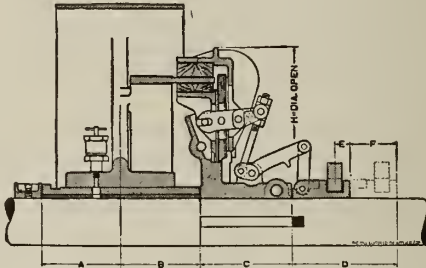
SUPERIORITY—THE HILL CLUTCH CO. has unequalled facilities for the design and manufacture of friction clutches. For 36 years Hill power transmission machinery has been acknowledged to lead all others. No other manufacturer has had a wider experience in

the manufacturing of friction clutches, and complete power transmission machinery equipment or a greater knowledge of the varying conditions of operation that must be met.

EFFICIENCY—The advantages of the Smith Type clutch lie in its unequalled mechanical stability, tremendous starting power, ease of adjustment, and removal of wearing parts.

To obtain such rigidity all parts of the toggle mechanism are of steel and forgings, with the single exception of the connecting lever which is of cast iron.

The friction surfaces are wood to iron, which is a combination offering great frictional resistance. The wood shoes are made from the best grade of well seasoned maple. Large shoe area is supplied, and all of the shoe area is equally effective. The frictional resistance is the same at all points. This is due to the heavy cast iron jaws, rigid guides, and the balanced toggle action transmitting the pressure effort of the operator.



DIMENSION DIAGRAM, HILL FRICTION CLUTCH PULLEYS—SOLID OR SPLIT

DATA, SINGLE ARM PULLEY

Diam., in.	12	13	14	15	16	17	18 & 19	20 & 21	22 to 35, incl.	36 to 47, incl.	48.
Face, in.	13	14	15	16	17	18	19	20	21	22	24

STANDARD BEARING LENGTHS FOR CLUTCH PULLEYS

Face, in.	4½	5½	6½	7½	8½	9½	10½	11½	12½	14	15	16	17
A plus B, in.	7	8	9	10	11	12	13	14	15	16	17	18	19
Face, in.	18	19	20	21	22	23	24	25	26	27	28	29	30
A plus B, in.	20	20	20	22	22	24	24	26	26	28	28	30	30

SPACE ON SHAFT

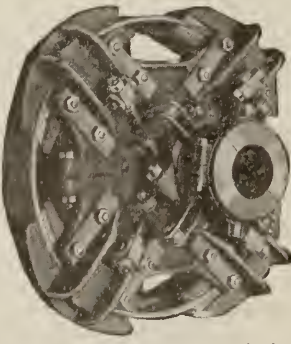
H. p. at 100 r. p. m.	9	12	15	20	27	35	45	60	75	90
C, in.	4½	4¾	5	5½	6¾	7½	8	8½	8¾	9½
D, in.	5	5¼	5½	7½	7½	8	8½	8¾	8¾	9½

H. p. at 100 r. p. m.	110	140	175	230	350	480	625	875	1100	1300
C, in.	9¼	9¾	11	12	12	14	17	18	19	20
D, in.	9½	10¾	11	11	11	12	14½	16	18	20

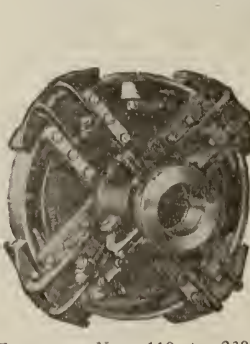
"A = B" for all pulleys. Pulleys having faces wider than those listed will be furnished with 2 sets of arms.



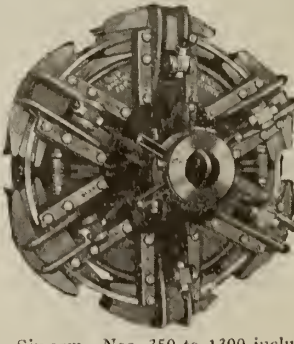
Three-arm—Nos. 9 to 45, inclusive



Four-arm—Nos. 60 to 90, inclusive



Four-arm—Nos. 110 to 230 inclusive



Six-arm—Nos. 350 to 1300 inclusive

FOUR DESIGNS OF HILL SMITH TYPE FRICTION CLUTCH

THE CARLYLE JOHNSON MACHINE CO.

Manufacturers of Friction Clutches and Cut-off Couplings
MANCHESTER, CONN.

Products.

JOHNSON FRICTION CLUTCHES.

Johnson Cut-off Couplings.

Johnson Friction Clutch.

The Johnson clutch is made in both single and double types for light powered drives from $\frac{1}{2}$ to 4 h. p. per 100 r.p.m. Its extremely compact form and the readiness with which it admits of modification gives it a wide range of usefulness in this field. For line shaft or countershaft installations, or for incorporating into machinery, there is no other clutch that is so universally practical.

It has been thoroughly tested and has been found exceptionally efficient for work that falls within its rating.



SINGLE CLUTCH EXTERIOR

Construction and Operation.

The expanding ring principle on which the Johnson design is based involves the smallest possible number of working parts, and allows a powerful compounding of leverage. The ingenious adaptation of this principle in the Johnson clutch makes it easily the simplest, most compact, and most accessible device on the market.

A body fastened to the shaft carries the split friction ring in which are inserted a pair of toggle levers. A curve shaped wedge, which is made part of a sliding shipper sleeve, forces the levers apart, expanding the ring, bringing the outer surface into frictional contact with the inner surface of the friction cup, the hub of which is made to suit requirements. The leverage is so compounded that it requires but little pressure to operate the clutch.



SINGLE CLUTCH BROKEN AWAY

STANDARD CLUTCH DIMENSIONS

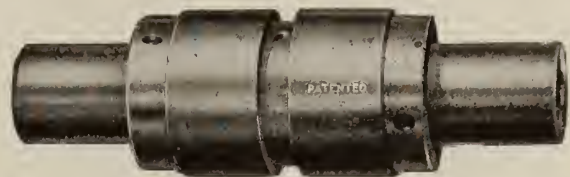
Clutch size number	Horse-power per 100 r. p. m.	Max. bore, I	Dimensions, Inches				Throw to engage clutch D
			A	B		C	
				Single	Double		
0	$\frac{1}{2}$	$1\frac{1}{16}$	$3\frac{3}{16}$	$3\frac{1}{4}$	5	3	$\frac{9}{16}$
2	$\frac{3}{4}$	$1\frac{1}{8}$	$4\frac{1}{8}$	$4\frac{1}{8}$	$6\frac{1}{8}$	4	$\frac{1}{2}$
4	1	$1\frac{1}{8}$	$4\frac{5}{8}$	$5\frac{1}{8}$	$7\frac{1}{2}$	$5\frac{1}{2}$	$\frac{3}{4}$
5	$1\frac{1}{2}$	$1\frac{1}{8}$	$5\frac{1}{8}$	$5\frac{1}{8}$	$8\frac{1}{8}$	6	$\frac{1}{2}$
6	2	$1\frac{1}{8}$	$5\frac{1}{2}$	$6\frac{1}{8}$	$8\frac{5}{8}$	$6\frac{1}{2}$	1
8	$2\frac{1}{2}$	$2\frac{1}{8}$	$6\frac{1}{8}$	$6\frac{1}{2}$	$11\frac{1}{8}$	$8\frac{1}{2}$	1
10	3	$2\frac{1}{8}$	$7\frac{5}{8}$	$5\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	$\frac{3}{4}$
11	4	$3\frac{1}{8}$	$9\frac{1}{8}$	$6\frac{1}{2}$	$10\frac{1}{8}$	$8\frac{1}{2}$	$1\frac{1}{8}$

Diameter of hub H must be at least 1 in. larger than shaft diameter. If a self-oiling bearing, it must be at least $1\frac{1}{4}$ in. larger.

The clutch may be adjusted to any desired tension by means of a single screw which moves two taper blocks set into the levers, and which is easily reached by means of a screwdriver through a hole in the friction cup.

The shipper sleeve is perfectly smooth, without projections of any sort, and entirely covers the working parts so no dirt can get near them.

The clutch hub bearing is ordinarily spiral grooved for lubrication. For high speeds and exceptionally strenuous service, bronze bushings, self-oiling bearings, or oilless wood bearings are supplied, as the case demands.



DOUBLE CLUTCH EXTERIOR

Advantages.

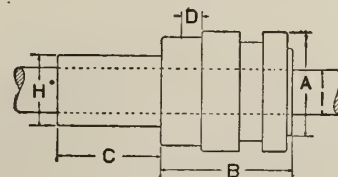
The Johnson clutch is easily adaptable in form to meet any requirements. It may be fitted with standard pulleys, gears, or sprockets, or may be modified to fit all sorts of special installations, where a stock clutch would not apply. Its superiority lies in its ability to operate smoothly and dependably in whatever situation it is placed.

Information Required.

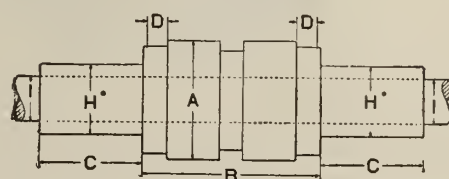
In submitting inquiries all possible information should be supplied regarding the nature of the machinery to be driven, the function of the clutch, and the frequency of operation; the horsepower required, the speed at which the clutch will run, and the provision for lubrication; the space available, the size of shaft and of clutch hub.

Attention to these points will insure quick service.

For more complete information, write for catalogue "H."



Single Type



Double Type

JOHNSON FRICTION CLUTCH

THE KINNEY MANUFACTURING CO.

Manufacturers of Friction Clutches and Cut-off Couplings

3529-3541 Washington Street
BOSTON, MASS.

BRANCH OFFICES

NEW YORK, N. Y. PHILADELPHIA, PA. CHICAGO, ILL. KANSAS CITY, MO. SAN FRANCISCO, CAL.

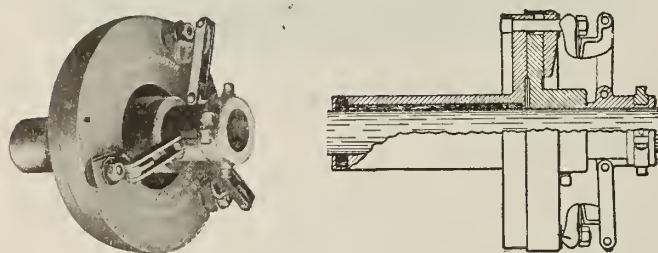
Products.

FRICITION CLUTCH PULLEYS and CUT-OFF COUPLINGS.

For Road Oiling Equipment, see page 128; for Pumps and Strainers, see pages 742-43.

Competitor Clutch (Pulley).

Six sizes, 2 to 13 h. p. per 100 r. p. m. These clutches are extremely simple in construction, practically indestructible, and seldom require adjustment or repairs.



COMPETITOR CLUTCH

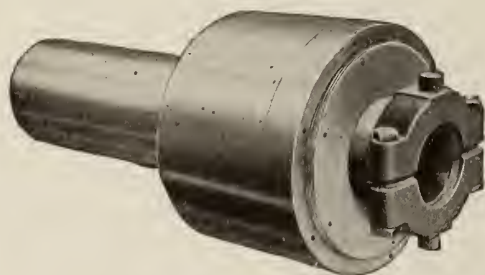
The metal to metal friction surfaces, when properly lubricated, engage easily and start the load without grinding, chattering or other noises. Their use eliminates sudden strains on the belting or machinery. When the pulley is idle the inside disk is the only moving part.

They can be used equally well with gear or chain drive.

All sizes are furnished with wick oiled sleeve.

Oiltight Clutch.

Eight sizes 2 to 80 h. p. per 100 r. p. m. The smallest friction clutch made per horsepower. As the case is oiltight it may be filled with oil, which insures thorough lubrication of all working members.



THE OILTIGHT CLUTCH

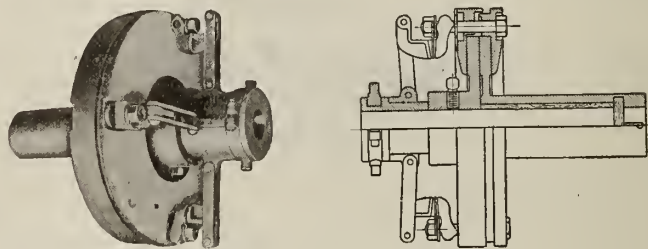
It is made with single or multiple disks, depending upon the horsepower required for the speed and space available.

Made to order only.

Interchange Clutch (Pulley or Cut-off Coupling).

Four sizes, 6 to 24 h. p. per 100 r. p. m. The construction of the Interchange clutch is similar to the Competitor type except that the friction members are made in four parts, in place of three, having two rings which are interchangeable. With this feature the clutch may be used on either the driving or driven end of the drive. When the clutch is disengaged the inside disk is the only moving member.

When used as a driven clutch the fitted ring is



INTERCHANGE CLUTCH

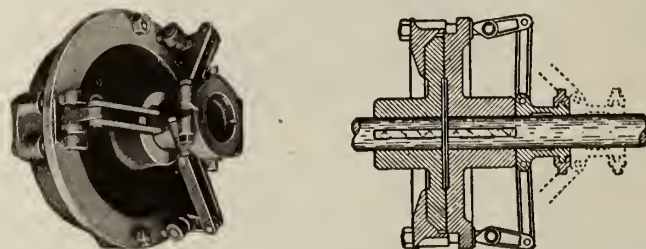
placed on the disk, with short hub; this will allow the sleeve disk to revolve freely and become the only moving member when clutch is disengaged.

By changing the sleeve disk for a disk with short hub and roller bearing to guide the end of the shaft, the clutch may be used as a cut-off coupling.

Cut-off Coupling (Worrall Type).

Six sizes 65 to 1200 h. p. at 100 r. p. m.; 200 to 2000 h. p. at 300 r. p. m. This clutch has been on the market for a great many years and has demonstrated its superiority over all other clutches for heavy duty.

Power is directly transmitted through the two flanges keyed firmly to the shafts and not through bolts, loose joints or working parts. When disengaged the



CUT-OFF COUPLING

flanges are entirely separated eliminating all friction.

The clutch and shafts are automatically centered when in use by the bevel face disk. This is the only positive method of centering heavy shafts. There is no end thrust upon the shifter or shaft bearings.

MEDART PATENT PULLEY COMPANY

Power Transmission Machinery

GENERAL OFFICES AND WORKS

ST. LOUIS, MO.

ENGINEERING SALES OFFICES: PHILADELPHIA, PA. and CHICAGO, ILL.

OFFICE and WAREHOUSE: 211 Vine Street, CINCINNATI, OHIO

Products.

Specialists, not alone in PULLEYS, but manufacturers of Every Appliance for Use in Connection with the Mechanical Transmission of Power, including TURNED and POLISHED STEEL SHAFTING.

MEDART

TRADE-MARK

Line Shafting Equipment.

Founded 40 years ago, with the Medart patented steel rim pulley as the nucleus, our business has experienced a gradual well planned development in the single field of making complete equipment for the mechanical transmission of power, and in building machinery also for straightening, turning and polishing round bars of steel, bronze, copper, etc. Today the name "Medart" is synonymous with "*everything* in the line shafting equipment" and "the best machinery for straightening and turning round metal bars," particularly of steel.

Although common impression, due to our corporate name perhaps, has been that the name "Medart" means "Specialists in Pulleys alone," the facts are that pulleys—every type: cast iron, wood split, and steel rim—constitute only a small percentage of our production, and we are importantly engaged in the manufacture of turned and polished steel shafting, couplings, collars, hangers, bearings, bearing supports, friction clutches, gearing, rope sheaves, belt tighteners, American and English system rope drives and so on. In fact, we cover the mechanical transmission field, and have fully equipped some of the largest and best known plants that are noted for high efficiency.

Shafting.

That we are the only exclusive manufacturers of a complete line of power transmission machinery which manufactures shafting in our own mill, on a basis permitting us to quote mill prices, is something engineers and buyers should keep in mind when securing proposals covering tentative line shafting installations. Shafting in any considerable overhead equipment comprises a heavy percentage of the total tonnage involved. Hence, we are able to quote very attractively covering all line shafting equipments. It will be to your great advantage

to secure all overhead equipment from one source of supply—at a saving.

"Medart" shafting is produced by the turning and polishing process.

Transmission Appliances.

Our flange couplings are all male and female design. We fit them to shafts under hydraulic pressure and afterwards face off to insure true alignment. Also we offer compression keyed-on, three-part keyless, universal joint and jaw clutch type couplings.

Our line of hangers and bearings and bearing supports includes different types, all heavy and well designed. Hanger frames are of the 4-way adjustment types. Bearings are either ring, collar or wick oiling or fitted with grease cups—adapted for ball and socket or screw adjustment. Pillow blocks of every style, including base plates, wall boxes, floor stands, brackets, etc.

Our V-groove type friction clutch, having an interchangeable sleeve to which may be fitted either a pulley, gear, sprocket or rope sheave, made solid or split construction, is noted for its great strength, matchless frictional power, simplicity and long life in service. Is adapted for conversion to cut-off coupling.

Pulleys.

Our steel rim pulley—light in weight, perfect in balance—is superior to any possible construction of pressed and riveted sheet steel, because stronger, stiffer, and will stay round. Made all sizes up to 16 ft. in diameter and 50-in. face. Our equipment for manufacture of cast iron pulleys, 3 in. to 16 ft. in diameter, is complete from the best foundry conditions and the most modern types moulding machines to the highest efficiency in machine-shop practice. Medart wood split pulleys do the work—and they will last as long as the shafting will last.

Our heavy duty "Hercules" all-steel pulley is matchless. It will withstand successfully more abuse than any other make or construction of pulley. It is built to suit specific conditions, and guaranteed on a money-back basis.

GEARS—It does not matter what is needed in gears—we can build them. We have thousands of patterns, and, besides, the most efficient moulding machines and gear cutting shop equipment.

Send for our General Catalogue and discounts. Let us quote your next specifications.

GEO. W. PYOTT CO.

Manufacturers of Power Transmission Appliances

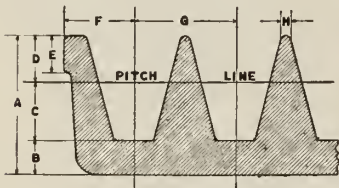
OFFICE AND WORKS
North Avenue and Noble Street
CHICAGO, ILL.

Products.

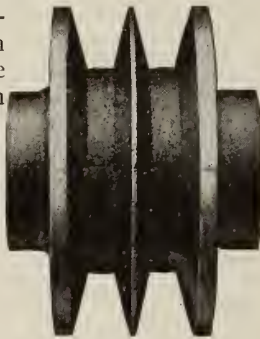
CAST IRON SHEAVES; CAST IRON PULLEYS; SPUR, BEVEL and WORM GEARS; FRICTION CLUTCHES; SPROCKET WHEELS; LINE SHAFT HANGERS and ACCESSORIES; PACKAGE ELEVATORS; SPIRAL CONVEYORS; COUNTER-SHAFT BOX END for Conveyor; BELT CONVEYORS.

Cast Iron Sheaves.

The "V" belt drive is designed for noiseless transmission of power with short centers and at high speed. It very effectually supplants the silent chain drive. Prices of complete rope and other drives furnished on application.



Dimension Diagram



Front View

CAST IRON SHEAVES FOR "V" BELT

DIMENSIONS IN INCHES

Size of belt, in.	A	B	C	D	E	F	G	H
$\frac{3}{8}$	1	$\frac{5}{16}$	$\frac{1}{8}$	$\frac{7}{16}$	$\frac{1}{4}$	$\frac{5}{8}$	1	$\frac{1}{16}$
$1\frac{1}{4}$	$1\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{5}{8}$	$\frac{3}{8}$	1	$1\frac{1}{16}$	$\frac{1}{8}$

Cast Iron Pulleys.

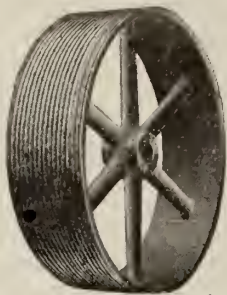
Cast iron pulleys are permanent and are suited to a wider range of service than any other type of pulley.

Pyott pulleys are commercially perfect, symmetrical in appearance, accurately balanced, strong and true running.

This company also manufactures the Pyott stock split pulley with standard bore and interchangeable bushings.



BALL AND ROLLER BEARING PULLEYS



CAST IRON SHEAVE FOR MANILA OR WIRE ROPE



PLAIN CAST IRON PULLEY



Fig. 7 Fig. 8
FLANGED PULLEYS



Fig. 10, Style "A"
TIGHT AND LOOSE PULLEYS



Fig. 11, Style "B"
TIGHT AND LOOSE PULLEYS

Gears.

All types of gears, cast or cut teeth.



SPUR GEAR



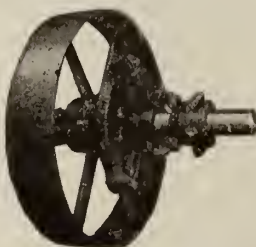
WORM GEAR



BEVEL GEAR

Pyott Steel Plate Friction Clutch.

This clutch is designed for severe work, such as coal and ore handling, gypsum and cement making, and heavy power transmitting. Can be fitted with extended sleeves or used as cut-off coupling.



No. 18 Clutch with 36 x 8-in. Double Belt Pulley



Front View

PYOTT STEEL PLATE FRICTION CLUTCH

DATA, PYOTT STEEL PLATE FRICTION CLUTCHES				
No.	Largest bore, in.	H. p. at 100 r. p. in.	Price, solid	Price, split
6	2	3	\$ 30.00	\$ 42.00
9	2½	5	42.00	54.00
12	3	7	54.00	70.00
15	3½	9	70.00	87.00
18	4½	14	93.00	114.00
21	5	19	124.00	148.00
24	5½	25	138.00	168.00
27	6	32	155.00	190.00
30	6½	40	175.00	217.00
33	7	48	183.00	232.00
36	7½	56	194.00	250.00
40	8	73	257.00	320.00
44	8½	100	300.00	370.00
48	9	125	350.00	425.00
54	9½	175	500.00	575.00
60	10	225	730.00	830.00

NOTE—Bores can be made larger when absolutely necessary.

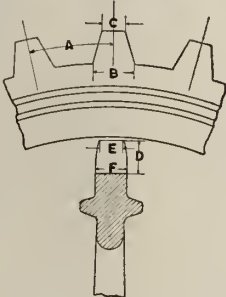
Cast Iron Sprocket Wheels, Plain or Chilled Rims.

Sprocket wheels suitable for all types of chain can be furnished and they can be fitted with jaw clutches or with steel plate friction clutches. Also gap wheels for dragline conveyors.



CAST IRON SPROCKET WHEEL

DIMENSIONS IN INCHES						
Chain No.	A	B	C	D	E	F
25	7/8	1/8	7/8	1 1/2	3/4	1 1/2
32	1 1/8	1/8	1 1/8	1 7/8	3/4	1 7/8
33	1 1/8	1/8	1 1/8	1 7/8	3/4	1 7/8
35	1 1/8	1/8	1 1/8	1 7/8	3/4	1 7/8
42	1 1/8	1/8	1 1/8	1 7/8	3/4	1 7/8
51	1 1/8	1/8	1 1/8	1 7/8	3/4	1 7/8
52	1 1/8	1/8	1 1/8	1 7/8	3/4	1 7/8
57	1 1/8	1/8	1 1/8	1 7/8	3/4	1 7/8
62	1 1/8	1/8	1 1/8	1 7/8	3/4	1 7/8
66	1 1/8	1/8	1 1/8	1 7/8	3/4	1 7/8
78	1 1/8	1/8	1 1/8	1 7/8	3/4	1 7/8
85	1 1/8	1/8	1 1/8	1 7/8	3/4	1 7/8
103	1 1/8	1/8	1 1/8	1 7/8	3/4	1 7/8
124	1 1/8	1/8	1 1/8	1 7/8	3/4	1 7/8



DIMENSION DIAGRAM

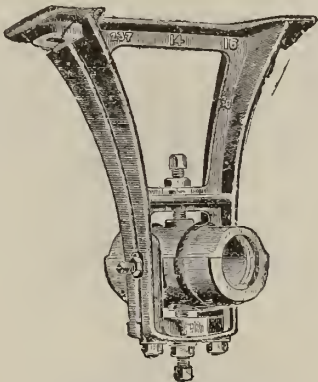
Line Shaft Hangers.

This company manufactures and keeps in stock a complete line of 4-point adjustable hangers, pillow blocks, wall brackets and floor stands.

Having side as well as vertical adjustment it is much easier to erect and correctly align them than the older types. Where buildings have settled or shrunk, it is only necessary to readjust the set screws, without moving the frame, to relieve the pressure on the bearings caused when the alignment is disturbed.

These frames can also be fitted with Pyott standard ring oiling boxes as shown.

All other types of line shaft and factory equipment are also manufactured.

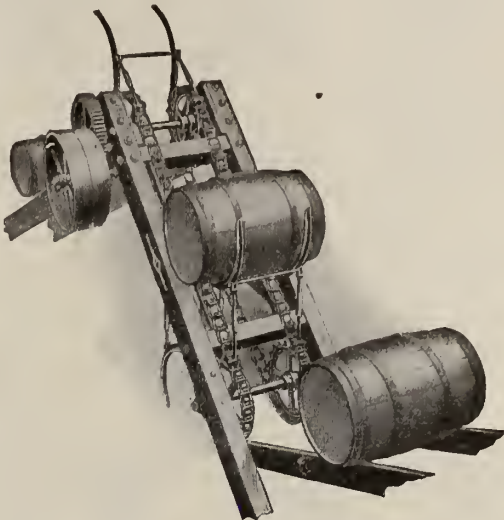


LINE SHAFT EQUIPMENT OF ALL TYPES

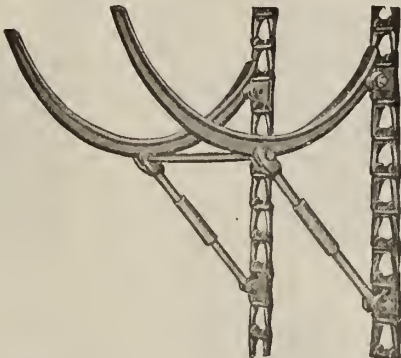
Package and Barrel Elevators.

For conveying barrels, boxes, tierces, bags, kegs

and other bulky packages. All the single arms are fitted with cushion spring braces. Elevator can be built to meet all conditions of operation. Spiral conveying systems furnished complete.



PACKAGE AND BARREL ELEVATOR

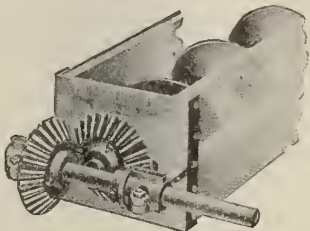


ARMS OF PACKAGE CONVEYOR WITH SPRING BRACES

Countershaft Box End for Conveyor.

This device provides a cast iron end box to furnish bearings necessary for the miter gear countershaft, all self-contained.

DIMENSIONS IN INCHES		
Diam. conveyor	Diam. driving end	Diam. counter-shaft
4	1	1
6	1½	1½
8	1½	1½
9	1½	1½
10	2	2
10	1½	1½
12	2	2
12	2 1/16	2
14	3	2
14	2	2
14	2 1/16	2
16	2	2 1/16
16	3	2 1/16
18	3	2 1/16



COUNTERSHAFT BOX END FOR CONVEYOR

Belt Conveying Systems.

All styles and types of belt conveying systems furnished to meet individual requirements.

VALLEY IRON WORKS

Manufacturers of Power Transmission Equipment

WILLIAMSPORT, PA.

NEW YORK, N. Y., 30 Church Street

Products.

A complete line of POWER TRANSMISSION EQUIPMENT.

For Grates, see pages 680-81.

Power Transmission Equipment.

The VALLEY IRON WORKS' line of power transmission equipment embodies the highest development in power transmission.

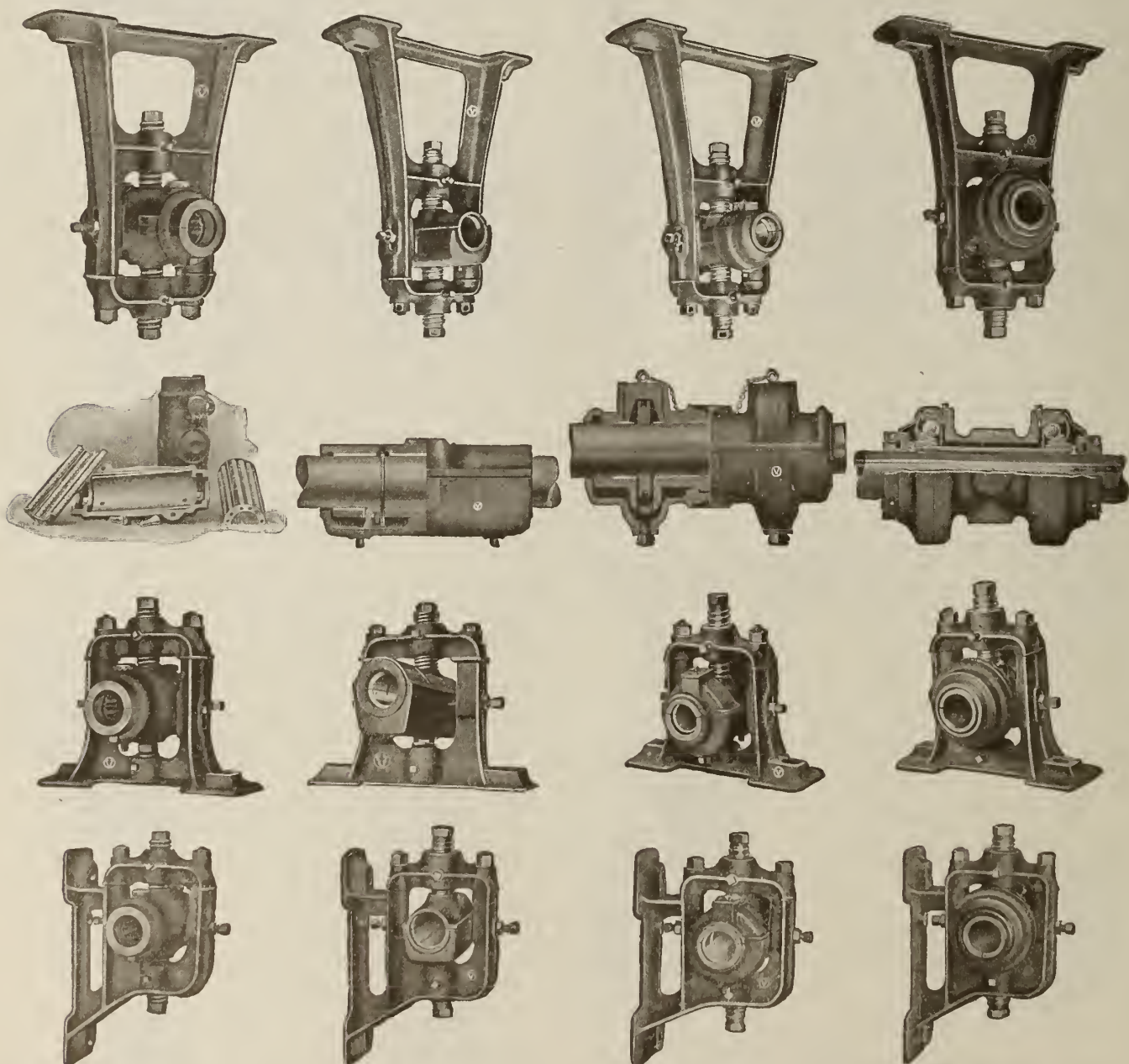
The line is complete to suit every purpose. All equipment is accurately constructed, materials are of

the highest grade obtainable for the purpose, and inspections and tests are rigid, insuring long life, safety and high efficiency.

Large stocks and exceptional shipping facilities insure prompt deliveries.

The engineering department of this organization is composed of experts in power transmission equipment and their services are at the disposal of those having power transmission problems to solve.

Where ever you order, always specify the "Hercules."



HERCULES HYATT ROLLER BEARING HANGERS AND PILLOW BLOCK

HERCULES DUPLEX OILING HANGERS AND PILLOW BLOCK

HERCULES COLLAR OILING HANGERS AND PILLOW BLOCK

HERCULES CHAPMAN BALL BEARING HANGERS AND PILLOW BLOCK



STANDARD SOLE PLATE
For standard, Universal and Hercules adjustable pillow blocks.
Plain sole plates for wick and ring oiling rigid pillow blocks, also furnished



WEDGE ADJUSTABLE SOLE PLATE
For wick and ring oiling rigid pillow blocks



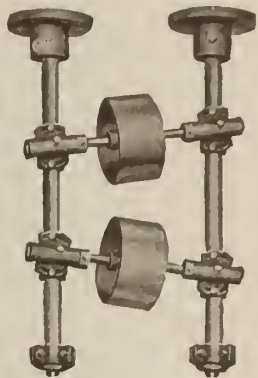
SQUARE JAW CLUTCH COUPLING
Substantially designed for general service and finished in first class manner.
Spiral jaw clutch couplings also furnished, either right or left hand



UNIVERSAL JOINT COUPLING
Made single and double.
Only practicable in small powers, moderate speeds and where space does not permit other forms of connections



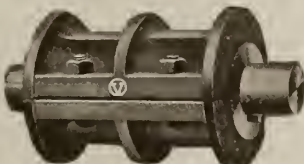
ADJUSTABLE MULE STAND
Adjustable in every direction.
Complete as illustrated with ceiling plate, guy rods, turnbuckles and compression grease cups. Crowned iron pulleys furnished unless otherwise specified.
Stationary mule stands also furnished



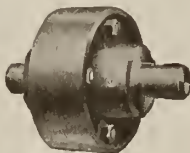
DOUBLE BRACE BINDER FRAMES
Complete as illustrated with any rods, turnbuckles and compression grease cups. Crowned iron pulleys furnished unless otherwise specified.
Single brace binder frames also furnished



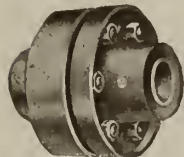
SOLID SLEEVE COUPLING
For light work only. Finished all over. Has countersunk set-screws



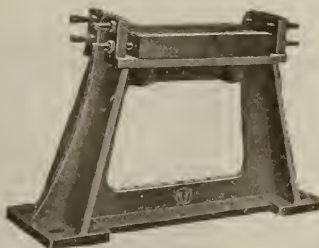
STANDARD CLAMP COUPLING
Complete with bolts and key



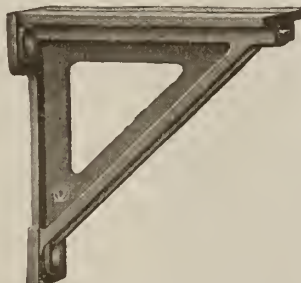
STANDARD PLATE COUPLING
Furnished complete with bolts and key



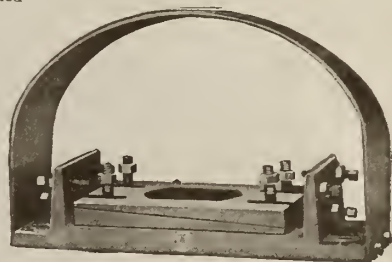
HENDERSHOT COUPLING
Doubly strong, compensates for shaft inequalities, self-aligning, has interlocking internal jaws eliminating strain on connecting bolts and has greater compression area than other couplings



WEDGE ADJUSTABLE FLOOR STAND
Has ample strength, weight and base of area for the respective shaft sizes; is well adapted to heavy duty and high speed service. Carefully made and finished. Furnished with split babbitted bearing boxes



EXTENSION WALL BRACKET
Makes an excellent support for pillow blocks. Horizontal and vertical adjustments are provided



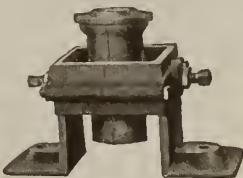
WALL BOX FRAME
Strong and well made. Designed for the Standard, Universal and Hercules adjustable and wick and ring oiling rigid pillow blocks. Provides horizontal and vertical adjustments as well as the removal of pillow block cap



DOUBLE FLANGE SAFETY SET COLLARS
Made solid and split for all sizes of shafting. Comply with all legal requirements as to safety by having setscrews and bolts protected. Faced on ends, accurately bored and reamed



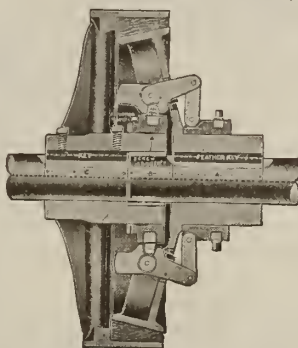
PEDESTAL FLOOR STAND
Furnished with common split babbitted bearings



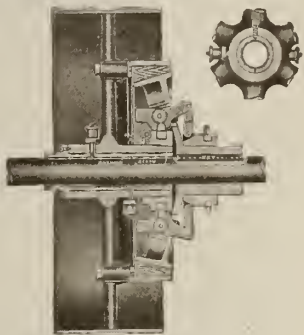
VERTICAL SHAFT FLOOR BEARING
Ball and socket adjustable. Split bearing and frame



VERTICAL SHAFT STEP BEARING
Adjustable in all directions. Tempered steel button and babbitted bushing, surrounded by oil reservoir of ample capacity. Operates with minimum friction loss



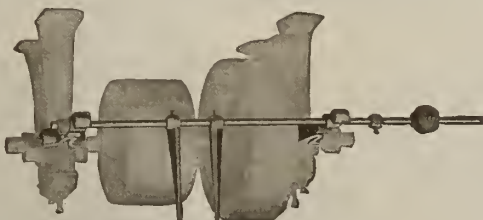
CROWELL FRICTION CUT-OFF COUPLING
Neat, compact and powerful. Rigid and simple in construction, the satisfactory working of our frictions when they are properly put in position and cared for in a proper manner. Every inquiry and order relative to friction clutches should be explicit, stating the speed and the approximate horsepower to be transmitted, also the exact diameter of shaft. When shaft is not furnished by us, a wire template, not less than 1/8 in. in diameter and pointed at each end, should accompany the order. All parts of our friction clutches are interchangeable. They are perfectly balanced and are fitted with square keys and setscrews and may run at any speed



CROWELL FRICTION CLUTCH PULLEY



BEAM CLAMPS
For standard I-beams. Holds hanger absolutely rigid and eliminates oscillating so frequent with more fragile and cheap devices. All fastening bolts furnished



BELT SHIFTER FIXTURE
Complete shifting attachment by means of which any one of the standard Hercules or Universal drop hangers can readily be fitted up as a countershaft hanger with a very simple and desirable belt shifting rig attached

T. B. WOOD'S SONS COMPANY

Power Transmission Machinery

CHAMBERSBURG, PA.

Products.

A complete line of POWER TRANSMISSION EQUIPMENT: Shafting; Belt Clamps; Solid and Split Safety Set Collars; Flanged or Plate Couplings; Flexible Couplings; Double Cone Compression Couplings; Universal Giant Keyless Couplings; Ribbed Compression Couplings; Square and Spiral Jaw Shifting Clutch Couplings; Solid Sleeve Couplings; Universal Joint Couplings; Ball and Socket Line Shaft, Heavy and Extra Heavy Headshaft Hangers of either Plain, Chain or Ring Oiling Type; Cast Iron Wall Brackets; Floor Stands; Peerless or Four Set Screw Hangers; Rigid and Adjustable Pillow Blocks and Post Hangers of Plain, Chain, Wick or Ring Oiling Type; Plain Flat Boxes; Solid Journal Boxes; Vertical and Angle Shaft Bearings; Rigid and Adjustable Step Bearings; Girder Clamps; Belt Shifters; Cast Iron or Steel Arch Wall Frames; Plain and Wedge Adjusting Base Plates; Cast Iron Pulleys; Taper Cone Pulleys; Step Cone Pulleys; Universal Giant Split Pulleys; Guide Pulleys; Clamp Hub Pulleys; Flanged Pulleys; Tight and Loose Pulleys; Web Center Pulleys; Dynamo Pulleys; Friction Clutch Pulleys; Flywheels; Balance Wheels; Engine Pulleys; Cork Insert Pulleys; Stationary and Adjustable Mule Pulley Stands; Single and Double Braced Binder Frames; Belt Tighteners; Horizontal, Vertical, Swinging and Rack and Pinion Types; Universal Giant Friction Clutches and Cut-off Couplings; Premier Friction Clutches for Countershaft Service; Clutch Shifting Mechanisms; Rope Transmission Drives; Rope; Rope Sheaves; Tension Carriages; Quill Drives; Quill Bearings; Fire Wall Sleeves.

Safety Set Collars.

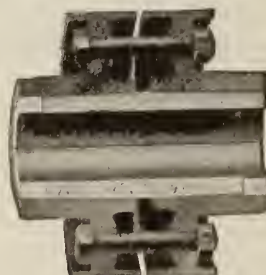
Made either solid or split, bored for all sizes of shafting. Finished all over and fitted with hardened set screws. All screws, bolts and nuts are protected by flanges projecting beyond heads and nuts.



SAFETY SET COLLAR

Couplings.

This line consists of flange or plate couplings, double cone, ribbed and Universal Giant compression couplings, the latter being the coupling that requires no keys; shift-



UNIVERSAL GIANT COMPRESSION COUPLING

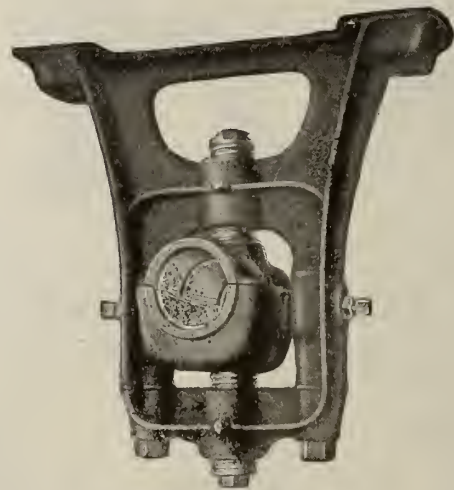
ing jaw clutch couplings, either spiral or square jaws, solid sleeve and Universal joint couplings.

Hangers.

Many different types of hangers are included in this line, all of a modern design, possessing unique adjusting and power saving features, fitted with either ring or chain oiling or plain grease cup bearings.

This company is also prepared to equip hangers with closed end bearings and bearings recessed for concealed collars. This line comprises line shaft, heavy and extra heavy headshaft drop hangers, post hangers and bracket hangers, being made in both the ball and socket or the four set screw or Peerless types.

Adjustable girder clamps of a unique design are also made by this company for attaching its hangers to steel girders.



HEADSHAFT HANGER

Pillow Blocks.

From many different patterns, this company is prepared to supply rigid and adjustable pillow blocks suitable for operation under various conditions. This classification comprises plain flat boxes, standard rigid, wick, ring and chain oiling rigid pillow blocks and post boxes, solid journal boxes, ball and socket and four set screw ring oiling adjustable pillow blocks; also plain or wedge



PILLOW BLOCK

adjusting cast iron and steel arch wall frames, base plates, cast iron wall brackets, plain or wedge adjusting ball and socket floor stands and fire wall sleeves.

Cast Iron Pulleys.

This company manufactures and is prepared to furnish cast iron pulleys of every description, all of a correct design, having metal properly distributed. These cast iron pulleys are machine moulded, carefully finished and well balanced.

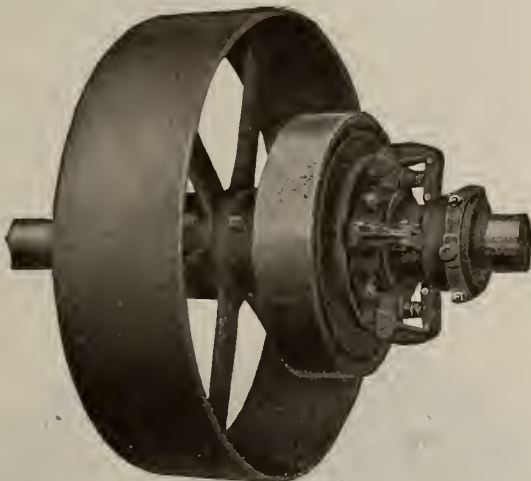


CAST IRON PULLEY

Universal Giant Friction Clutches.

These clutches are of the disk type, of a consistent design throughout and are made either solid or split, the same type of construction being used for all sizes and all speeds. The clutch is complete within itself either for use as a cut-off coupling or in connection with ordinary pulleys, gears, rope sheaves, sprockets or any regular or special part that it is desired to use as a driving or driven mechanism. The sleeve and body of this clutch being independent, both are held rigidly in lateral position upon mounting and sustain no end thrust whatever when clutch is thrown in or out of engagement. The friction surfaces are protected from dust, dirt and other foreign substances. If desired, clutch may be equipped with special cover to protect mechanism.

All styles of shifting devices can be supplied including fork and lever stands, compound levers, worm geared and single or double spur geared shifter stands.



UNIVERSAL GIANT FRICTION CLUTCH

Belt Tighteners.

Included in this line are belt tighteners made with "A" frames and vertical side frames, all with screw adjustment; in addition, rack and pinion tighteners for horizontal or vertical use, also swinging tighteners. Also, stationary and adjustable mule pulley stands and single and double brace binder frames.

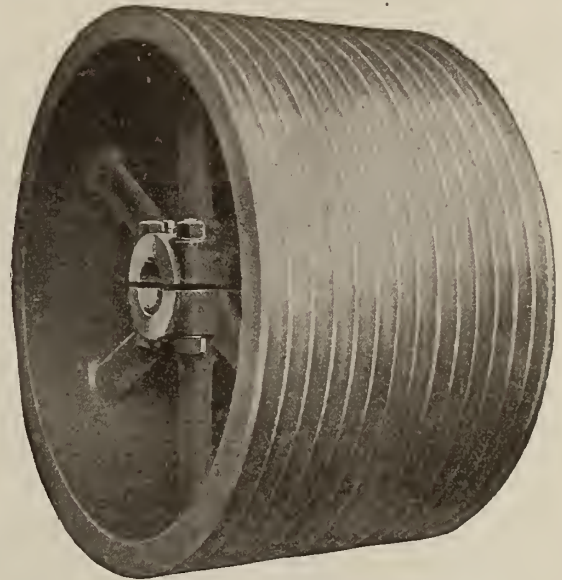
Belt and Clutch Shifting Mechanism.

Belt shifters supplied which may be attached to any of the hangers; and for friction clutches, fork and lever stands, compound levers, worm geared and single or double spur geared shifter stands can be supplied.

Rope Transmission.

Complete installations of either American or English system drives. Rope sheaves with grooves of every description also furnished; tension carriages, track, track hangers, tail rope sheaves and weights.

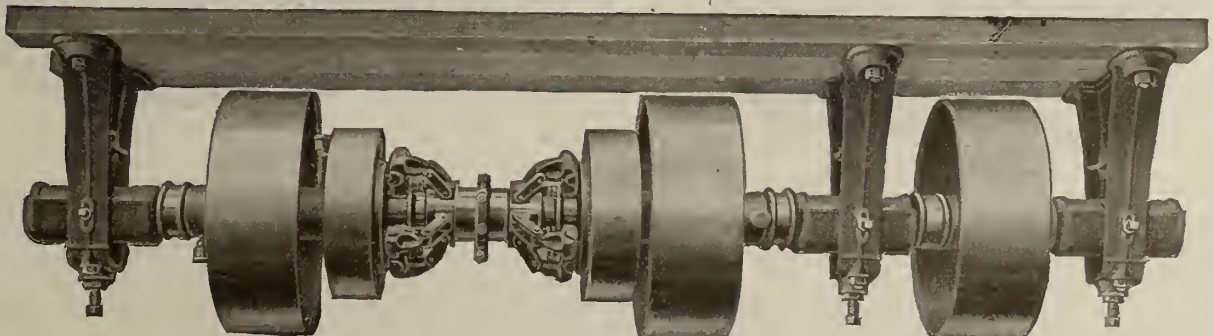
A corps of competent engineers, with years of experience in designing and installing satisfactory rope driving equipments, is always ready to plan drives to meet conditions as they may exist.



ROPE SHEAVE

Countershafts.

By assembling standard equipment, this company is able to economically produce in a very short time, a line of countershafts that have never been surpassed either as to quality of workmanship and efficiency, or variety of design.



COUNTERSHAFT

HYATT ROLLER BEARING CO.

NEW YORK, N. Y.

BRANCHES

CHICAGO, ILL.

DETROIT, MICH.

NEWARK, N. J.

Products.

FLEXIBLE ROLLER BEARINGS.
SHAFT HANGERS.
BEARING BOXES.
PILLOW BLOCKS.
POST HANGERS.

Scope of Use of Hyatt Roller Bearings.

Hyatt roller bearings are used for steel mill cars and roller tables, trolleys, cranes, hoists, machine tools of all kinds, line shafts, concrete machinery, all kinds of trucks and cars, textile machinery, conveyors, automobiles, tractors, mine cars, etc.

Roller Bearings.

These bearings are antifriction bearings that merit the careful consideration of every engineer, because they are designed and constructed according to sound engineering principles.

The chrome-vanadium steel rollers are heat treated to a hardness that successfully resists wear. Assembled in a correctly designed substantial cage, they provide an antifriction unit that is simple to apply and that is dependable and effective. Hyatt roller bearings have been used for years with unvarying success in industrial machinery.

The rapidly growing use of antifriction bearings in all classes of machinery to conserve power, to cut down lubrication and attention costs and to insure dependability of operation, is a matter of especial interest to every engineer.

Eventually antifriction bearings will entirely displace plain friction bearings as succeeding years increase the demand for more economical, more dependable operation of machinery. The gigantic wastes that have existed in our country due to its abundance of fuels

of the shaft and the bearing to stand up under shock loads without permanent deformation.

Line Shaft Roller Bearings.

Hyatt line shaft roller bearings are made for all standard sizes of shafting and, being split, can be slipped into position without removing pulleys, couplings or hangers.

The boxes are filled with oil after which they need not be lubricated for 4 months.

The bearing consists of a series of flexible rollers of chrome-vanadium steel, retained in position by a substantial steel cage. Being hollow and having helical openings throughout their length, the rollers continually cover all bearing surfaces with oil.

Hyatt bearings are sturdily and accurately constructed and give satisfactory service.

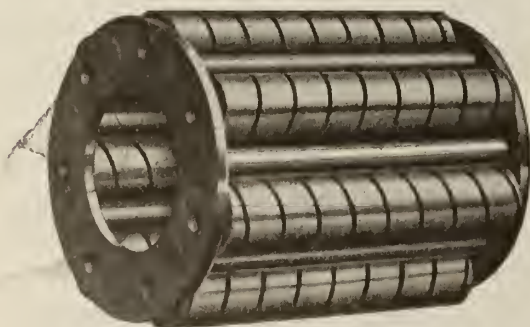
Many are still in operation after 25 to 30 years of practical service earning dividends through savings in power, oil and labor.

The widespread need for increased efficiency in production has caused more attention to be paid to the power savings made possible by reducing the friction of moving parts of machinery.

The perfection of anti-friction bearings has eliminated a large percentage of the power waste caused by ordinary friction bearings.

The true rolling motion of Hyatt line shaft roller bearings eliminates at least 50% of the friction that exists in plain babitted bearings, making possible a reduction of 15% of the total power.

By the use of Hyatt line shaft roller bearings present equipments can be increased without enlarging the power plant, or a 15% reduction in the power bill can be effected—a saving of special importance at this time.



HYATT ROLLER BEARING



HYATT LINE SHAFT ROLLER BEARING

and materials are being slowly but surely checked, and antifriction bearings are one of the soundest means of eliminating these wastes.

By reason of the slight flexibility of the roller, Hyatt bearings carry the load on an area. This materially reduces the unit load and enables the surfaces

Hyatt Bearing Boxes, Shaft Hangers and Pillow Blocks.

This company is prepared to furnish bearing boxes, shaft hangers, pillow blocks and post hangers of excellent design and construction, dimensions of which are given on the following page.

Full information sent on request.

G-A BALL BEARING MANUFACTURING CO.

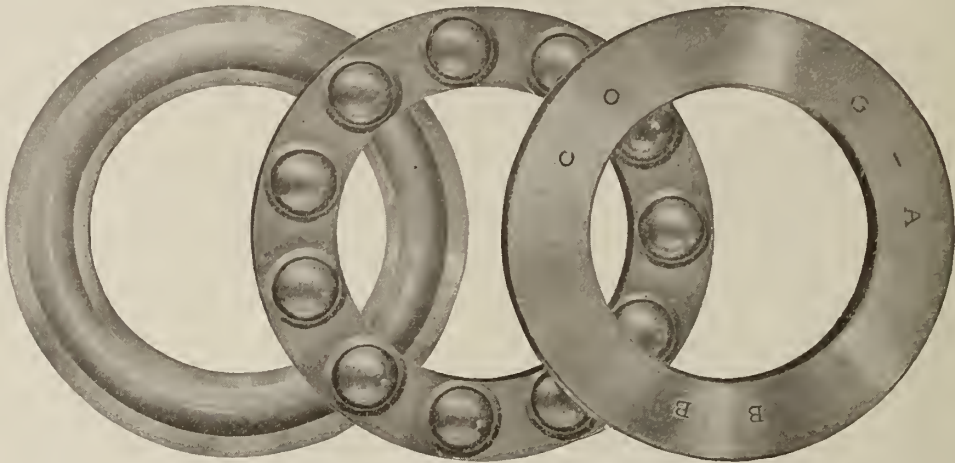
123 to 141 Albany Avenue
CHICAGO, ILL.

Products.

G-A BALL THRUST BEARINGS.

Material.

The rings of these bearings are made of the highest grade chrome bearing steel, free (commercially) from such impurities as sulphur and phosphorus; hence, a supreme quality. These rings are hardened by a special process whereby every ring is subjected to the same heat, rendering the metal hard and tough and superior in every way to the results obtained by case hardening. The balls used are of the very highest grade of chrome steel balls, being accurate to within 0.0001 in.

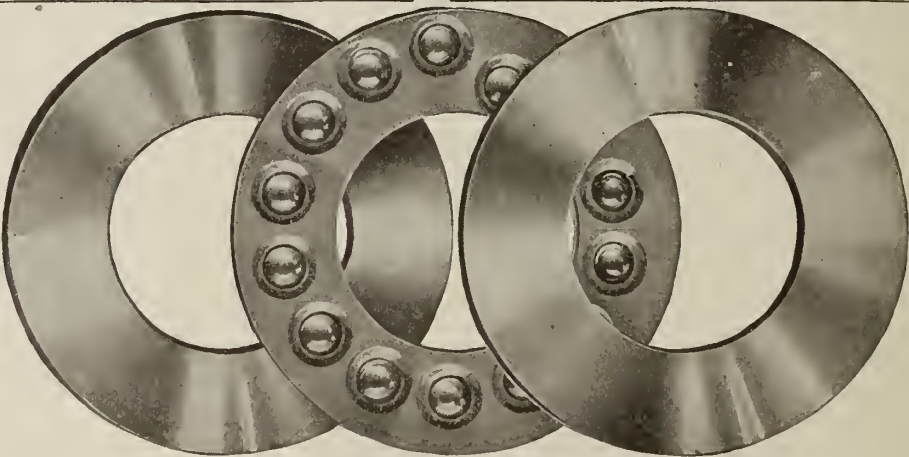


B SERIES GROOVED THRUST BEARINGS
One direction; grooved races; flat seats; inch standard

No. of bearings	Inside diameter, in.	Outside diameter, in.	Height, in.	Balls, in.	Price	No. of bearings	Inside diameter, in.	Outside diameter, in.	Height, in.	Balls, in.	Price
1-B	$\frac{1}{2}$	$1\frac{3}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	\$4.25	10-B	$1\frac{5}{8}$	$2\frac{33}{32}$	$\frac{3}{2}$	$\frac{5}{16}$	\$8.25
2-B	$\frac{5}{8}$	$1\frac{13}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	4.60	11-B	$1\frac{3}{4}$	$2\frac{11}{16}$	$\frac{3}{4}$	$\frac{5}{16}$	9.20
3-B	$\frac{3}{4}$	$1\frac{17}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	5.00	12-B	$1\frac{7}{8}$	$2\frac{15}{16}$	$\frac{3}{4}$	$\frac{5}{16}$	10.00
4-B	$\frac{7}{8}$	$1\frac{21}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	5.40	13-B	2	$2\frac{15}{16}$	$\frac{3}{4}$	$\frac{5}{16}$	10.85
5-B	1	$1\frac{25}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	5.85	14-B	$2\frac{1}{4}$	$3\frac{1}{16}$	$\frac{1}{2}$	$\frac{5}{16}$	12.25
6-B	$1\frac{1}{8}$	$1\frac{29}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	6.25	15-B	$2\frac{1}{2}$	$3\frac{1}{8}$	1	$\frac{5}{16}$	14.40
7-B	$1\frac{1}{4}$	$2\frac{3}{32}$	$\frac{23}{32}$	$\frac{5}{16}$	6.60	16-B	$2\frac{3}{4}$	4	$\frac{1}{2}$	$\frac{5}{16}$	16.80
8-B	$1\frac{3}{8}$	$2\frac{7}{32}$	$\frac{23}{32}$	$\frac{5}{16}$	7.00	17-B	3	$4\frac{5}{16}$	$1\frac{1}{8}$	$\frac{5}{16}$	18.60
9-B	$1\frac{1}{2}$	$2\frac{11}{32}$	$\frac{23}{32}$	$\frac{5}{16}$	7.50	18-B	$3\frac{1}{2}$	5	$1\frac{1}{4}$	$\frac{5}{16}$	27.75
						19-B	4	$5\frac{3}{4}$	$1\frac{3}{8}$	$\frac{5}{16}$	35.00

Thrust Washers.

The races of the "C" series bearings are flat. The load carrying capacity of the bearing is, therefore, considerably less than that of thrust bearings with grooved races. The bearings are not recommended for high speed work.



C SERIES THRUST WASHERS
One direction; flat races and seats; inch standard

No. of bearings	Inside diameter, in.	Outside diameter, in.	Height, in.	Balls, in.	Price	No. of bearings	Inside diameter, in.	Outside diameter, in.	Height, in.	Balls, in.	Price
1-C	$\frac{1}{2}$	$1\frac{7}{32}$	$\frac{5}{16}$	$\frac{3}{16}$	\$2.40	18-C	$1\frac{5}{8}$	$2\frac{33}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	\$3.90
2-C	$\frac{5}{8}$	$1\frac{11}{32}$	$\frac{5}{16}$	$\frac{3}{16}$	2.40	19-C	$1\frac{3}{4}$	$2\frac{11}{16}$	$\frac{5}{8}$	$\frac{1}{4}$	5.25
3-C	$\frac{3}{4}$	$1\frac{15}{32}$	$\frac{5}{16}$	$\frac{3}{16}$	2.40	20-C	$1\frac{7}{8}$	$2\frac{15}{16}$	$\frac{5}{8}$	$\frac{1}{4}$	5.25
4-C	$\frac{7}{8}$	$1\frac{19}{32}$	$\frac{5}{16}$	$\frac{3}{16}$	2.40	21-C	2	$3\frac{1}{16}$	$\frac{5}{8}$	$\frac{1}{4}$	5.25
5-C	$\frac{15}{16}$	$1\frac{23}{32}$	$\frac{5}{16}$	$\frac{3}{16}$	2.40	22-C	$2\frac{1}{8}$	$3\frac{1}{8}$	$\frac{5}{8}$	$\frac{1}{4}$	5.25
6-C	$1\frac{1}{16}$	$1\frac{27}{32}$	$\frac{5}{16}$	$\frac{3}{16}$	2.70	23-C	$2\frac{1}{4}$	$3\frac{1}{4}$	$\frac{5}{8}$	$\frac{1}{4}$	6.75
7-C	$\frac{7}{8}$	$1\frac{31}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	2.70	24-C	$2\frac{1}{2}$	$3\frac{1}{2}$	$\frac{5}{8}$	$\frac{1}{4}$	6.75
8-C	$1\frac{1}{8}$	$1\frac{35}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	2.70	25-C	2	$3\frac{1}{8}$	$\frac{13}{16}$	$\frac{5}{16}$	6.75
9-C	1	$1\frac{39}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	2.70	26-C	$2\frac{1}{8}$	$3\frac{1}{8}$	$\frac{13}{16}$	$\frac{5}{16}$	7.50
10-C	$1\frac{1}{16}$	$1\frac{43}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	2.70	27-C	$2\frac{1}{4}$	$3\frac{1}{4}$	$\frac{13}{16}$	$\frac{5}{16}$	7.50
11-C	$1\frac{1}{8}$	$2\frac{3}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	2.70	28-C	$2\frac{3}{8}$	$3\frac{3}{8}$	$\frac{13}{16}$	$\frac{5}{16}$	8.25
12-C	$1\frac{1}{4}$	$2\frac{7}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	3.00	29-C	$2\frac{1}{2}$	$3\frac{1}{2}$	$\frac{13}{16}$	$\frac{5}{16}$	8.25
13-C	$1\frac{1}{2}$	$2\frac{11}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	3.00	30-C	$2\frac{3}{4}$	$4\frac{1}{8}$	1	$\frac{3}{8}$	9.00
14-C	$1\frac{3}{4}$	$2\frac{15}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	3.00	31-C	$2\frac{7}{8}$	$4\frac{1}{2}$	1	$\frac{3}{8}$	9.00
15-C	$1\frac{5}{8}$	$2\frac{19}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	3.90	32-C	3	$4\frac{3}{8}$	1	$\frac{3}{8}$	9.75
16-C	$1\frac{7}{8}$	$2\frac{23}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	3.90	33-C	$3\frac{1}{8}$	$4\frac{3}{4}$	1	$\frac{3}{8}$	13.50
17-C	$1\frac{9}{8}$	$2\frac{27}{32}$	$\frac{5}{8}$	$\frac{1}{4}$	3.90	34-C	$3\frac{1}{4}$	$5\frac{1}{8}$	1	$\frac{3}{8}$	18.00

THE NORMA COMPANY OF AMERICA

High Speed Antifriction Bearings and Precision Measuring Instruments

Anable Avenue

LONG ISLAND CITY, N. Y.

Products.

"NORMA" BALL BEARINGS; "NORMA" ROLLER BEARINGS; "NORMA" THRUST BEARINGS; "NORMA" COMBINATION RADIAL and THRUST BEARINGS; "MINIMETER" MEASURING INSTRUMENTS.

"Norma" Ball Bearings.

These are essentially high speed, high duty bearings preëminently adapted to conditions where long service and silent running are sought, under high speed operation. It must be evident that a bearing that will give satisfaction at high speeds will maintain the same high standard of performance at low and moderate speeds.

The silence and speedability of the "Norma" bearing are due to the following distinctive features: open type and separable construction giving instant access without tools to every part for inspection or cleaning, facilitating lubrication, and permitting the independent rigid mounting of both inner and outer races; rigid mounting of both races preventing wear in the housing, with consequent vibration and noise and misalignment; extremely high precision maintained by the use of the "Minimeter"; materials of high quality improved by special treatments; workmanship and inspection of extreme refinement.

Made in both single and double types, in all the internationally standardized sizes.

"Norma" Roller Bearings.

These heavy duty, high efficiency units are preëminently adapted for service where shock, jar, vibration, and wide and sudden load variations will be encountered—service destructive to even the best ball bearing. One exclusive feature of the "Norma" roller bearing is that it has twice the steady load capacity of a ball bearing of the same dimensions, and a temporary overload capacity up to 50% of its own rating. Its unique feature of design is the use of cylindrical rollers between a cylindrical inner race and a convex outer race. It has all the distinctive "Norma" characteristics of design and construction: open, separable type; rigid mounting of both inner and outer races; extremely high precision; speed qualities second only to the "Norma" ball bearing.

Made in all the internationally standardized ball bearing sizes.

"Norma" Thrust Bearings.

In these units "Norma" standards of design and precision have been applied to the making of bearings with maximum efficiency under end thrust—it being

"NORMA"

TRADE-MARK

understood that even the best thrust

bearing can be only a compromise with true antifriction principles. "Norma" thrust bearings have the durability and the speed qualities which come with correct design, superior materials, and unsurpassed precision of dimensions—they are high speed, silent running bearings. They can be furnished in both single and double types, either with or without housings, as conditions require. The housed types have the advantages of being self-contained and preadjusted.

Made in all the internationally standardized thrust bearing sizes.

"Norma" Combination Bearings.

These high duty units afford the complete solution of that difficult problem—handling a combined radial and thrust load with the maximum of efficiency. In essentials they consist of a standard "Norma" radial unit and a standard "Norma" thrust unit united in one housing

that is self-contained and preadjusted to the limit of exactness. Two types are offered: "Norma" combined annular ball and ball thrust bearing, and "Norma" combined roller and ball thrust bearing.

"Minimeter" Measuring Instrument.

This instrument brings to manufacturing on a commercial scale that degree of precision in measurement which otherwise can not be obtained outside the scientific laboratory. It is a device which, measuring to the 1/10,000 part of an inch, entirely eliminates the personal equation of the operator—the feel, the touch. Its use reduces duplicate part production, interchangeable manufacture, to scientific accuracy. It is furnished in a great variety of mountings, for practically every class of internal and external measurement.

Co-operative Service.

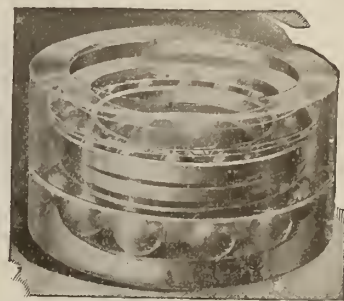
The company's Engineering Department is at the service of any one interested in the adoption or application of antifriction bearings for any purpose. This service is maintained and freely rendered in the conviction, based upon experience and observation, that the selection of the proper type of bearing for a specific duty, and its proper mounting, are as important as the quality of the bearing itself, in the effect upon the results accomplished and upon the performance realized.



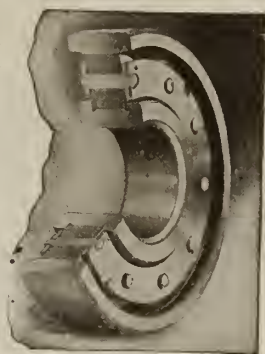
"NORMA" BALL BEARING



"NORMA" THRUST BEARING



"NORMA" COMBINATION ANNULAR BALL AND BALL THRUST BEARING



"NORMA" ROLLER BEARING

ROYERSFORD FOUNDRY & MACHINE CO.

Manufacturers of Power Plant Specialties

52 North Fifth Street
PHILADELPHIA, PA.

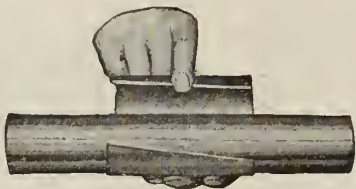
Products.

OLD RELIABLE "SELLS" ROLLER BEARINGS; COMPRESSION COUPLINGS; UNIVERSAL RING OILING HANGERS; SAFETY SET COLLARS; "SELLS" ROLLER or RING OILING BEARINGS; BRACKET HANGERS; PILLOW BLOCKS; COMBINATION OIL or GREASE GUNS; "ROLLERINE", the ball and roller bearing lubricant.

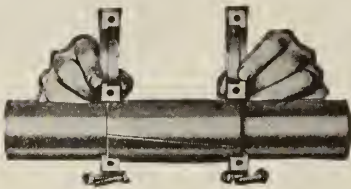
Power Transmission Machinery, Grinders, Shears, Punches, Dies, Sensitive Drill Presses, Foot Presses, Grinding and Polishing Machines, Tumbling Barrels.

Roller Bearings.

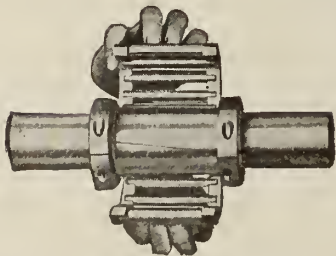
"Sells" roller bearings are made single and double roller structure, the single type being adaptable for all ordinary service. The double structure is intended for exceptionally heavy belt pulls, such as are found near most driving pulleys.



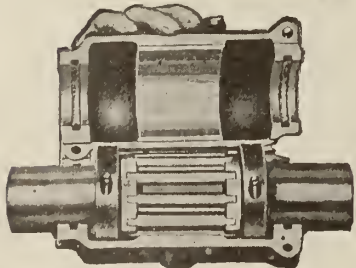
The Split Bushing



The Split Collar



The Split Roller Structure

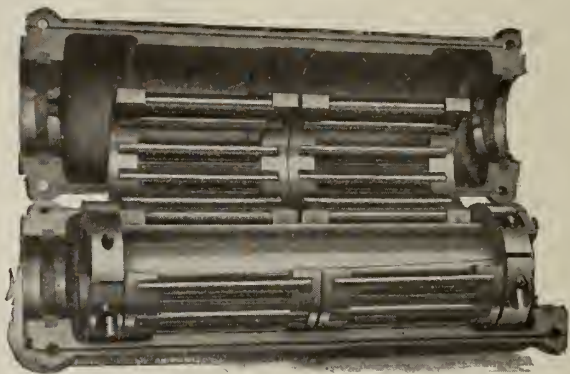


The Split Box

DETAILS OF "SELLS" DOUBLE ROLLER BEARING

CONSTRUCTION—Every feature of the Old Reliable "Sells" is split, making it easy to apply to shafting. There is no other bearing that combines so many advantages for economy in operation as the "Sells." Its high carbon split steel sleeve protects the shaft from all wear. This is firmly clamped in place by split collars. High carbon split steel lining is also used to protect the raceway in the housing from wear.

The split cage separates the rollers, preventing roller-against-roller friction, holding rollers parallel to the shafting, to each other and to the raceway. Friction is obviously eliminated at every point, because the bearing is of the full floating type.



"SELLS" DOUBLE ROLLER BEARING—HEAVY LOADS

DATA, "SELLS" ROLLER BEARING BOXES
With Single Roller Structure for Line Shafts and Counter Shafts

Size of shaft, in.	Length of box, in.	Width of box, in.	Height of box, in.	Prices	Code
1 1/2 & 1	6 3/4	2 1/8	2 3/4	\$6. 00	Ibex
1 1/2 & 1 1/4	6 1/2	3	3 1/8	7. 00	Ice
1 1/2 & 1 1/2	7 1/8	3 3/8	3 1/2	8. 00	Idea
1 1/2 & 1 3/4	8	3 3/4	4 1/8	9. 50	Idiot
1 1/2 & 2	8 3/4	3 1/2	4 1/4	11. 00	Idol
2 & 2 1/4	9 3/4	4 1/8	5 1/4	13. 50	Ignite
2 & 2 1/2	10 1/2	4 3/8	5 1/2	15. 50	Ik
2 1/2 & 2 3/4	10 5/8	5 5/8	6 1/4	19. 00	Image
2 1/2 & 3	11	5 1/2	6 1/4	22. 50	Imbibe
3 & 3 1/4	11 7/8	5 1/2	6 3/8	34. 50	Immerse
3 & 3 1/2	12 3/8	6 1/8	6 7/8	38. 50	Impose
3 1/2 & 3 3/4	14 1/8	6 3/8	7 1/4	67. 00	Imposter
3 1/2 & 4	15	7 1/8	7 3/4	77. 00	Improve
4 & 4 1/4	15 7/8	7 3/8	8 1/4	88. 00	Inapt
4 1/2 & 4 3/4	16 1/8	8	8 1/2	100. 00	Inca
4 1/2 & 5	16 1/2	8 1/8	8 7/8	113. 00	Incense
4 1/2 & 5	17	8 1/8	9 3/8	128. 00	Income

Subject to discount.

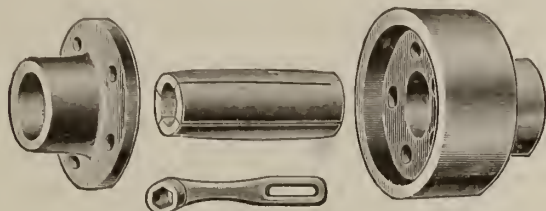
DATA, HEAVY DUTY "SELLS" ROLLER BEARING BOXES
With Double Roller Structures for Main or Jack Shafts and Heavy Belt Pulls

Size of shaft, in.	Length of box, in.	Width of box, in.	Height of box, in.	Prices	Code
1 1/2 & 2	13	3 1/2	4 5/8	\$19. 00	Impound
2 & 2 1/4	13 3/4	4 1/2	5 1/4	23. 50	Imprint
2 & 2 1/2	14 3/8	4 3/4	5 1/8	26. 50	Inarch
2 1/2 & 2 3/4	15 1/4	5 5/8	6 1/8	32. 50	Inborn
2 1/2 & 3	15 7/8	5 1/2	6 1/4	39. 00	Inbred
3 & 3 1/4	17 1/8	5 1/2	6 5/8	59. 00	Inclose
3 & 3 1/2	17 1/2	6 1/8	6 7/8	66. 00	Incoag
3 1/2 & 3 3/4	19 3/8	6 1/2	7 1/4	94. 00	Indeed
3 1/2 & 4	19 3/4	7 1/8	7 3/4	110. 00	Indent
4 & 4 1/4	21	7 1/8	8 1/4	126. 00	Index
4 1/2 & 4 3/4	21 3/4	8	8 1/8	140. 00	Indigo
4 1/2 & 5	22 3/8	8 1/8	8 7/8	161. 00	Induce
5 & 5 1/2	24	8 1/2	9 1/8	179. 00	Infant
5 1/2 & 5 1/2	24 3/4	9 5/8	10	230. 00	Increase
5 1/2 & 6	26 1/2	10 1/4	11 1/4	316. 00	Incrout

Subject to discount.

Standard Compression Couplings.

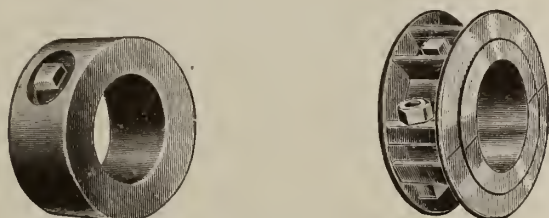
The heaviest and strongest couplings on the market. Perfectly balanced and afford accurate alignment. No projecting parts to catch or tear clothing.



STANDARD COMPRESSION COUPLINGS

Standard Safety Set Collars.

These collars are made in solid and split types. They are absolutely safe, the set screws are sunk—a good safety first feature.



STANDARD SAFETY SET COLLARS

"Rollerine."

"Rollerine" is the ideal lubricant for "Sells" roller bearings, or, in fact, any bearing. No resin oil, wax, talc, soapstone or gum of any sort is used in compounding it. It will not harden or gum.

"Rollerine" comes in quantities from quart cans to barrels.

A sample can of "Rollerine", that will prove all that has been said, will be sent free to anyone who will write for it.



CAN OF "ROLLERINE"

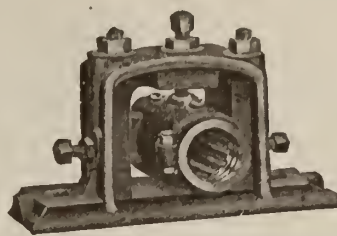
"Sells" Combination Oil and Grease Gun.

Affords the most efficient means of applying "Rollerine" to "Sells" roller bearings. It is also adapted for heavy oils and greases of all kinds.

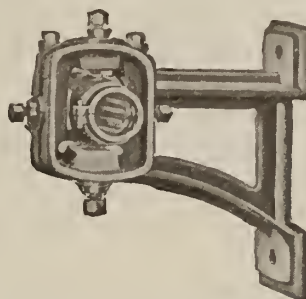
The "Sells" combination oil and grease gun puts the lubricant where it should go.



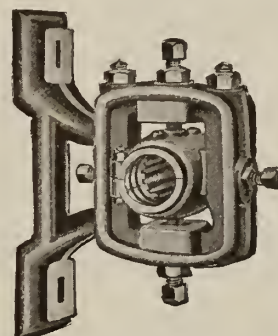
"SELLS" COMBINATION OIL AND GREASE GUN



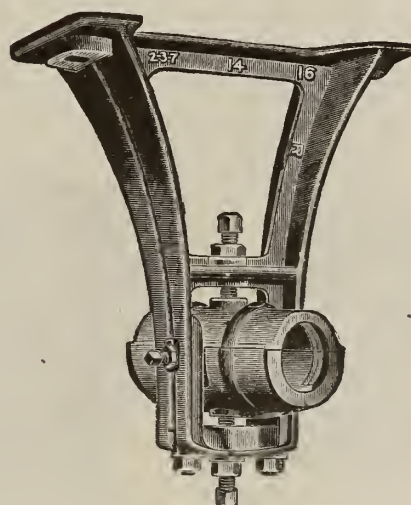
ROYERSFORD PILLOW BLOCK WITH "SELLS" ROLLER OR RING OILING BEARINGS



ROYERSFORD BRACKET HANGER WITH "SELLS" ROLLER OR RING OILING BEARINGS



ROYERSFORD POST HANGER WITH "SELLS" ROLLER OR RING OILING BEARINGS



UNIVERSAL RING OILING HANGER

Catalogue.

In addition to the products listed above, a complete line of power transmission machinery is carried by this company.

A catalogue with prices will be sent on request.

SKF INDUSTRIES, INC.

Manufacturers of Ball Bearings

SALES, SERVICE AND RESEARCH DIVISION

165 Broadway
NEW YORK, N. Y.

BRANCH OFFICES

ATLANTA, GA., 513 Healey Building
BOSTON, MASS., 711 Little Building
BUFFALO, N. Y., Fidelity Trust Building
CHICAGO, ILL., 1314 Marquette Building
CLEVELAND, OHIO, 1036 Guardian Building

DETROIT, MICH., Majestic Building
NEW YORK, N. Y., 165 Broadway
PHILADELPHIA, PA., 1624 Real Estate Trust Building
ST. LOUIS, MO., 304 Pontiac Building
SAN FRANCISCO, CAL., 115 New Montgomery Street

CANADIAN SKF, LTD.

TORONTO, ONT., 83 King Street, East

MONTREAL, QUE., 412 St. James Street

Products.

SKF SELF-ALIGNING, RADIAL and THRUST BALL BEARINGS; SKF SELF-ALIGNING BALL BEARING HANGERS and PILLOW BLOCKS; BALL BEARING LOOSE PULLEY and FRICTION CLUTCHES.

Hess Bright Deep Groove Radial Ball Bearings, Atlas Steel Balls.

Design of Ball Bearings.

SKF ball bearings are made in all international standard sizes and in the three following types:

Radial bearings, designed for use where the load is carried at right angles to the shaft.

Adapter bearings, a modification of the radial bearings, for use where it is not possible to machine the shaft.

Thrust bearings, which take the load in the direction of the axis of the shaft.

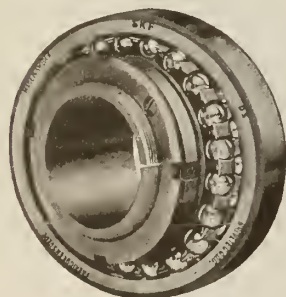
Owing to the correct design and extreme care taken in every stage of manufacture of SKF ball bearings, the following features will be noted, the combination of which are only found in these bearings:

(a) Double row of balls, extra carrying capacity and greater safety.

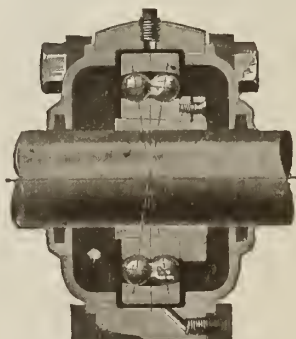
(b) Self-aligning construction is such that there can be no binding strains in the bearings. Uneven loads, or jolts and shocks of hard service can not cramp or wedge the balls. Both rows of balls carry the load.

(c) Superior workmanship and accuracy. The bearings are as free from friction as it is possible to make them.

Accuracy and high finish are essential to the successful operation of any bearing. In SKF ball bearings, these two factors are paramount, and the rigid control and inspection used throughout set a distinct standard in careful manufacture.



ADAPTER TYPE BALL BEARING USED IN SKF HANGERS



CASING AND BEARING MOUNTED ON SHAFT

Construction of SKF Adapter Bearing.

The SKF adapter type bearing has a split tapered sleeve known as an adapter. The bearing has a tapered bore and seats on the adapter. In practice the sleeve is slipped on the shaft, the bearing is placed on it and by tightening a lock nut on the sleeve the bearing is forced

into place and the sleeve is clamped firmly on the shaft.

No moving part touches the shaft. Therefore there can be no wear on the shaft. The bearing and adapter are completely incased in a cast iron housing which is both oiltight and dustproof.

Power Saving with SKF Ball Bearing Hangers.

Exhaustive tests in manufacturing plants have demonstrated that transmission losses due to friction of plain bearings amount to 20% to 40% of total power used in the plant.

The chart illustrates how, by the use of SKF self-aligning ball bearing hangers, 60% of these losses may be avoided.

A long line of shafting was mounted first in ring oiled babbitt hangers and second in SKF self-aligning ball bearing hangers. The shafting was driven by the same motor and run at various speeds and loads.

It will be noted that on a shaft running at 150 r.p.m. under a load of 840 lbs., the use of SKF ball bearing hangers results in a saving of 62% of the power lost by plain bearings. This means a saving of from 12% to 24% of the total cost of power.

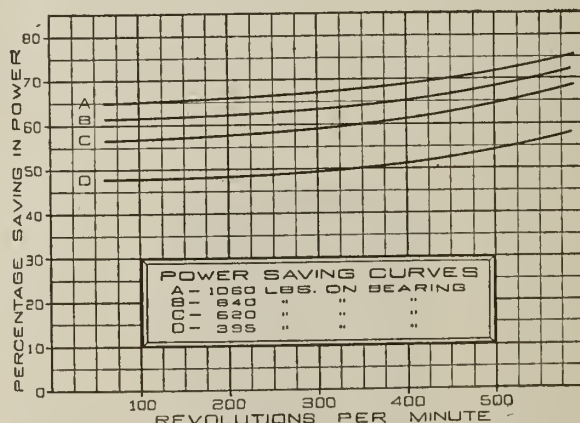


CHART ILLUSTRATING PER CENT OF REDUCTION IN POWER LOSS BY SUBSTITUTING SKF BALL BEARINGS FOR PLAIN BEARINGS

Using Smaller Motors.

With SKF ball bearings the starting friction is no greater than the running friction. This is a very important fact, for, as it is not necessary to provide for heavier starting loads, a much smaller motor may be used. Shafts in cast iron, babbitt or bronze bearings frequently become "set" if the shafting equipment is idle for any length of time.



SKF BALL BEARING HANGER

The oil is pressed out of these bearings and it is extremely difficult to start the shaft from rest. Again, when bearings are operating at normal speed, rubbing friction is constantly consuming power at a sacrifice of efficiency.

With SKF ball bearings rolling friction is practically uniform from rest up to very high speed. On this account SKF ball bearing hangers start with a minimum effort and operate at all times with the highest possible efficiency.

Where ball bearing hangers are used, the selection of a motor for shop drives reduces itself to the problem of providing alone for normal machine power consumption, without the necessity of providing for the heavy overload capacity usually required to "start up."

For example: if machines in the shop normally require 250 h.p. to drive, and an additional 50 h.p. is consumed by the line shaft in distributing this power, a saving of 50% of the power required for the line shaft will reduce the total power required by 25 h.p. or $8\frac{1}{3}\%$ of the total. With a motor costing approximately \$9.00 per h.p. there will be an initial saving of approximately \$225.00 in the motor cost.

Other SKF Features.

Aside from these valuable savings, SKF transmission equipment will save 80% of the lubricant needed for plain bearings. 80% in maintenance bills is a conservative estimate of what SKF will save on repairs.

The SKF oiltight housing insures a clean shop, free from dripping oil. Heating is absolutely eliminated, and so fires caused by hot bearings can be permanently avoided.

SKF transmission equipment possesses numerous advantages and one or the other of these will always show their superiority. SKF ball bearings save where others waste; they give service where others give trouble. A trial will convince you of SKF merits better than anything we can say.

SKF Self-aligning Ball Bearing Hangers and Pillow Blocks.

The type of construction employed in SKF hangers and pillow blocks embodies extreme simplicity with great strength. The ball bearings are contained in accurately machined casings which are securely positioned in the hanger or pedestal pillow block frame by a four-point adjustable suspension.

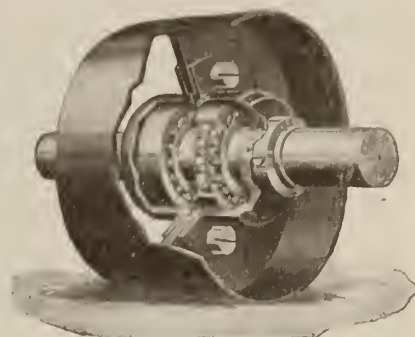
Inasmuch as SKF ball bearings themselves are self-aligning, no pivoted "cradles" or ball and socket supports are required.

The self-aligning feature of SKF ball bearings is of marked value for line shafting. Buildings settle, floors drop and gradually shafting will pull out of line. Misalignment may not be visible to the eye but still be enough to bind the best plain bearing.

SKF ball bearings, on the other hand, prevent such binding. They align themselves with the shaft and operate smoothly and efficiently even when the shaft is not in perfect line. Worn bearings, heating and reballing, so often found where plain bearings are used, are entirely absent in a plant using SKF hangers. The time and expense saved by this feature alone is sufficient to warrant a most careful consideration of SKF.

SKF Ball Bearing Loose Pulleys.

They eliminate trouble and expense; no dripping of oils, noiseless, dustproof, highly balanced, run at any speed, require lubricating only three or four times a year. Every pulley is tested and filled with lubricant enough to last six months, before leaving the factory. Simple to install, place on the shaft and tighten one set screw.



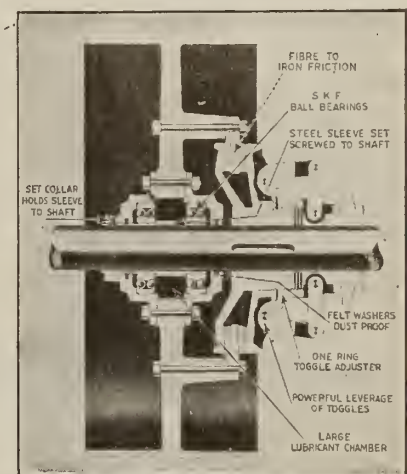
Exploded View



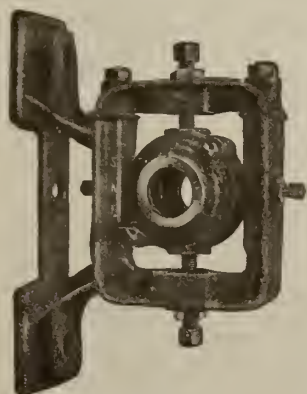
Disassembled
SKF BALL BEARING LOOSE PULLEY

SKF Ball Bearing Friction Clutch Pulleys.

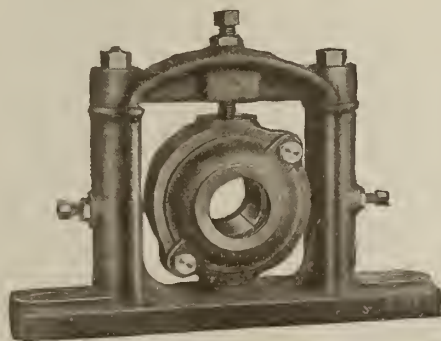
Drive buffing lathes, emery and disk grinders, fans, punch presses, etc., direct from the shaft. The SKF ball bearing friction clutch pulley is simple in construction, easy to install, and requires less space on the shaft than ordinary clutches. Ball bearings are dustproof, and the lubricant chamber needs re-filling but two to four times a year according to conditions. Prices on application.



SKF BALL BEARING FRICTION
CLUTCH PULLEY



SKF BALL BEARING POST
HANGER



SKF BALL BEARING PEDESTAL PILLOW
BLOCK

For supporting shafting from the floor or from a wall bracket



SOLID TYPE OF RIGID PILLOW BLOCK
Made in sizes $3\frac{1}{8}$ in. and under. Very compact, casing being a part of the base of the block

ALBAUGH-DOVER CO.

Manufacturers of Cut Gears

2100 Marshall Boulevard
CHICAGO, ILL.

Products.

CUT GEARS—Spur, Bevel, Miter, Spiral, Helical and Herringbone Gears; Rawhide and Bakelite-Micarta Gears and Pinions; Worms, Worm Wheels and Internal Gears; Ratchets; Heavy Duty Hardened Auto Transmission and Tractor Gears; Ignition Gears; Pump Gears; Magneto Gears; Washing Machine Gears; Sprockets.

Member of the American Gear Manufacturers' Association.

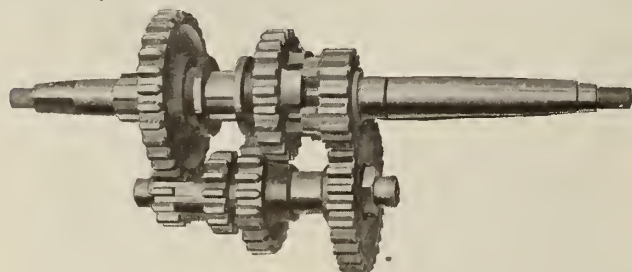
Equipment, Facilities and Co-operative Service.

Modern machinery and efficient methods enable this company to manufacture gears in the most perfect manner and with the least possible delay. Bevel gears are generated to the true involute form on either Bilgram or Gleason bevel gear shapers. Transmission gears are generated principally on Fellows shapers. Spur, helical and spiral gears are generated on a large battery of the finest and most modern gear hobbing machines.

The company has also a large number of single cutter gear machines and thread milling machines. The plant, capital and engineering force afford facilities for prompt action on any special requirements. The engineering staff is at the disposal of all parties, and will gladly advise, recommend or furnish estimates.

Cut Gears.

QUALITY OF MATERIALS—Gears are made from bar steel, drop forgings, cast steel, semisteel, high grade cast iron, brass or bronze. Quality of materials used is the best available. Customers' material specifications are closely followed.



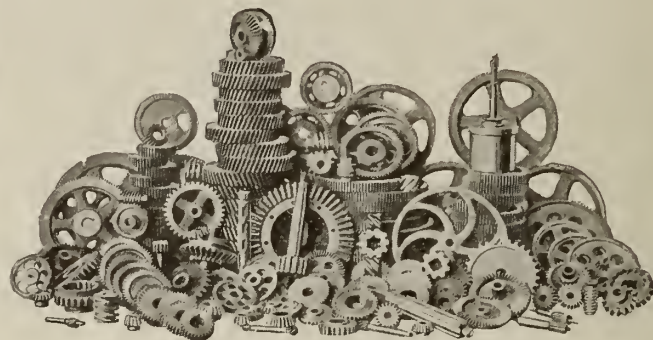
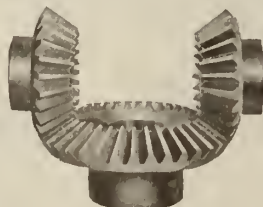
TRANSMISSION GEARS

SPUR GEARS—Cut from the bar, steel forgings, castings, or best grade cast iron, sizes up to 48 in. in diameter. Stub tooth gears, particularly for automobile drives, hardened and ground, give greater strength and are more quiet than ordinary spur gears.

BEVEL GEARS—The supe-



BEVEL GEARS



VARIOUS TYPES OF GEARS

rior running qualities of our bevel gears are well known—hardened and ground gears for tractor, truck and auto drives, transmissions, machine tools, etc., 4 to 1 ratio; diameters up to 20 in.; miter gears up to 16 in.

SPIRAL GEARS—Spiral and helical gears, made from bronze, steel or cast iron, are accurately cut and smooth running; generated to eliminate thick and thin teeth and so as to get perfect involutes.

Supplied in any style for all purposes.



SPIRAL GEARS

HERRINGBONE GEARS—Smooth running. Action is continuous, with no shocks when load is transferred from tooth to tooth; wear and objectionable side thrust are practically eliminated.

Manufactured in any metal up to 20 in. in diameter.

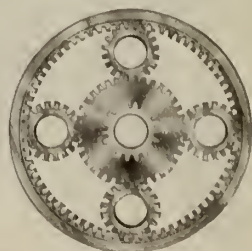
RAWHIDE AND BAKELITE-MICARTA GEARS AND PINIONS—Especially fitted for high speed service where conditions require absence of noise.

Made with brass or steel flanges reaching to top of teeth, all securely riveted or bolted together, protecting and supporting teeth. In most cases the rawhide of the pinion is made slightly wider than the face of the metal gear, which insures a quiet drive as there is no metallic contact.

WORMS AND WORM WHEELS—Worm gear drives are used where great reduction in velocity or great increase in power is desired. The best combination of materials is used, insuring smoothness of action and long life.

INTERNAL GEARS—Manufactured in all pitches up to 4 diametral pitch and 28-in. pitch diameter.

SPROCKETS—All types of roller and silent chain sprockets made for all purposes, and their quality and workmanship correspond with that shown in all Albaugh-Dover gears.



INTERNAL GEARS

FAWCUS MACHINE COMPANY

Manufacturers of Cut Gears and Special Machinery

PITTSBURGH, PA

WORKS
PITTSBURGH, PA.
FORD CITY, PA.

Products and Services.

CUT GEARS, including Herringbone, Spur, Bevel and Worm.

Flexible Couplings, Special Machinery.

This company builds special machinery to order and invites inquiries on any kind or size of gear. Send the problem or specification.

Complete transmissions are designed.

Shop facilities are such that orders can be handled rapidly.

The services of the engineers of this company are available when needed.

Size of Gears and Drives.

Cut herringbone gears, 2 in. to 20 ft. in diameter. Cut special gears, 2 in. to 20 ft. in diameter. Cut bevel gears, 2 to 48 in. in diameter. Cut worm gears, 2 in. to 10 ft. in diameter. Flexible couplings, for shafts 1 to 20 in. in diameter. Enclosed worm gears, 5 h.p. to 25 h.p. Standard enclosed herringbone gear drives, 25 h.p. to 1500 h.p. (Herringbone Gear Booklet on request.) Special enclosed gear drives, 25 h.p. to 15000 h.p.

Turbine reduction gears, 25 h.p. to 3000 h.p.

Uses.

For general mine and mill use wherever power is transmitted, as for steam and electric hoists, motor driven pumps and air compressors, mine machinery, rubber and steel mill drives.

Fawcus herringbone gears can be advantageously used wherever a positive means of transmitting power is required.

Special Features.

Fawcus herringbone gears transmit power more quietly and efficiently than is possible with spur gears.

Gear and pinion teeth are cut in solid blanks on Fawcus patented machines, and each pair is given a thorough running test before shipment.

The accuracy of herringbone gears makes possible their use for high



TRADE-MARK

speeds and for high ratios of speed reduction.

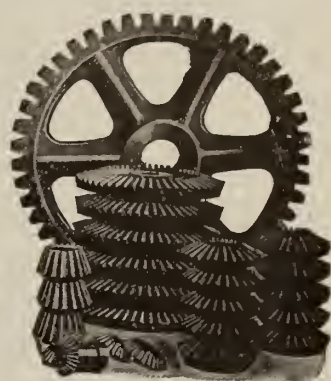
Gears and drives are all designed to suit special conditions for power transmitted and space available.

Workmanship.

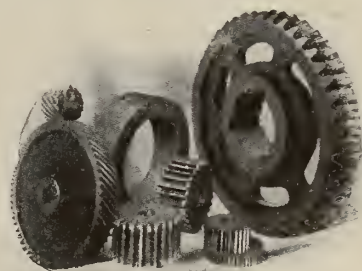
There is a vast difference between cut gears and *correctly cut* gears. This difference means less noise, less wear, less friction, less power wasted, less fuel consumed, time and money saved. Rapidity of cutting is of less importance with us than accuracy of cutting.

Guarantee.

Fawcus herringbone gears, when designed by the company's engineers and installed and taken care of in accordance with our directions, are guaranteed to give entirely satisfactory service, and to run quietly, efficiently and without showing undue wear under normal conditions of service.



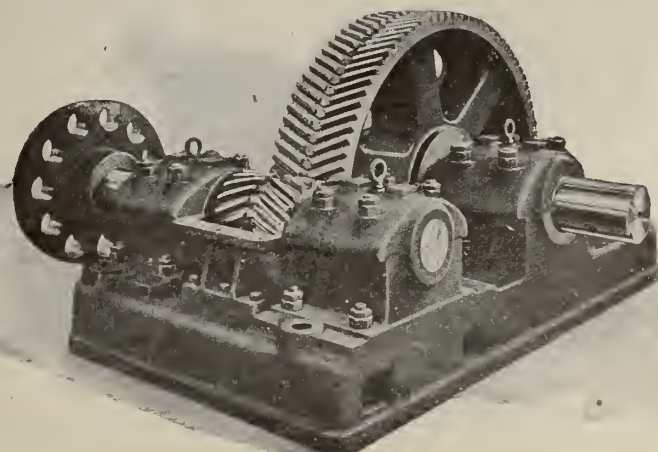
BEVEL GEARS



SPUR GEARS



HERRINGBONE GEAR



FAWCUS HERRINGBONE GEAR DRIVE

FOOTE BROS. GEAR & MACHINE CO.

Manufacturers of Cut Gears

213 North Curtis Street
CHICAGO, ILL.

Products.

IXL Productions as follows:

ALL SPUR GEAR SPEED TRANSFORMERS, WORM GEAR SPEED TRANSFORMERS; SPUR, BEVEL, MITER and SPIRAL GEARS; WORM, INTERNAL, HELICAL and TRACTOR GEARS; TRACTION ENGINE GEARS; HEAVY DUTY HARDENED GEARS; RAWHIDE PINIONS; CLOTH PINIONS; CUT STEEL MACHINE RACKS; SPROCKETS; FOOTE-IXL TRACTOR TRANSMISSIONS.

Special Machinery Built to Order.

Engineering Service.

Foote Engineers are ready and willing to assist in solving any tractor or gear problems. They have indicated worthwhile economies and better methods for many manufacturers. This service is without obligation.

Literature.

Valuable catalogues, and gear data book sent on application; also transmission circulars.

Reducers.

SPUR GEAR TYPE—IXL all spur gear speed transformers are modern in every way, low priced and of highest quality. Insure efficiency, compactness, durability and strength. Built for heavy duty and continuous service. Entirely enclosed, oiltight, dustproof and fool-proof.

Can be used in many places and under conditions where worm gear reducers can not be used. The value is shown where they take the place of gearing and belting, having a reduction of from 5 to 1 up to 100 to 1 or more. Particularly adapted for use in connection with electric power, where they supply a practical and efficient method of reducing the motor speed.

WORM GEAR TYPE—The IXL worm gear speed transformers have been on the market since 1895, during which time they have demonstrated their efficiency and durability. Recent improvements have added greatly to the value. Each transformer is thoroughly tested before it leaves the factory. They are manufactured with a number of different ratios in the same size case. This is accomplished by a change from a single to a double, triple or quadruple thread in the worm, and also by changing the pitch and number of teeth.

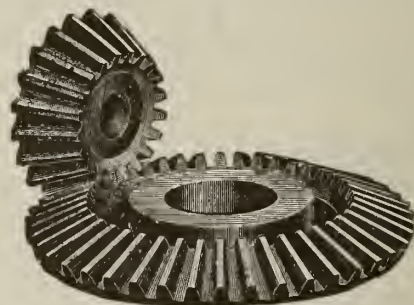
LITERATURE—Send for complete data and information regarding the use of Foote spur gear speed reducers.

Miter and Bevel Gears.

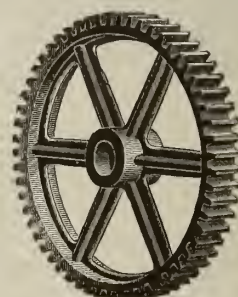
With the use of modern machines and methods for generating, planing or cutting by the Gleason and Bilgrim system, IXL miter, angle and bevel gears are cut with the finest accuracy, thus insuring smoothness and quiet running.

Spur Gears.

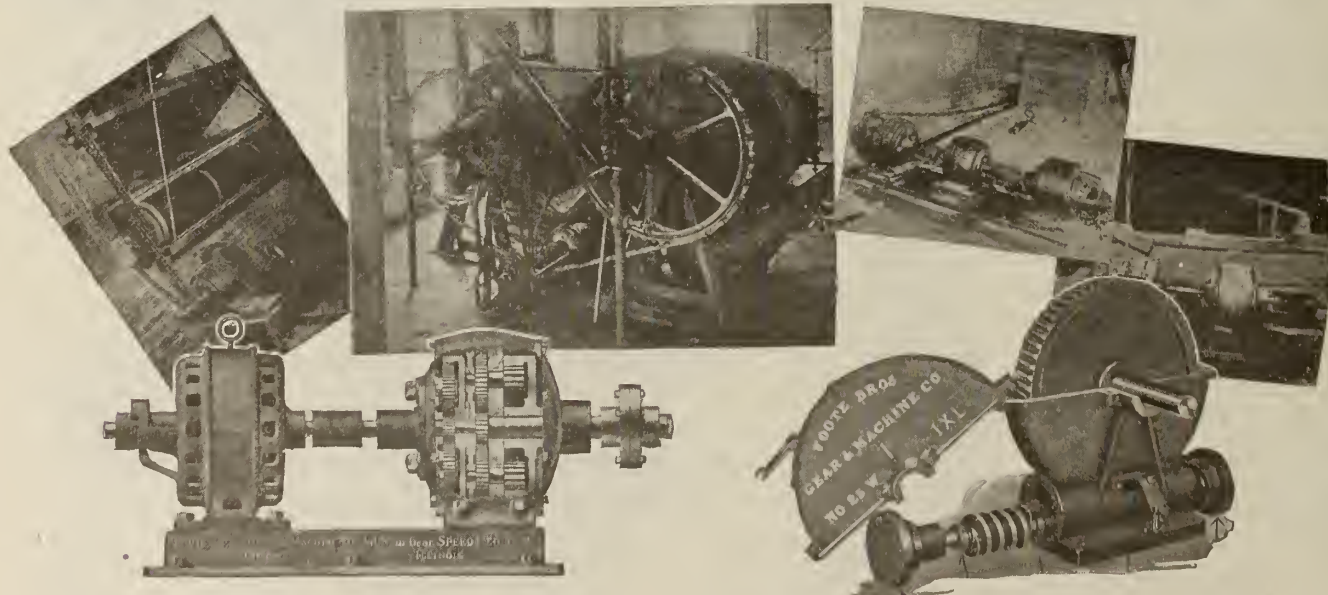
Cut spur gears all sizes up to 144 in. in diameter, made from high grade steel forgings, castings or the very best grade cast iron.



IXL BEVEL GEARS



IXL SPUR GEAR



SPUR GEAR REDUCER AND APPLICATIONS

WORM GEAR REDUCER AND APPLICATIONS

Worm Gears.

Foote Bros. are equipped to solve problems and furnish worm gear drives of any style and material desired. IXL quality worm gears are manufactured to meet all requirements, using the best combination of materials in each case.

Heavy Duty Hardened Gears.

Every type of heavy duty hardened spur, bevel, spiral gears and all other gears required for all purposes, including tractors, transmissions, differentials, steering, for machine tools, etc.; also for tractor, truck and auto drives, treated by special *heat treatment* process.

These hardened steel gears have four times the actual strength of cast iron gears of equal size.

In any machine, hardened steel gears will take up considerably less space than ordinary cast iron or steel gears giving equal power.

Wearing qualities are 50 to 1 in comparison to soft steel or cast iron gears.



IXL HEAVY DUTY HARDENED GEARS

Spiral Gears.

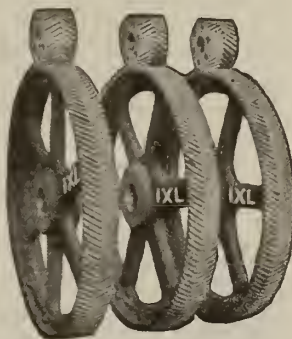
IXL spiral gears can be supplied in any size for every purpose. Many designers have availed themselves of Foote Bros. service in solving spiral gear problems. Co-operation is gladly given with any who are interested.

Internal Gears.

IXL internal gears are made or cut of every description, either plate back or plain rings. All pitches up to 4-diameter pitch are generated on Fellows gear shaper; 3-diameter pitch and coarser are planed on Gleason's planers.

Herringbone Gears.

IXL double helical or herringbone gears in any metal or any size up to 80 in. in diameter. This form of gear has angular teeth of great strength owing to their special formation, the 2 teeth always having 2 points of contact in the plane of axis, causing them to work smoothly and noiselessly. Especially adapted for hoisting, mining and rolling mill machinery.



IXL HERRINGBONE GEAR

Sprockets.

Block, roller silent or any other style of chain sprockets furnished for any purpose, and made of any material desired, in any quantity. IXL sprockets have proved their value in all branches of industry.

Racks.

This company is prepared to cut finished IXL machine racks from almost any size blank in almost any pitch, and in continuous section of any length that can be conveniently shipped.

Rawhide Pinions.

For high speed drive in connection with metal gears IXL rawhide noiseless pinions insure maximum efficiency, elasticity and durability. IXL rawhide gears and pinions are made up with brass flanges reaching to the top of the teeth, all securely riveted and bolted together, giving protection, support and long life to the teeth. When an extra quiet drive is wanted these pinions can be made with face of rawhide slightly wider than its metal mate, thus avoiding metal contact. This style costs extra and can only be used where there is plenty of space. Thickness of flanges on both styles depends on the pitch, face and diameter.

Cloth Pinions.

Cloth pinions have met with considerable favor, many claiming them superior, in noiseless operation, long life and high tooth strength, to all other non-metallic pinions in vogue. IXL are made of cloth or cotton filler compressed under hydraulic pressure, held by metal flanges. Prices quoted on receipt of specifications.

Foote-IXL Tractor Transmissions.

The only tractor transmission with the power pulley so arranged that it can be used inside or outside of tractor wheels for either internal chain or external drive.

Constructed of best procurable materials. Case is made from high grade semisteel, carefully machined; oilproof and dusttight. Bearing supports are rigid, keeping gears in perfect alignment under severest conditions, allowing transmission of maximum power to bull pinions. Gears are made from high grade steel treated and hardened by special process; are extra heavy, and figured for ample surplus to care for severest strains. Shafts are made of special alloy high carbon steel, allowing for extremely heavy duty without twisting or straining. All bearings are Hyatt roller mounted, doing away with friction throughout the case. Best type of lubrication.

This company was the pioneer in standardizing tractor transmissions.



MODEL D FOOTE-IXL TRACTOR TRANSMISSION

2 speeds and reverse with pair change gears on side of case which can be reversed in position giving 2 lower speed ratios. For bull pinion drive, 30 to 40 h.p. motors.

MODEL B FOOTE-IXL TRACTOR TRANSMISSION—2 speeds and reverse for bull pinion drive, 25 to 30 h.p. motors. Model C is same as the model B, but with 3 speeds and built for 40 to 50 h.p. motors.

MODEL D-U FOOTE-IXL TRACTOR TRANSMISSION—Same gear arrangement as model D with direct axle drive feature. Can be furnished with engine and front axle supporting frames eliminating further framework. For 30 to 40 h.p. A model E-U is made with same features as the D-U for 45 to 60 h.p. motors.

OTHER TRACTOR TRANSMISSIONS—Live axle and hull pinion types for 2-3, 3-4 plow tractors. Full data and specifications furnished on request

ESTABLISHED 1890

W. A. JONES FOUNDRY & MACHINE CO.

Speed Reducers and General Power Transmission Machinery

4403 West Roosevelt Road
CHICAGO, ILL.

BRANCH OFFICE: 30 Church Street, NEW YORK, N. Y.

Products.

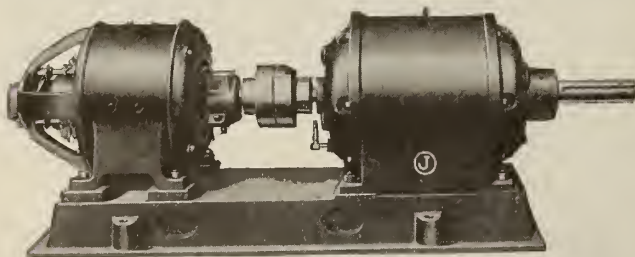
SPUR GEAR SPEED REDUCERS; WORM GEAR REDUCERS; CUT GEARS of Cast Iron, Cast Steel, Forged Steel, Bronze, Rawhide and Bakelite; CAST TOOTH GEARS and SPROCKETS; PULLEYS, Solid or Split; LEMLEY FRICTION CLUTCHES; FLANGE COUPLINGS; PILLOW BLOCKS; HANGERS; ELEVATING and CONVEYING MACHINERY.

Rope Sheaves, Flexible Couplings, and General Power Transmission Machinery.

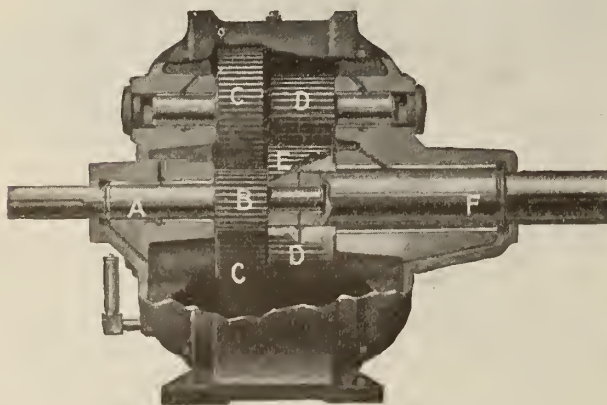
Spur Gear Speed Reducers.

Jones spur gear speed reducers are designed for reducing speeds between electric motors and driven machines or shafts, and are rapidly replacing belts, chains and other forms of drives in many of the largest mills and plants in the country. Jones reducers are simple in construction, positive in operation, occupy small space, and comply with all safety laws.

All gears and pinions are generated from special analysis steel, the involute stub tooth of 20° pressure angle being used throughout. All shafts are ground to size and supported at both ends by liberal bronze bushed bearings. All moving parts operate in a bath of oil, and as no dust, grit or liquids can enter the machines their length of life is almost unlimited. Jones spur gear reducers are designed to handle excessively heavy overloads with a high degree of efficiency—some of the larger units being built for loads in excess of 200 h.p.



REDUCER AND MOTOR ON BASE



SECTIONAL VIEW OF REDUCER

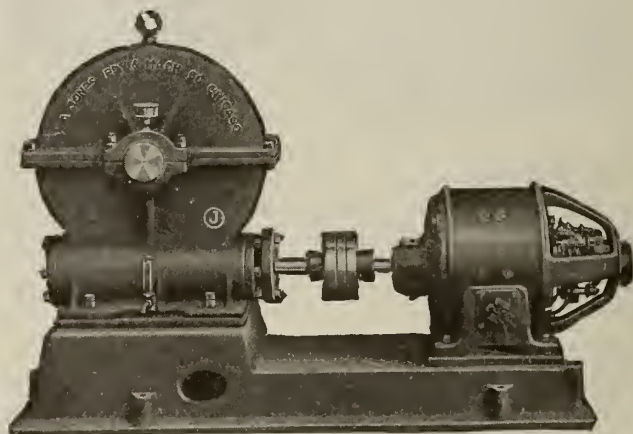
Practically any reduction ratio may be obtained, reductions of 200 to 1 being not unusual.

Speed Reducer Bulletin will be sent on request, and Jones engineers will gladly make an analysis of reduction problems without obligation. Write today.

Worm Gear Reducers.

Jones worm gear reducers are made from the highest grade material, and in a strictly first class manner. All worm gears are accurately hobbed, and the special analysis steel worms are milled in special thread milling machines, which insures a low coefficient of friction and long life.

Prices and information gladly sent on request. Ask now.

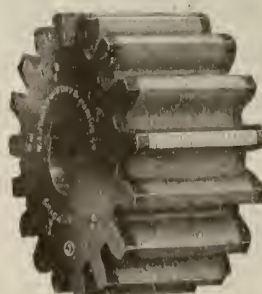


WORM GEAR REDUCER AND MOTOR ON BASE

Cut Gears.

Cut gears are furnished in cast iron, cast steel, forged steel, bronze, rawhide or Bakelite, in sizes up to 80 in. in diameter. Every spur, worm or spiral gear is hobbed in the latest types of machines. Gears with involute stub teeth of 20° pressure angle can be supplied at the same prices as for the ordinary tooth form of 14½° angle. Breakdown and rush orders will be given special attention.

Write for prices.



RAWHIDE PINION



CUT SPUR GEAR

Cast Tooth Gears and Sprockets.

A stock of several thousand gear patterns enables the W. A. JONES FOUNDRY & MACHINE CO., in most cases, to save the extra cost of patterns and to render unusually quick service on rush orders.

Ask for catalogue and quantity discounts on spurs, worms, worm gears, bevels and miters.



CAST SPROCKET

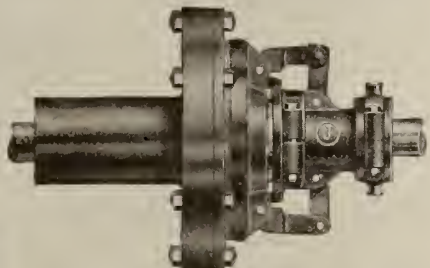


CAST MITERS

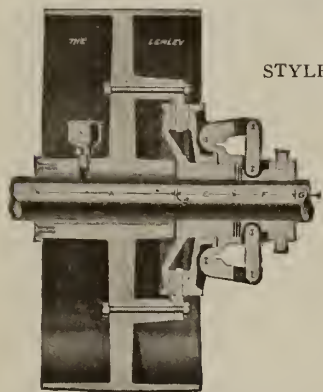
Lemley Friction Clutches.

Lemley friction clutches are made for both line and countershaft work as well as for gas engines.

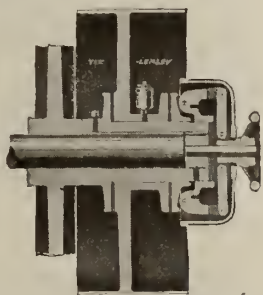
These clutches are superior to many other clutches, in that the friction rings can be replaced without removing the clutch from the shaft; adjustment is simple and positive; and the



STYLE B LEMLEY FRICTION CLUTCH WITH SLEEVE



STYLE B LEMLEY FRICTION CLUTCH WITH PULLEY



LEMLEY GAS ENGINE CLUTCH

toggle arrangement operates to throw the clutch both in and out of operation. To eliminate clutch troubles buy the Lemley. Some of the largest manufacturers use them exclusively.

Ask for catalogue L6 or, if interested in gas engine clutches, ask for L7.

Pillow Blocks.

Jones pillow blocks possess a number of features that make them superior to any others now on the market. Made in both plain, and duplex oiling types.

Send for descriptive matter.



STANDARD RIGID PILLOW BLOCK

Couplings.

There is no flange coupling on the market superior to the Jones. They are finished all over, and the hubs are accurately bored to size and key-seated.

Style "A" flexible coupling is one of the best of its kind on the market and will take care of considerable misalignment. Style "B" is the most flexible coupling on the market and is especially adapted for loads of a pulsating nature.

Write for bulletin.



FLANGE COUPLING



DUPLEX OILING PILLOW BLOCK

Pulleys, Solid or Split.

Jones cast iron pulleys are superior to pressed steel or wooden pulleys, as they have no rivets to work loose and they can not warp or shrink.

They have the rims turned and crowned and the hubs bored true with the rims and setscrewed ready to run.

Jones split cast iron pulleys are just as easy to apply as are those of steel or wood and they always run true.

A large stock of standard sizes is on hand, from which immediate shipment can be made.

Write for catalogue and quantity discounts.



CAST IRON PULLEY

Hangers.

Jones universal adjustment shaft hangers are in a class by themselves

Equipped with either our plain babbit bearing or with our Duplex oiling type.

Descriptive matter on request.

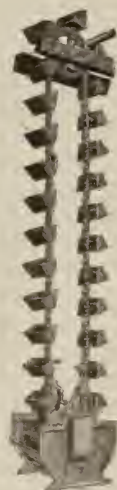


UNIVERSAL ADJUSTMENT HANGER

Elevating and Conveying Machinery.

The W. A. JONES FOUNDRY & MACHINE Co. manufactures a complete line of elevating and conveying machinery of all kinds and carry the largest stock of detachable chain and attachments in Chicago. Special machinery built to order.

Send specifications and ask for estimates, which will be furnished without obligation.



BUCKET ELEVATOR

EDW. R. LADEW CO., INC.

Manufacturers of Leather Belting and Accessories

GLEN COVE, N. Y.

BRANCHES

BOSTON, MASS.
NEW YORK, N. Y.

CHICAGO, ILL.
PHILADELPHIA, PA.

NEWARK, N. J.
CHARLOTTE, N. C.

PITTSBURGH, PA.
CLEVELAND, OHIO

Products.

LEATHER BELTING; BELTING ACCESSORIES and LEATHER SPECIALTIES, which include: Lace Leather, Cut Lacing, Belt Cement, Belt Preservative, Hydraulic Leather, Leather Packing, Washers, Disks, Shafting Rings, Automobile, Truck and Motorcycle Belts, Leather Welting, Straps of every description.



Ladew Engineering Service.

The proper application of belting is an engineering problem deserving of skilled counsel and the best experience. More belts are destroyed by abuse than by use—abuse here implying neglect of proper care as well as ill-advised applications. To correct wrong conditions where known, as well as to guard against them in advance where possible, Ladew Engineering Service is maintained. This consists in the advice and assistance of experienced belting engineers who will study any belting problem and give expert advice on its solution. Ladew service is offered free to all belt users seeking the highest belting economy—which means the lowest belting cost per horsepower per year of service.

Distribution.

Branches and distributors in all principal cities of the world carry complete stocks.

"Flintstone" Leather Belting.

Introduced in 1835, and steadily improved ever since, "Flintstone" is pre-eminent the belt for all drives where everything depends upon, and everything is expected from, the power transmission. The care in selection of leather and in methods of manufacture forbids "Flintstone" selling as a cheap belt. But, hundreds of times over, in the decades past, "Flintstone" has proved itself to be the most economical belt—the belt which gives the greatest number of years of service at the lowest cost per year. Or, stated otherwise, "Flintstone" will transmit more power over a longer period at the lowest cost per horsepower per year. The Ladew trade-mark on "Flintstone" is a guarantee of maximum belting service at minimum belting cost.



"FLINTSTONE" BELTING BRAND

"Turtle" Waterproof Leather Belting.

Introduced in 1860, "Turtle" is the original waterproof belt. It is made from center cuts of the best selected hides, tanned and curried by most approved

methods, thoroughly impregnated with a water resistant, water repellent material, and built up with a special waterproof cement. Even under most extreme moisture conditions, the laps or plies will not open up. For all drives where the utmost in service is sought, in the presence of

water, steam, oil or acid fumes, "Turtle" has a record that proves its unsurpassed qualities. The Ladew trade-mark on each "Turtle" belt is a guarantee of Ladew quality which has been a belting standard for over 80 years.



"TURTLE" BELTING BRAND

Special Belts for Special Purposes.

The Ladew line, in addition to the two main brands mentioned above, includes a number of other brands made from sections of the hide not considered suitable for "Flintstone" and "Turtle." These are high grade belts, though never sold as "first grade" belts, capable of splendid service where the conditions are clearly understood, so that the right belt can be supplied for each particular purpose. In many cases a material saving results by the use of these special belts under the advice of Ladew engineers. The house of Ladew also has unequaled facilities for producing, in short order, belts for special or unusual conditions.

Ladew Belting Accessories.

These include lace leather, cut lacing, belt cement and belt preservative—all made to the Ladew standard of quality and embodying a belting experience of more than 80 years. A Ladew leather belt, with joints laced with Ladew lacing or cemented with Ladew belt cement, will give a length and character of service which makes first cost an insignificant consideration.

Ladew Leather Specialties.

Hydraulic leathers, leather packings, leather washers and disks, shafting rings, and other mechanical specialties in leather made by Ladew are manufactured with the idea of service and sold to a trade which measures value by service rendered.

Catalogue.

"Ladew Leathering Belting" is the title of a 108-page book describing Ladew methods, processes, policies and products. It is furnished on request, together with a belting data sheet for the analysis of any belting problem.

PAGE BELTING COMPANY

CONCORD, N. H.

BRANCHES

BOSTON, MASS., 60 Pearl Street
BUFFALO, N. Y., 18 Ellicott Street
CHATTANOOGA, TENN., 1104-12
Market Street

CHICAGO, ILL., Washington Boulevard
and Des Plaines Street
NEW YORK, N. Y., 258 Broadway
PHILADELPHIA, PA., 52 N. 5th Street

PORTLAND, ORE., 61-7 Fourth Street
SAN FRANCISCO, CAL., 587-91 Market
Street
SYRACUSE, N. Y.

Products.

LEATHER BELTING (Flat, Round, Link and Angular); LEATHER LACING; LEATHER FILLET, LEATHER CUPS, WASHERS and PACKING; LEATHER MECHANICAL GOODS; PULLEY LAGGING.

Guarantee.

All products are guaranteed free from defects of material or workmanship and to give satisfaction with proper usage, where adaptability to work to be performed is considered in their selection.

Leather Belting.

CROWN—Belting of first quality made from large hides of carefully selected No. 1 leather, tanned with oak bark by slow process. Mineral tanned or rawhide of same quality for special purposes. All belting short lapped, as stock is taken only from the firm portions of the hide without running into thin shoulder parts. This, besides enabling a short lap, also permits, substantially, uniform thickness of belt. Stretch thoroughly removed by two processes during currying and one after belts are made up. Comes in different weights or thickness for various purposes. Heavy, extra heavy, planer, (very heavy and can be had only in limited way), light and heavy double. Quality of all fully guaranteed.



TRADE-MARK
An indication of quality and
a means of identifying belt

TARPON—Belt is guaranteed not to come apart no matter how badly it may be wet. It is made from regular Crown stock, the leather is thoroughly waterproofed, and it is designed for moist or damp places or where a belt is liable at times to be actually submerged—as in wheel pits. For laundries, dyehouses, paper mills, and for localities of high climatic humidity, it is invaluable. It possesses all the durability and high pulling power of the best leather belts which so far exceed rubber and other textile belts, and is proof against water and moisture in those places where rubber belts used to be indispensable. As leather belts average nearly four times the length of life of rubber belts, the economy of a waterproof leather belt, even at a considerably advanced price over rubber, is manifest.



TRADE-MARK
An indication of quality and
a means of identifying belt

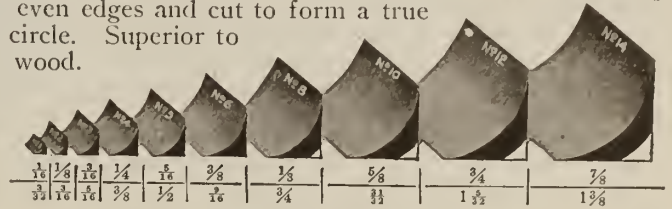
NEVERSLIP—Belting designed for small pulleys and high speed, or wherever a combination of great flexibility and strength is wanted. The belt is made by a special process owned by PAGE BELTING COMPANY, exclusively, and no other belt can combine with a minimum of stretch such adaptability for high speed on small pulleys and for loads which are often variable or heavy. For such conditions, where avoidance of slip is sought this belt is superior to all others.



TRADE-MARK
An indication of quality and
a means of identifying belt

Leather Fillet.

Made from uniform and flexible leather with sharp even edges and cut to form a true circle. Superior to wood.



LEATHER FILLET

NOTE—Upper row of figures shows, in inches, length of straight sides or short sides. Lower row of figures shows length of curved or long side. The curved side shown above is as it is on the pattern, but before fillet is applied to pattern this long side is the straight side and the 2 short sides are the curved sides

Leather Cups, Packings and Washers.

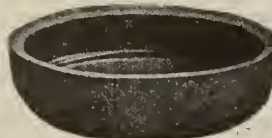
Made from oak or chrome leather. Designed for valves, pumps, joints, oil wells, etc., and for all pressures, hydraulic or pneumatic work, and work in oil, alcohol or glycerine. All kinds of special cut leathers of this nature readily furnished.



HYDRAULIC CUP



FLANGE PACKING



PUMP CUP



U-LEATHERS

Well moulded and accurate in size

Automobile Clutch Leathers.

OAK LEATHER CLUTCH LININGS—Made from a specially prepared oak tanned leather of the very choicest stock and in various thicknesses. For durability and—what is more important—for satisfactory work, they are unsurpassed. Made with square ends or with laps prepared on ends, or made endless with waterproof cement at the factory, as preferred.

CHROME OR MINERAL TANNED LEATHER CLUTCH LININGS—Made from chrome or mineral tanned leather and only recently put on the market. Have a faculty for gripping quickly and easily, and are made from the best part of steer's hide.

Belt Lacing.

Following brands in whole sides, or sides with belly cropped off, or in hand cut, free from holes, hacks or scratches, 100-ft. bunches.

HERCULES RAWHIDE LACING—Extremely strong and durable. Lacing of carefully selected stock.

CROWN TANNED LACING—Choicest of its kind in strength and quality.

Pulley Lagging.

Supplied cut to length and width out of different qualities of stock, to meet any requirements.

MAIN BELTING COMPANY

13th and Carpenter Streets
PHILADELPHIA, PA.

BRANCH OFFICES

NEW YORK, N. Y., 2 Rector Street
BOSTON, MASS., 165 High Street
PITTSBURGH, PA., 33 Terminal Way

CHICAGO, ILL., 17 North Jefferson Street
ATLANTA, GA., 64 South Forsyth Street
SAN FRANCISCO, CAL., 156 Second Street

MONTREAL and TORONTO: MAIN BELTING COMPANY OF CANADA, LTD.

Products.

LEVIATHAN and ANACONDA BELTING for Power Transmission, Elevating and Conveying; MAIN TROUGHING ROLLERS, Adjustable and Fixed; MAIN FLAT CARRYING ROLLERS.

Special White Food Conveyor Belt; Duck Brand Liquid Dressing; Blaxtick Bar Dressing; Belt Fasteners.

Which Belt to Use and Where.

Neither Leviathan nor Anaconda takes precedence over the other in point of quality. Each belt is made to the highest standards in material and workmanship with the distinct purpose of meeting efficiently specific conditions. To enable the user readily to determine which belt is pre-eminently suited to the position the following is suggested.

LEVIATHAN—Should be used on main, counter and machine drives under all ordinary conditions in general industries such as railroad and machineshops, iron and steel mills, lumber and woodworking plants, brick, stone, slag, cement, sand, and general ore-reducing plants, cotton seed and peanut oil mills.

ANACONDA—Adapted to positions where severe conditions extraneous to the drive itself are encountered, such as:



TRADE-MARK

Water—Paper mills, dye houses, bleacheries, canneries, packing houses, tanneries, etc.

Machine Oil—Automatic machinery, leaky bearings, oil tempering shops, etc.

Hot Atmosphere—Hot air blowers, drying rooms, laundries, etc.

Corrosive Gases—Forge shops, foundries, pyrites roasters, spring manufacturing plants, etc.

Acid Fumes—Chemical plants, sheet mills, tin products and fertilizer plants, smelters, etc.

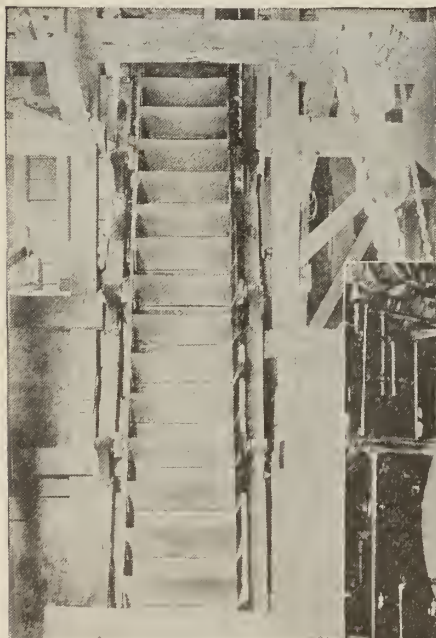
Steam—Canneries, dye houses, bleacheries, packing houses, laundries, etc.

Slippery Dust—Flour mills, gypsum and talc mills, bronze-powder plants, etc.

LEVIATHAN and ANACONDA in ELEVATING and CONVEYING—Leviathan is adapted to all normal industrial conditions. Anaconda is supplied in such special conditions as handling hot materials, materials of chemical content, grain and slippery dust.

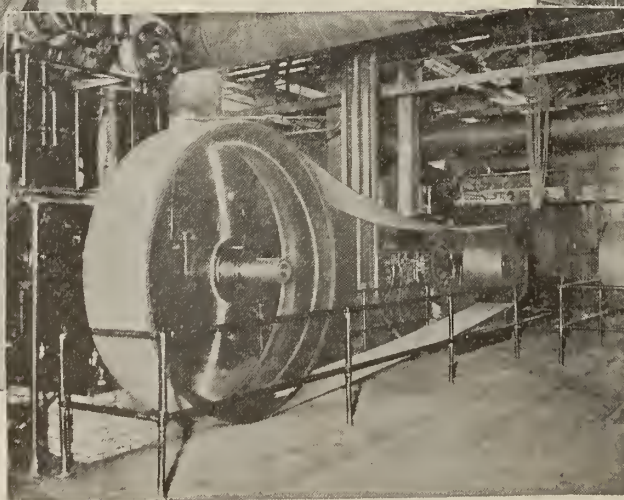
How the Guarantee of the Main Belting Company Protects the User.

Leviathan-Anaconda belts are made in various ply of solid fabric impregnated with special compound; so treated, stretched and aged as to produce a strong, pliable belting, well high indestructible.



36" X 12 PLY BELT LEVIATHAN

One of the large number of Leviathans that have made good with one of the largest stone companies in this country



ANACONDA 20" X 6 PLY

This is an endless Anaconda, 20" x 6 ply, running more than a mile a minute, pulling a 10% overload. It has been running seven months, and has not stretched yet. There are two more just like it in the same powerhouse. One is two years old, the other just installed. As fast as leather belts come off these positions, Anaconda is replacing them



AN INSTALLATION OF THREE LEVIATHANS

A 360' x 8 ply Leviathan to crusher washer belt, 265' x 20" x 6 ply Leviathan to screens, Loading belt, 100' x 24" x 6 ply Leviathan to cars

The MAIN BELTING COMPANY's patented stretching and treating processes produce, in Leviathan and Anaconda, belts of far greater density than any other belts of their type. Because of this extreme density they are unaffected by changes in the humidity of the atmosphere. This density increases their resistance to wear in the same way that compressing an automobile brake lining by a hydraulic press increases its resistance to wear.

The pliability, tensile strength and co-efficient of friction are also enhanced by the treatment.

Excessive stretch, which is the prime fault of ordinary commercial belts, is positively removed by the MAIN BELTING COMPANY's exclusive processes. This is one of the reasons why we alone among the manufacturers of belting make a "Stretch Guarantee."

GUARANTEE AGAINST STRETCH—For every 1% a belt stretches after the first cut, the Main Belting Company will refund 3% of the purchase price. The first cut is excepted merely because it is generally recognized that it is more a matter of taking up slack than taking out stretch.

The guarantee will apply on every belt we recommend—and we do not recommend Leviathan or Anaconda for positions where they do not belong.

Main Belting Conveyor Rollers.

The Style "C" roller illustrated admits of instant adjustment to meet special conditions in any plant. Styles "A" and "E," while not adjustable, are perfectly finished and have the same high conveying qualities as the Style "C" roller.

The Style "C" Main adjustable troughing roller has the following points of advantage, some of which may be found in other equipment, but no other one roller contains them all.

(1) **MAXIMUM ANGLE OF TROUGH** Is 20°—The troughing pulleys are adjustable to 3 positions; 10°, 15° and 20° from horizontal. If the troughing pulleys are put in their lowest position, a belt of much heavier ply may be used than would ordinarily be possible.

Experience shows that the maximum angle at which a belt may be troughed without finally cracking is 20°, and it should be troughed only so much as is necessary to keep the material from spilling. This is why adjustability is so desirable.

The slight gain in the carrying capacity of a belt troughed at 35° over one troughed at 20° is obtained at the price of the premature destruction of the belt, and a belt which is troughed excessively also has a decided tendency to run off the rollers.

(2) **EDGES OF THE TROUGHING AND THE FLAT PULLEYS OVERLAP**—The troughing pulleys overlap the edges of the end pulleys on the center roll. The inside edge of the troughing pulley is considerably under the top line

of the center roll pulleys, and all possibility of the belt coming into contact with the edges of any of the pulleys is absolutely eliminated.

(3) **SELF-ADJUSTING BEARINGS**—The shaft of the flat roller is suspended in dustproof babbitted swivel bearings. The bearings are not rigidly fixed to their supports but are suspended in them and are free to adjust themselves to accommodate any warping of the stringers. Hence the possibility of the shaft binding in the bearings and ceasing to revolve is eliminated. A belt is worn excessively by pulleys which do not turn, as their rims are soon worn away, presenting holes whose knife-like edges cut the belt.

(4) **FLAT ROLL CARRIES THE LOAD**—Maximum support is given to the belt in the center, where the load is carried, by comparatively long central pulley or roll, investigation having conclusively proved that the highest efficiency is attained by having a large portion of the belt width running flat.

(5) **POSITIVE LUBRICATION AT EACH BEARING SURFACE**—Each bearing surface is provided with an individual compression grease cup effecting positive lubrication.

(6) **CORRECT MECHANICAL DETAILS**—Rollers are ample in every respect.

Rims of the troughing pulleys are reinforced, making it impossible for the rim to wear away and leave a sharp edge to cut the belt.

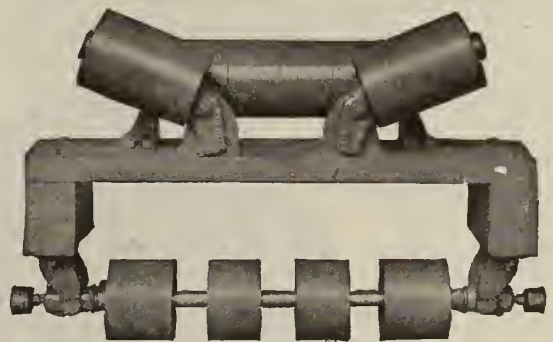
Shafting is $1\frac{3}{8}$ in. in diameter for all sizes.

Pulleys are 6 in. in diameter, with faces lathe-finished absolutely true with bore, making a true running smooth roll that will not wear the surface of the belt nor cause the belt to vibrate excessively.

Grease cups on troughing pulleys are placed well within pulley rim, thus protected from injury. Set screws are all of ample size and easily accessible.

Literature.

For information regarding power transmission problems, see our Book on Power Transmission.



STYLE "C" MAIN TROUGHING ROLLER; STYLE "R" MAIN RETURN ROLLER, ADJUSTABLE TO 10°, 15° AND 20° TROUGH



STYLE "A" MAIN TROUGHING ROLLERS; STYLE "S" MAIN RETURN ROLLER

With 15° trough for 12- to 14-in. belt; 15° or 20° trough for 16- to 18-in. belt; and 20° trough for 20- to 24-in. belts



STYLE "E" MAIN FLAT CARRYING ROLLER; STYLE "R" MAIN RETURN ROLLER

F. RANIVILLE COMPANY

Belting and Mechanical Leather Specialties

MAIN OFFICE AND FACTORY
GRAND RAPIDS, MICH.

EASTERN BRANCH OFFICES AND WAREROOMS: 6 Church Street, NEW YORK, N. Y.

Products.

LEATHER BELTING; MECHANICAL LEATHER SPECIALTIES; BELT CLEANERS and BELTING CEMENTS.
CLEANING and REBUILDING of OLD LEATHER BELTS.

Raniville's Flat Leather Belting.

Raniville makes a satisfactory belt for every requirement. Consult their Engineering Department.

Raniville's Solid Rounded Leather Belting.

Made with precision and accuracy to rigid specifications and standardized sizes



RANIVILLE'S FLAT LEATHER BELTING



RANIVILLE'S SOLID ROUNDED LEATHER BELTING

by superior methods peculiar to this plant. Three special qualities. Railway leather bell and register cord. Flat and rectangular leather belting. Cut-to-length machine belts with hooks. Raniville new lock lap cemented endless machine belts.



Before Ranivillizing

Old Leather Belts Made New.

Raniville's belt laundry scientifically cleans, treats and rebuilds old, worn, oil soaked leather belts at a very nominal cost. Their representative will call upon request, inspect that "junk" pile and make an estimate for "Ranivillizing." Get their prices.



After Ranivillizing
RANIVILLE TREATMENT OF OLD LEATHER BELTS

Mechanical Leather Specialties.

Below are listed a few outstanding mechanical leather specialties, both standard and special.

The illustrations serve to visualize the ability of this company to meet the most varied requirements in this line.

Motorcycle belts
Pulley covering
Hydraulic leather
Hand leathers
Buffing wheels
Valve leathers
Whip lashes
Frictions
Curried leather
Lace leather
Cut stock
Scrap leather
Friction belts

Conveyor belts
Speeder belts
Lugged belts
Apron belts
Fan belts
Vee belts
Disks
Packings
Washers
Straps
Cups
Aprons



RANIVILLE'S MECHANICAL LEATHER SPECIALTIES

Raniville's Laboratory Products.

Raniville's belt cleaners.
Raniville's belt treatments.
Raniville's belting cements.

THE RUSSELL MANUFACTURING CO.

Heavy Woven Fabrics
MIDDLETOWN, CONN.

NEW YORK OFFICE, 349 Broadway
CHICAGO OFFICE, 1438 Michigan Avenue

DETROIT OFFICE, 226 Jefferson Avenue, East
ATLANTA OFFICE, 60 South Forsyth Street

Products.

SOLID WOVEN WHITE COTTON BELTING; WATER-PROOF CONVEYOR and TRANSMISSION BELTING; CONE CLUTCH FACINGS, MULTIPLE DISC CLUTCH FACINGS; ASBESTOS LINING for Crane and Heavy Machinery Brakes.

Rusco Asbestos Brake Lining.

Rusco brake lining is manufactured from a special selected long fiber, pure asbestos, solidly interwoven with fine brass wire. This gives Rusco an extraordinary strength and a superior friction surface. The close, uniform weave obtained by the specially constructed looms insures Rusco a solid body, superior in strength and wear resisting qualities.

Rusco brake lining is thoroughly impregnated with a special compound that insures it against the action of oil, water, grease, dirt, and heat, and yet leaves it soft, pliable, and responsive to every demand.

This material having demonstrated its value for automobile brakes is now being made in greater widths and thicknesses for heavy duty, and is giving satisfaction for crane and heavy machinery brakes. Made in any width and thickness required.



RUSCO ASBESTOS BRAKE LINING

Rusco Multiple Disc Clutch Facing.

Rusco multiple disc clutch facings are composed of long fiber asbestos yarn, solidly interwoven with brass wire, and treated with a special compound which produces the highest possible friction surface, and the maximum service in the finished facing. They are compressed to the correct dimensions, and are guaranteed not to vary more than 10/1000 in. in thickness.

Like all Rusco products these clutch facings are built for service.



RUSCO MULTIPLE DISC CLUTCH FACINGS

Rusco Waterproof Conveyor and Transmission Belting.

This belting is made of long fiber cotton, solidly interwoven and impregnated with a special compound which makes it proof against water, oil, and steam, and adds greatly to its wearing qualities.

There are no stitches in this belt to wear and

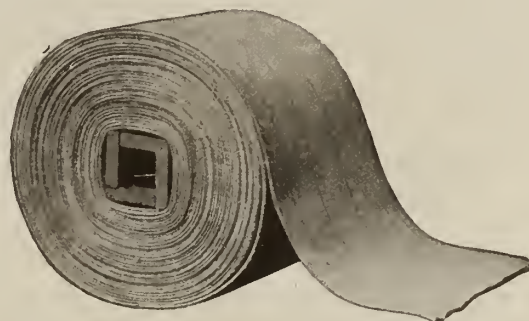
break, or plies to come apart. The belt is suitable for either conveyor or transmission purposes in industrial plants, and due to its waterproof qualities is particularly well adapted for all outdoor work. This belt is guaranteed to give satisfaction under any reasonable conditions.



RUSCO WATERPROOF BELTING

Russell Solid Woven White Cotton Belting.

Made in all widths and thicknesses of solidly interwoven cotton.



RUSSELL SOLID WOVEN WHITE COTTON BELTING

Rusco Cone Clutch Facing.

Rusco cone clutch facings satisfactorily solve the problem of heat resisting, efficient clutch lining.

Rusco clutch facing is a solidly woven fabric, absolutely uniform in thickness, and thoroughly impregnated with this company's special compound. It is tough and of sufficient elasticity to allow the clutch to easily engage and hold without slipping.

These facings can be furnished made of asbestos or cotton, as preferred. For dry cone clutches cotton facing is recommended. If run in oil the asbestos facing will give the most satisfactory service.



RUSCO CONE CLUTCH FACING

THE BRISTOL COMPANY

Manufacturers of Belt Fasteners and Safety Set Screws

WATERBURY, CONN.

BRANCH OFFICES

NEW YORK, 114 Liberty Street
SAN FRANCISCO, Rialto Building

PITTSBURGH, Frick Building

CHICAGO, Monadnock Block
BOSTON, Old South Building

Products.

BRISTOL'S PATENT STEEL BELT LACING, BELT PLATES, BELT RIVETS and SAFETY SET SCREWS.

For Bristol's Recording Instruments, see pages 558-59.

TRADE MARK
BRISTOL'S
REG. U. S. PAT. OFFICE.

and when applied, will roll back and grasp around the fibers without cutting them. Made in a complete line of styles and sizes.

Bristol's Patent Steel Belt Lacing.

Quickly and easily applied. Guarantees repairs to broken belts in the shortest possible time. No special tools required; all that is needed is a hammer, a block of soft wood and one's hands.

For all kinds of belts from the lightest split leather to the extra heavy conveyor belts.



NO. 1 STYLE, BRISTOL'S PATENT STEEL BELT LACING

Packed in assorted widths, or furnished packed all one width. Each box contains enough to lace 100 ins. in width of belt. Saves time and can be applied quickly without special tools.

No. 00, for belts from $\frac{1}{8}$ to $\frac{1}{4}$ in. thick, \$1.00 per box. No. 0, for belts from $\frac{1}{4}$ to $\frac{3}{8}$ in. thick, \$1.00 per box.
No. 1, for belts from $\frac{3}{8}$ to $\frac{1}{2}$ in. thick, \$1.50 per box.
No. 2, for belts from $\frac{1}{2}$ to $\frac{5}{8}$ in. thick, \$2.00 per box.
No. 3, for belts from $\frac{5}{8}$ to $\frac{3}{4}$ in. thick, \$2.50 per box.
No. 4, for belts from $\frac{3}{4}$ to $\frac{7}{8}$ in. thick, \$3.00 per box.
No. 5, for belts from $\frac{7}{8}$ to 1 in. thick, \$3.50 per box.



NO. 11 STYLE, BRISTOL'S PATENT STEEL BELT LACING, FOR RUBBER AND COTTON BELTS

No. 100, for belts from $\frac{1}{8}$ to $\frac{1}{4}$ in. thick, \$1.00 per box.
No. 10, for belts from $\frac{1}{4}$ to $\frac{3}{8}$ in. thick, \$1.00 per box.
No. 11, for belts from $\frac{3}{8}$ to $\frac{1}{2}$ in. thick, \$1.50 per box.
No. 12, for belts from $\frac{1}{2}$ to $\frac{5}{8}$ in. thick, \$2.00 per box.
No. 13, for belts from $\frac{5}{8}$ to $\frac{3}{4}$ in. thick, \$2.50 per box.
No. 14, for belts from $\frac{3}{4}$ to $\frac{7}{8}$ in. thick, \$3.00 per box.
No. 15, for belts from $\frac{7}{8}$ to 1 in. thick, \$3.50 per box.
No. 17, for belts from $\frac{1}{4}$ to $\frac{5}{8}$ in. thick, \$4.95 per box.
No. 19, for belts from $\frac{1}{8}$ to $\frac{1}{4}$ in. thick, \$6.05 per box.



STAGGERED POINT STYLE BRISTOL'S PATENT STEEL BELT LACING, FOR ALL KINDS OF BELTS

No. 1100, for belts from $\frac{1}{8}$ to $\frac{1}{4}$ in. thick, \$.90 per box.
No. 110, for belts from $\frac{1}{4}$ to $\frac{3}{8}$ in. thick, \$1.00 per box.
No. 110 $\frac{1}{2}$, for belts from $\frac{3}{8}$ to $\frac{1}{2}$ in. thick, \$1.25 per box.
No. 111, for belts from $\frac{1}{2}$ to $\frac{5}{8}$ in. thick, \$1.50 per box.
No. 112, for belts from $\frac{5}{8}$ to $\frac{3}{4}$ in. thick, \$2.00 per box.
No. 113, for belts from $\frac{3}{4}$ to $\frac{7}{8}$ in. thick, \$2.50 per box.
No. 114, for belts from $\frac{7}{8}$ to 1 in. thick, \$3.00 per box.
No. 115, for belts from $\frac{1}{4}$ to $\frac{5}{8}$ in. thick, \$3.50 per box.
No. 117, for belts from $\frac{1}{2}$ to $\frac{7}{8}$ in. thick, \$4.95 per box.
No. 119, for belts from $\frac{3}{8}$ to $\frac{1}{2}$ in. thick, \$6.05 per box.

Bristol's Patented Steel Belt Plates and Rivets.

May be used on rubber and cotton belts. Bristol's rivets are furnished with improved sharpened points,



BRISTOL PATENT BELT PLATE

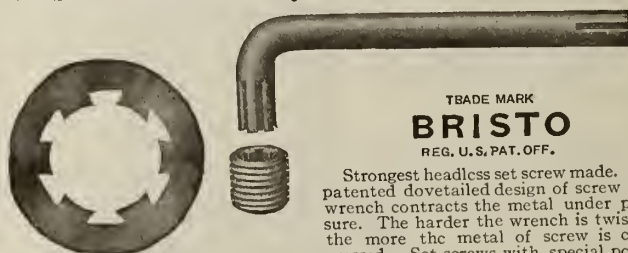
Size No.	List price, per gross	Size No.	List price, per gross	Size No.	List price, per gross
700	\$1.44	720	\$4.32	730	\$8.64
710	1.44	721	4.32	731	11.52
711	2.88	722	5.76	732	12.96
712	4.32	723	7.20	733	14.40
713	5.76	724	8.64	736	Assorted
714	5.76	726	Assorted	740	14.40
716	Assorted			741	17.28



BIFURCATED BELT RIVETS

No. 809 With Small Shank		No. 810 With Large Shank		No. 811 With Extra Large Shank	
Length, ins.	Per gross	Length, ins.	Per gross	Length, ins.	Per gross
$\frac{1}{8}$	\$.40	$\frac{1}{8}$	\$.60	$\frac{7}{8}$	\$.80
$\frac{1}{4}$	.40	$\frac{1}{4}$	.60	$\frac{1}{2}$	.80
$\frac{3}{8}$	.40	$\frac{3}{8}$	.60	$\frac{3}{4}$	.96
$\frac{1}{2}$	.40	$\frac{1}{2}$	.60	$\frac{1}{4}$	.96
$\frac{5}{8}$	.45	$\frac{5}{8}$	.68	$\frac{1}{8}$	1.10
$\frac{3}{4}$	.45	$\frac{3}{4}$	.68	$\frac{1}{16}$	1.10
		$\frac{7}{8}$	.75	$\frac{1}{32}$	1.20
		$\frac{15}{16}$	.75	$\frac{1}{64}$	1.20
		$\frac{1 1/8}$	.85	$\frac{1}{128}$	1.35
		$\frac{1 1/4}$	.85	$\frac{1}{256}$	1.35
				$\frac{1}{512}$	1.50

"Bristo" Patented Safety Set Screw.



Showing Dovetail Design

TRADE MARK
BRISTO
REG. U. S. PAT. OFF.

Strongest headless set screw made. The patented dovetailed design of screw and wrench contracts the metal under pressure. The harder the wrench is twisted, the more the metal of screw is compressed. Set screws with special points or special lengths furnished to order

"BRISTO" SAFETY SET SCREW

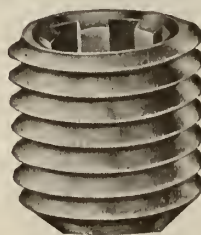


Fig. 13828B

In ordering, specify quantity, number and length.

No.	Diam., ins.	Length, ins.	U. S. std. threads per in.	Price 100 screws and 8 wrenches
40	$\frac{1}{4}$	$\frac{1}{8}$	20	\$4.00
50	$\frac{3}{8}$	$\frac{1}{4}$	18	4.00
60	$\frac{1}{2}$	$\frac{3}{8}$	16	5.00
70	$\frac{3}{4}$	$\frac{1}{2}$	14	6.00
80	$\frac{1}{2}$	$\frac{3}{4}$	13	7.00
90	$\frac{3}{4}$	$\frac{1}{2}$	12	8.00
100	$\frac{1}{2}$	$\frac{3}{4}$	11	10.00
120	$\frac{3}{4}$	$\frac{1}{2}$	10	12.00
140	$\frac{1}{2}$	$\frac{3}{4}$	9	15.00
160	1	$\frac{1}{2}$	8	20.00

CRESCENT BELT FASTENER COMPANY

381 Fourth Avenue
NEW YORK, N. Y.

BRANCH OFFICES: BIRMINGHAM, ENG. and TORONTO, CAN.

Products.

CRESCENT BELT FASTENERS; CRESCENT PLATES; CRESCENT RIVETS.



Crescent Belt Fasteners.

Crescent Belt Fasteners save labor and time, conserve the strength of the belt, and lengthen its life.

They make good belts give better service.



OUTSIDE OF CRESCENT JOINT SHOWING CRESCENT PLATES AND CRESCENT RIVETS

Uses.

Crescent Belt Fasteners, consisting of Crescent Plates and Crescent Rivets, are used for joining transmission, elevating and conveying belting of every length, width, thickness and material.

Advantages.

Crescent Belt Fasteners sustain the belt's full strength and reinforce it at the joint. None of the belt material is cut away, punched out or weakened. None of the lengthwise power carrying fibers are severed.

A Crescent joint hugs the pulley snug and tight, and insures full, even, continuous transmission of power. This is because the curve of the Crescent Plates conforms the joint to the pulley.

The edges of Crescent Plates are beveled, which allows for the rock of the belt as it leaves the pulleys and affords the correct flexibility to prevent cracking the belt behind the joint.

A properly made Crescent joint never requires attention. There is no expense for supervision or maintenance. A Crescent joint is quickly and easily made with no other tools than a hammer.

Crescent Plates are attached singly or in multiple according to the size of the belt. The service chart on this page shows the sizes of Crescent Plates and Crescent Rivets which should be used to insure the best results for all different conditions of work.

Crescent Belt Fasteners are recommended and regularly installed by many prominent belt manufacturers as the strongest, safest, most durable and economical method for the joining of power transmitting, elevating, and conveying belting of every length, width and thickness. Their effectiveness can be demonstrated in any plant.

For information write to Service Department.

CRESCENT PLATES AND RIVETS FOR ALL KINDS OF BELTING LENGTHS, WIDTHS AND THICKNESSES

Light Work Pulleys 3 in. or larger Belting 3/4 in. to 4 in. wide	For 3/4 and 1 in. of belt width, No. 25 1 1/2 " " " " " 45 2 " " " " " 65 2 1/2 " " " " " 85 3 " " " " " 805	Crescent Short Grip Plate, \$2.88 per gross " " " " " 8.64 " " " " " " " 11.52 " " " " " " " 11.52 " "
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General Work Pulleys 6 in. or larger Belting 1 1/2 in. to 8 in. wide	For 1 1/2 in. of belt width, No. 67 2 " " " " " 607 2 1/2 " " " " " 87 3 " " " " " 107 3 1/2 " " " " " 127 4 " " " " " 147	Crescent Medium Grip Plate, \$8.64 per gross " " " " " 14.40 " " " " " " " 11.52 " " " " " " " 14.40 " " " " " " " 17.28 " " " " " " " 20.16 " "
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For belting wider than 4 in. use two or more Crescent Plates of the same grip.

General Work Pulleys 9 in. or larger Belting 2 in. to 12 in. wide	For 2 in. of belt width, No. 63 2 1/2 " " " " " 83 3 " " " " " 103 3 1/2 " " " " " 123	Crescent Special Grip Plate, \$11.52 per gross " " " " " 14.40 " " " " " " " 17.28 " " " " " " " 20.16 " "
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For belting wider than 3 1/2 inches use two or more Crescent Plates of the same grip.

Heavy Work Pulleys 12 in. or larger Belting 5 in. to 36 in. wide	For 2 1/2 in. of belt width, No. 109 3 " " " " " 149 3 1/2 " " " " " 1409 4 " " " " " 189	Crescent Long Grip Plate, \$17.28 per gross " " " " " 23.04 " " " " " " " 25.92 " " " " " " " 28.80 " "
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For belting wider than 4 in. use two or more Crescent Plates of the same grip.

Attach all the above Crescent Plates with Crescent Large Shank Rivets as follows:
For belting 2/16 in. thick use size 5/16 Crescent Large Shank Rivets \$0.70 per gross

" " 3/16 " " " " " 6	" " " " " " 70
" " 4/16 " " " " " 7	" " " " " " 80
" " 5/16 " " " " " 8	" " " " " " 80
" " 6/16 " " " " " 9	" " " " " " 90
" " 7/16 " " " " " 10	" " " " " " 90
" " 8/16 " " " " " 11	" " " " " " 1.00
" " 9/16 " " " " " 12	" " " " " " 1.00
" " 10/16 " " " " " 13	" " " " " " 1.10
" " 11/16 " " " " " 14	" " " " " " 1.10

Note—To determine the quantity of Crescent Rivets needed to attach a given quantity of Crescent Plates, multiply the number of gross of Crescent Plates ordered by the bold face figures of the size number of the Crescent Plate. Example: 3 gross No. 127 Crescent Plates—3x12=36 gross of Crescent Large Shank Rivets required.

High Speed Light Work Pulleys 2 in. or larger	For 3/4 and 1 in. of belt width, No. 20 1 " " " " " 40 1 1/4 " " " " " 44 2 " " " " " 60	Crescent High Speed Plate, \$2.88 per gross " " " " " 5.76 " " " " " " " 5.76 " " " " " " " 8.64 " "
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For belting wider than 2 in. use two or more Crescent Plates of the same grip.

High Speed Light Work Pulleys 4 1/2 in. or larger	For 1 1/2 in. of belt width, No. 66 For belting wider than 3 in. use two or more Crescent Plates of this size.	Crescent High Speed Plate, \$8.64 per gross
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For attaching all Crescent High Speed Plates use Crescent Small Shank Rivets as follows:

For belting 5/16 in. thick use size No. 5/16 Crescent Small Shank Rivets \$0.50 per gross									
	3/16					6			50
	4/16					7			55
	5/16					8			55
	6/16					9			60
	7/16					10			60

Note—To determine the quantity of Crescent Rivets needed to attach a given quantity of Crescent Plates, multiply the number of gross of Crescent Plates ordered by the bold face figures of the size number of the Crescent Plate. Example: 5 gross No. 44 Crescent Plates—5x4=20 gross of Crescent Small Shank Rivets required.

Extremely Heavy Work Large pulleys Belting up to 72 in. wide	For 3 in. of belt width, No. 1611 4 " " " " " 2211	Crescent Jumbo Plate, \$28.80 per gross 34 56 " "
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For attaching Crescent Jumbo Plates use Crescent Jumbo Rivets as follows:

For belting	5/16 in. thick	use size No.	10/16 Crescent Jumbo Rivets	\$1.25 per gross
" "	6/16	" "	" "	" 1.40
" "	7/16	" "	" "	" 1.40
" "	8/16	" "	" "	" 1.55
" "	9/16	" "	" "	" 1.55
" "	10/16	" "	" "	" 1.70
" "	11/16	" "	" "	" 1.70
" "	13/16	" "	" "	" 1.85

Note—To determine the quantity of Crescent Rivets needed to attach a given quantity of Crescent Plates, multiply the number of gross of Crescent Plates ordered by the bold face figures of the size number of the Crescent Plate. Example: 8 gross No. 2211 Crescent Plates—8x22=176 gross of Crescent Jumbo Rivets required.

Crescent Rivet Extractor No. 79, \$1.00 each

Be sure to specify enough Crescent Rivets for attaching the Crescent Plates ordered.

An additional 50% of Crescent Rivets will provide for rejoining when shortening belt. It is well to order to have them handy. Every Crescent Plate and Crescent Rivet is marked with the registered trade-mark, "Crescent." Specify "Crescent Belt Fasteners" by name on all orders.

MORSE CHAIN COMPANY

Silent Chain Drive

ITHACA, N. Y.

BRANCH OFFICES

ATLANTA, GA., Candler Building
BOSTON, MASS., 141 Milk Street
CHICAGO, ILL., Merchants L. & T. Building
CLEVELAND, OHIO, Engineers' Building
DETROIT, MICH., 1003 Woodward Avenue
GREENSBORO, N. C., 805 Ashboro Street
KANSAS CITY, MO., Morse Engineering Co., Finance Building
NEW YORK, N. Y., 50 Church Street

MINNEAPOLIS, MINN., Strong-Scott Mfg. Co., 3d Street, S.
PHILADELPHIA, PA., 302 Harrison Building
PITTSBURGH, PA., Westinghouse Building
ST. LOUIS, MO., Morse Engineering Co., Chemical Building
SAN FRANCISCO, CAL., Monadnock Building
MONTREAL, CAN., JONES & GLASSCO, Reg'd, St. Nicholas Building
TORONTO, CAN., JONES & GLASSCO, Reg'd, Hamilton Bank Building

Products.

MORSE SILENT CHAINS and SPROCKETS for the transmission of power for every purpose.

General Description.

The use of special alloy steels with heat treatment and improved machinery combine to make the most durable and high grade finished drive on the market.

The Morse rocker joint silent chain drive is essentially a steel belt, made of flat links arranged to form teeth on one side of the chain which engage with teeth cut in the sprocket wheels over which it runs.

It is a gear belt, used in place of belting and gearing and is made in varying pitches from $\frac{3}{8}$ in. to 3 in. to transmit from $\frac{1}{4}$ to 5000 h.p.

It is in use today for over 3,100,000 h.p., giving positive speed ratios, on short centers, saving construction costs, power, oil and maintenance. The more severe the duty the more need of Morse silent chain, insuring positive, durable 99% efficient service.

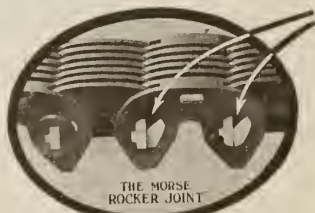


MORSE ROCKER JOINT SILENT CHAIN

Design of the Morse Rocker Joint.

The principal difference between the Morse silent chain and all others is in that unseen and all-important part, the joint. The Morse is constructed with this fact in view—the joint bears the burden of service in any chain. Instead of a single pin, as in other joints, two special pins, each held in its respective half, form the joint. No bushing is required.

When the chain is pulled out straight, between sprockets, the flat of seat pin bears against one of the flat faces of rocker pin. As the chain bends in circling each sprocket, the curved side of one pin rolls or rocks against the broad, flat side of the other, eliminating destructive grinding friction entirely.



DETAIL OF MORSE ROCKER JOINT

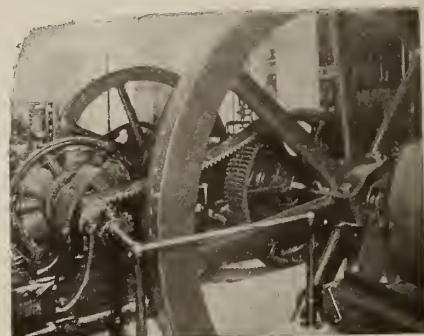
Speed and Service.

This exclusive "rocker joint" construction enables the Morse to run at a speed far in excess of other chains

because lubricant is not essential to its operation; and after years of service (in nearly every line of industry) it is accepted as the most durable chain on the market.

Material Parts.

"Morse drives" have great mechanical strength and are made with a large factor of safety assuring 100% overloads. They are simple, need little attention, and consist of driving and driven sprockets (solid or split, bored and keyed) and silent chain belt, and are all ready for installing at once. Driven sprockets are usually of cast iron. Driving sprockets of cast iron or steel as service requires.

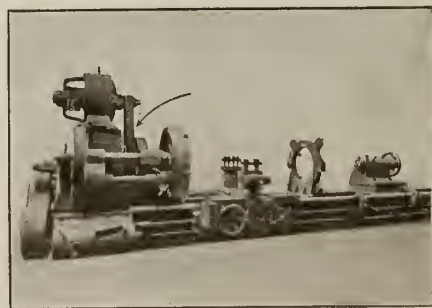


200 H.P. COMPRESSOR DRIVE, 9TH STREET TERMINAL WAREHOUSE, N. Y. C. LINES, CLEVELAND, OHIO

Advantages.

Morse is accepted as the drive that is positive as gears, flexible as a belt; unaffected by heat, cold, moisture or oil; durable, and gives long life, and is especially desirable for service, in chemical and metallurgical works and in textile, lumber and rubber mills, where dust, gases, acid fumes and steam ruin leather belting.

The satisfactory service and efficiency and world-wide demand and use in the most severe duty of chemical works, smelters, mines, and mills is the evidence of their success.



MORSE SILENT CHAIN DRIVING LARGE LATHE AT WATERTOWN ARSENAL

Morse Engineering Service.

Upon receipt of a general layout, Morse engineers will design the drive to suit special requirements. Engineering service and designs are at the free disposal of clients. Address nearest office for free bulletins applying to every industry.

VICTOR R. BROWNING & CO.

Conveying, Excavating and Hoisting Machinery

17701 Lake Shore Boulevard
CLEVELAND, OHIO.

PLANTS: CLEVELAND, OHIO; MANSFIELD, OHIO

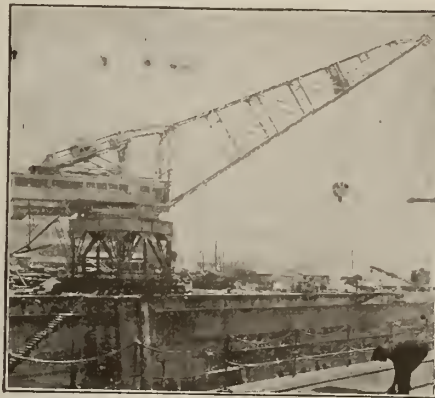
Products.

CONVEYING, HOISTING and EXCAVATING MACHINERY, including:

Overhead Traveling Cranes
Gantry Cranes
Jib Cranes
Wall Cranes
Electric, Steam and Gasoline Locomotive Cranes
Electric Hoists
Electric, Steam, Coal and Oil Steam Shovels
Clamshell and Scraper Buckets
Magnets
Motors
Controllers
Dragline Excavators
Suction and Dipper Dredges
Barges
Scows

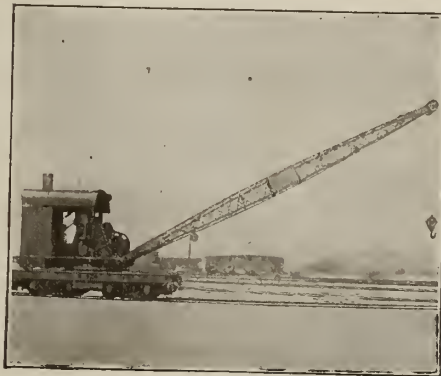


TRADE-MARK

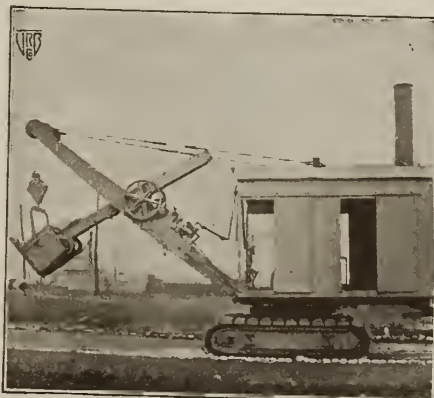


LARGEST LOCOMOTIVE CRANE EVER BUILT

Lifts 10 tons at a 90-ft. radius and 20 tons at a 130-ft. radius



10-TON VRB LOCOMOTIVE CRANE



VRB STEAM SHOVEL MOUNTED ON NEW TANK CRAWLER TRUCK



THE VRB HOIST



ONE OF MANY TYPES OF SPECIAL CRANES MANUFACTURED



DREDGE DESIGNED AND BUILT AT THE VRB FACTORIES



TWO OF MANY TYPES AND SIZES OF ELECTRIC OVERHEAD TRAVELING CRANES

THE CHAMPION ENGINEERING COMPANY

Manufacturers of Electric Traveling Cranes

MAIN OFFICE AND WORKS
KENTON, OHIO

BRANCH OFFICES

NEW YORK, J. W. SPENSLEY, Sales Engineer, 149 Broadway
TOLEDO, W. C. LLOYD & Co., Second National Bank Building
LOS ANGELES, L. G. HENES, Title Insurance Building
PHILADELPHIA, WILLIAMS & THOMAS MACHINERY Co., 829
Commercial Trust Building

SAN FRANCISCO, L. G. HENES, Monadnock Building
SEATTLE, HALLIDIE MACHINERY Co., L. C. Smith Building
PORTLAND, PORTLAND MACHINERY Co., 62 First Street
PITTSBURGH, LAUGHLIN-BARNEY MACHINERY COMPANY, 481
Union Arcade

Products.

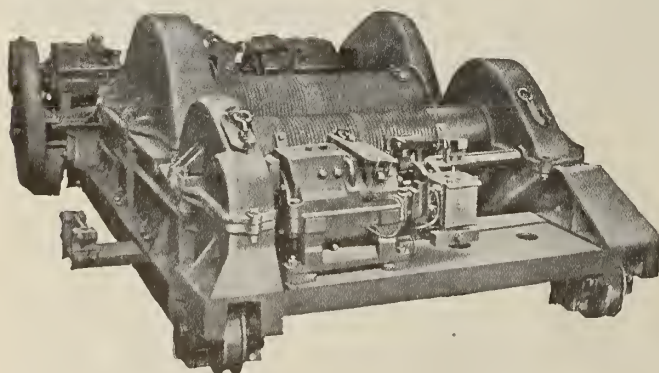
CHAMPION ELECTRIC TRAVELING CRANES for all classes of service.

Description.

Champion cranes have been designed to meet every possible requirement in the crane field. Simplicity, accessibility and perfect interchangeability of parts are the predominant features. Even the most severe requirements, usually called for by steel mill crane specifications, are fulfilled, and, at the same time, a machine of high efficiency is produced.

TROLLEY—The side frames consist of two heavy castings connected by a wide, heavy steel girt or separator. This separator, carrying only the hoisting motor and motor electric brake, is fastened to the side frames so as to relieve the bolts of all shearing strains. The component parts are made stiff enough to withstand the heavy shocks and severe strains put upon them by this class of service.

To facilitate occasional repairs and to insure perfect alignment, all fastenings throughout are effected by through bolts with U. S. standard nuts. Bearings are provided with caps fitted with split bronze bushings. All shafts, of forged steel, are located in a horizontal plane and each shaft, with its pinions and gears or hoisting drum, can be lifted individually. Bearings have been proportioned so that they produce comparatively low bearing pressures.



CHAMPION DOUBLE HOOK TROLLEY

The trolley track wheels are of heavy pattern and furnished either of cast iron with chilled ground treads as standard, cast steel or any other alloy cast steel. They are keyed to the axles, revolving in M.C.B. pattern phosphor bronze bearings.

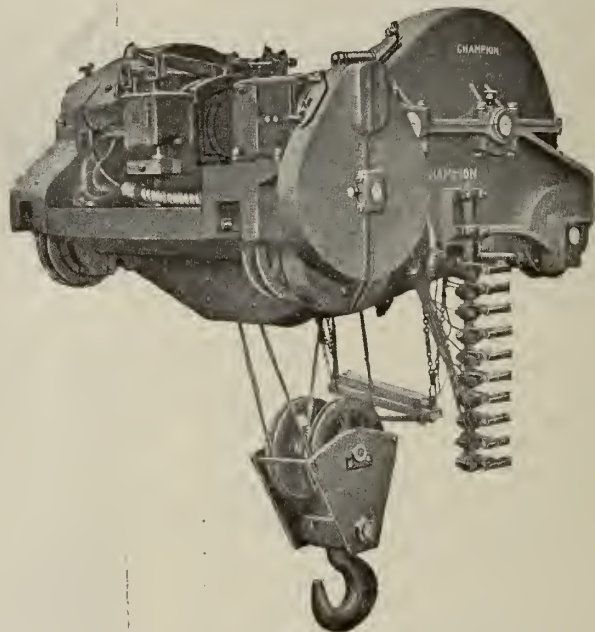
The cable drum, keyed to the drum shaft, is grooved from a solid casting and provided with large guarding



TRADE-MARK

flanges. The grooves are large enough to entirely bury the cable.

The lower block is of the side plate design, the hook forged of steel of special specification and wrought by special process. It swivels on bearings equipped with nickel chrome steel balls.



SIDE AND FRONT VIEWS OF COMPLETE CHAMPION TROLLEY

HOISTING ELEMENTS—All gears in the machine are steel with cut teeth. All pinions are cut from steel forgings. Gears have been designed with wide face and substantial arms, so as to stand overloads caused by sudden starting, stopping and reversing the motor.

A safety lug is provided at each end of the trolley frame 1 in. above the rail, to prevent excessive drop in case of breakage. By placing a wedge under the rail and running the lug against it the weight will be taken on the wedge for ease in removing track wheels.

A differential, flexible band has been adopted, which speedily grips the brake wheel or case when lowering. The advantage of this type is that it applies itself without undue shock, making the operation certain, smooth and noiseless.

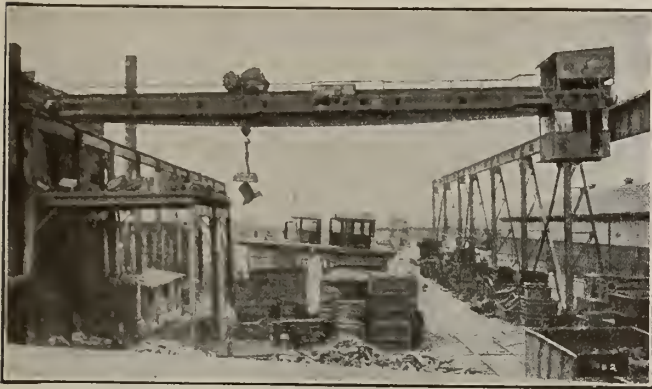
BRIDGE—The Champion standard crane bridge, on which the trolley operates, is composed of two box section steel girders mounted and carried on end trucks of cast steel or structural steel with cast steel end brackets.

Gusset plates arrest the tendency of the crane structure to get out of square owing to defects in crane runway, to sudden stopping and starting when the load is close to one end of the crane, or to similar causes.

The bridge motor in a horizontal position is located near the center of the span and attached to the front girder.

The end lengths of the shafts on which the truck pinions are geared are made very short, so that when it becomes necessary to remove the end section in order to replace the pinion, only the short section need be removed. This avoids disturbing the balance of the cross shafting.

A powerful foot brake is provided for stopping the crane on the runway at any point without reversing the bridge motor. The brake wheel is large in diameter and provided with a band lined with asbestos friction material. The brake wheel is located on the bridge motor extension, and operated from the crane operator's cage.



OUTDOOR CHAMPION CRANE INSTALLATION

PLATFORM—The platform, extending from one end of the girders to the other, is provided with a toe-board at least 4 in. high. The platform extends from the outer toe-board angle clear to the web of the girders, so that no machinery parts or tools can fall through any openings to the ground. The bridge motor is mounted in a horizontal position, on heavy structural steel brackets. This design permits adjustments and perfect accessibility to all the motor parts. The motor armature can be moved with facility and landed on the platform. When required, in the case of cranes for heavy steel mill type, the platform will be entirely of steel. In all cases, on commercial or mill type cranes, the platform is provided with a top rail 42 in. from the floor and an intermediate rail 21 in. below this. The vertical posts are located at frequent intervals.

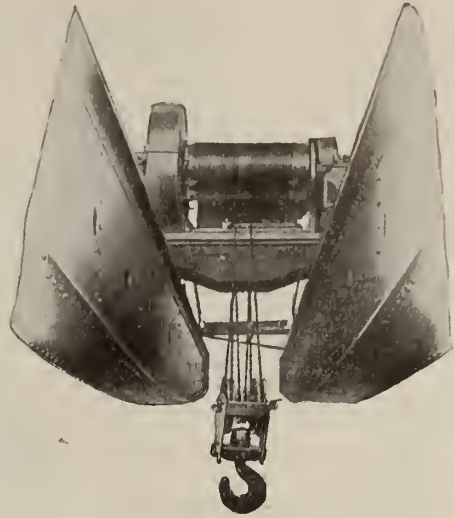
Adaptability.

They can receive any crane hoist motor and motor brake either A. C. or D. C.

LUBRICATION—The trolleys are so constructed as to be adapted to both grease and oil lubrication.

Safety.

To prevent excessive drop in the case of breakage, a safety lug is provided at each end of the trolley. Excessive deflection (due to overload) can not be communicated to the trolley frames by means of the loose load girt, thus precluding the possibility of binding the machinery. The hoist mechanism is provided with an automatic switch, limiting the upper travel of the hook to prevent the damage in case of over hoisting or double



CHAMPION SAFETY LIMIT STOP

blocking. The device or limit contact is actuated by the hook block itself arriving at the predetermined limit. The magnetic switch is normally closed and held in a closed position at the switchboard on the operator's cage. It is opened whenever the circuit is interrupted.

In other words the safety hoist limit operates by "breaking" and not making a circuit. The latter method can not be done with certainty. The trolley is also designed to receive any other form of limit contact in the market. Ready attachment can be made of all standardized safety devices such as truck wheel guards, bumpers, safety pans and also of side platforms to the sides and ends of trolleys for the purpose of securing more perfect accessibility.

Wiring.

All Champion cranes are wired in accordance with the National Board of Fire Underwriters' rules. All wiring is done in flexible steel or rigid conduit with condulets.

Bulletins.

Bulletins describing and illustrating the advantages and superiority of Champion cranes will be sent on request.



INDOOR CHAMPION CRANE INSTALLATION

CHESAPEAKE IRON WORKS

Traveling Cranes and Steel Structures

BALTIMORE, MD.

Products.

ELECTRIC TRAVELING CRANES.
STEEL BUILDINGS and BRIDGES.
STRUCTURAL STEEL and ORNAMENTAL
IRON WORK.



TRADE-MARK

Chesapeake Electric Traveling Cranes.

They are the most rugged cranes built, and are designed along the most approved lines of modern crane construction.

The trolleys are of the simplest possible construction, and all working parts are extremely heavy, thereby assuring maximum life under the most adverse operating conditions.

Due to the extreme simplicity of design, all parts are accessible for inspection and repair. Each unit can be removed without disturbing any other unit.

TROLLEY—The trolley incorporates, in every respect, those features which make for durability, and incorporates in the simplest manner these essential details:

A rigid "H" frame carries all mechanism, and does not rely on any part of the mechanism for rigidity.

All gears and shafts are extremely heavy. All bearings are bronze bushed.

Gear covers or guards protect all gears.

GIRDERS—The girders, of various types to suit span and other conditions, are of the most efficient design, to counteract the abuse of the most reckless operator.

The bridge drive is of the heavy type, having the driving motor located near the center of the span.

A platform, with angle toe guards and double bar hand rail, extends the entire length of the bridge drive girder.

"SAFETY FIRST" FEATURES—The "safety first" features include many details which are furnished regularly only on Chesapeake cranes.

Switchboard, mounted in steel cabinet with steel door and lock, includes a double pole main switch, contactor, safety plug and independent overload relays for each direct current motor.

Limit switch, which prevents overhoisting, is operated by hook block in conjunction with no-voltage contactor on switchboard, with re-set push button in front of operator.

All gears are enclosed or suitably protected.

Bumper blocks on bridge ends.

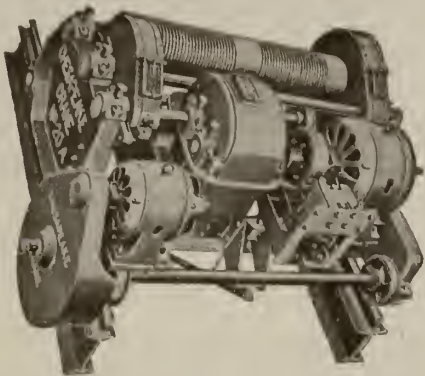
Rail sweeps on bridge ends.

Extreme accessibility to all parts for inspection and removal for repairs.

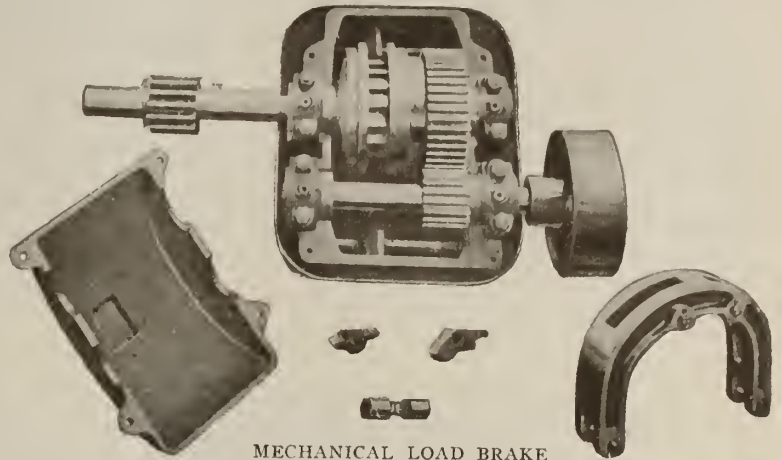


CHESAPEAKE ELECTRIC TRAVELING CRANES IN PLANT OF EASTERN ROLLING MILLS CO., BALTIMORE, MD.
Capacity of each, 25 tons, with 10-ton auxiliary hoist

ALTERNATING CURRENT TYPE TROLLEY—The alternating current type trolley is similar in every respect to the direct current trolley, excepting that the hoisting mechanism is equipped with a mechanical load brake as described.

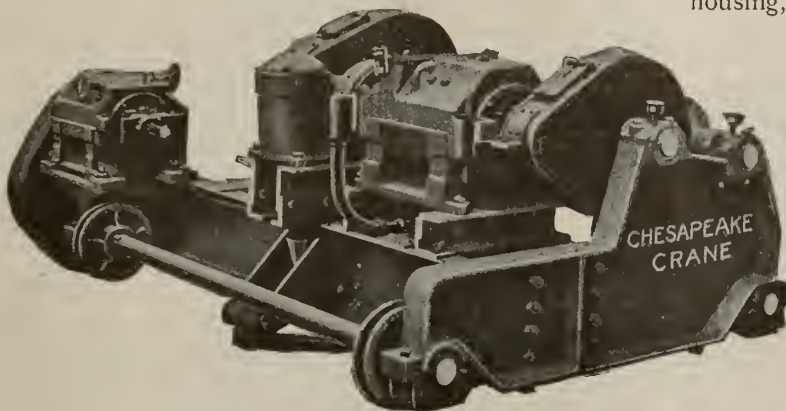


ALTERNATING CURRENT TYPE TROLLEY



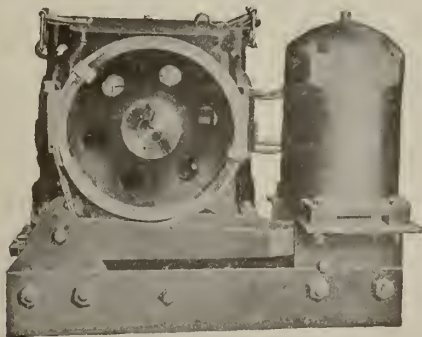
MECHANICAL LOAD BRAKE

DIRECT CURRENT TYPE TROLLEY—Built to meet the most exacting requirements of heavy duty crane service, being extremely heavy in all details, and most accessible in all parts. Lowering of load is controlled by a dynamic braking system and in addition a powerful electric brake is applied to the motor to hold load when current is off.



DIRECT CURRENT TYPE TROLLEY

ELECTRIC BRAKE—Of the iron clad solenoid band type, has holding power equally effective in either direction, in stopping empty hook when hoisting at high speed or in stopping and holding full load when lowering. Brake is always on when current is off and is entirely released when motor is running in either direction.



ELECTRIC BRAKE

MECHANICAL LOAD BRAKE—The Chesapeake load brake, which is of the multiple disk type, is positive in its action, and has ample capacity to sustain the full load, without the use of the electric brake, and will not

allow the load to run down, except when operated by the hoist motor, in the lowering direction.

The load brake, with its gears, is enclosed in an oilproof case, forming a complete self-contained unit. It is simple in design and extremely heavy in all details.

BOTTOM BLOCK—Consists of heavy structural steel housing, the side plates forming a guard for the sheaves



BOTTOM BLOCK

and hoisting rope. Cast iron sheaves machined to suit the hoisting rope are bronze bushed and revolve on a heavy steel shaft which is lubricated through grease receptacles.

Hook is of forged steel and revolves on high grade ball bearings.

Steel Structures.

Specialists in the design, fabrication and erection of steel structures, including office and shop buildings, highway bridges, etc.

A full line of angles, channels and I-beams are always carried in stock.

Inquiries.

Careful attention is paid to all inquiries. Submit structural steel and crane problems to our engineering departments, and a satisfactory solution is assured.

THE CLEVELAND CRANE & ENGINEERING CO.

MAIN OFFICE AND WORKS
WICKLIFFE, OHIO
(NEAR CLEVELAND, OHIO)

NEW YORK OFFICE, 50 Church Street

PITTSBURGH OFFICE, First National Bank Building

Products and Services.

ELECTRIC TRAVELING CRANES.

Hand Power Traveling Cranes; Special Gantry;
Ore and Coal Handling Machinery.

Cranes for different purposes designed and constructed on order.

Cleveland Cranes.

This company manufactures electric cranes in all capacities from 1 ton to 300 tons for either direct or alternating current, and for inside or outside service.

Hand power cranes are also manufactured in capacities from 1 ton to 50 tons.

For crane clearance dimensions see opposite column.

A general description may briefly include the following details of construction:

FACTOR OF SAFETY—At least 6, factor being larger according to conditions.

BRIDGE—Of double or single plate and angle, or a box girder, or a single I-beam or lattice truss type of girder, depending on span, capacity, speed, etc.

BRIDGE TRUCKS—Attached to girders with shoulder construction, which gives a large bearing surface for keeping crane in alignment.

BRIDGE GEARS—All gears and pinions have teeth cut from the solid.

CAB—Of ample size for all electric controlling mechanism, with floor space sufficient for complete operation.

TROLLEY—A casting of I section type, arranged to carry hoist and trolley traveling mechanism.

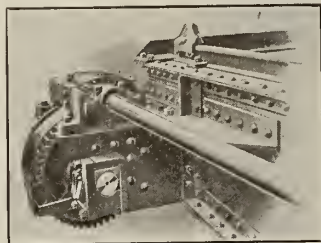
HOIST DRUM—Finished with right- and left-hand grooves, keeping load equally distributed on both girders.

TRACK WHEELS—For both bridge and trolley, are double flanged, rolled steel, cast iron with chilled tread or cast iron center with high carbon rolled steel tires shrunk on.

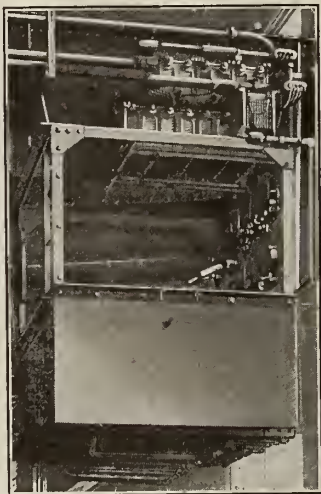
LOAD BRAKE—Double friction type, automatic running submerged in oil bath.

ELECTRIC BRAKE—Attached to hoisting motor, automatic, operated by a solenoid, and so connected as to apply instantly when current is interrupted.

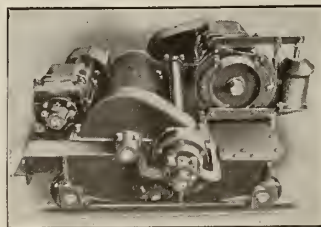
FOOT BRAKE—A powerful bridge brake stops bridge when traveling in either direction.



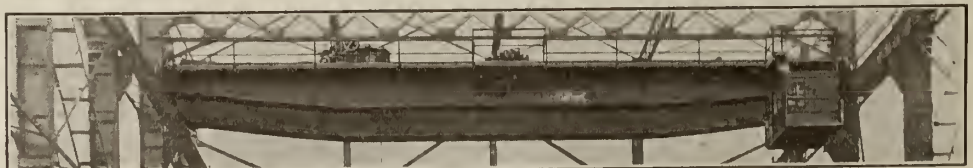
CORNER VIEW STRUCTURAL STEEL M.C.B. END TRUCK



CRANE CAB



FULLY ENCLOSED 2-MOTOR TROLLEY



25 TON, 3 MOTOR HIGH SPEED SKULL CRACKER CRANE, 65 FT. LIFT, INLAND STEEL CO., INDIANA HARBOR, INDIANA
85 ft. 9 in. span

LIMIT SWITCH—Automatic, attached to each hoist, which breaks current when hook is raised above or descends below a predetermined point.

Ruggedness, simplicity and the recognized ideal method of operation are combined in this limit stop. When the limit of travel of bottom block is reached, it operates the limit stop direct and not in connection with something else. To lower, it is only necessary to reverse controller, automatically resetting limit stop. The construction is very simple, no gears, sprockets, traveling nuts, cams, or other moving parts are employed and consequently there is nothing to wear out.

Specific Data Required.

All inquiries for traveling cranes should give the following particulars:

(1) Load: maximum load in net tons to be lifted.

(2) Speed: if special speed for any function is preferred.

(3) Style: type of crane desired.

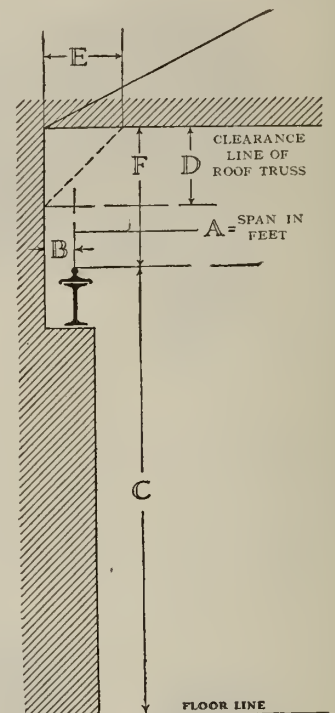
(4) Clearance dimensions as follows (see illustration):

A—span; B—end clearance; C—distance from top of runway rail to floor; F—overhead clearance; E and D—if there are roof braces interfering with end travel of trolley.

Upon receipt of above information, quotations will be promptly submitted.

Co-operative Service.

In case the styles of cranes shown here do not meet the requirements, the engineering department of this company will gladly submit individual prints and specifications on request.



CROSS SECTION OF BUILDING SHOWING DIMENSIONS REQUIRED FOR CRANE CLEARANCE

CLEARANCES (IN FEET AND INCHES) FOR "B" AND "F" TO BE ALLOWED IN A NEW BUILDING

Capacity, tons	"B," in.	"F," ft.	in.
ELECTRIC CRANES			
5	8	5	6
10	8	5	9
15	10	6	0
20	11	7	0
25	11	7	3
30	11	7	6
40	12	8	3
50	12	8	6
100	14	10	0

HAND POWER CRANES			
5	5	4	0
10	6	4	6
15	6	5	3
20	7	5	9
25	7	6	0
30	8	6	6
40	8	7	0
50	9	7	6

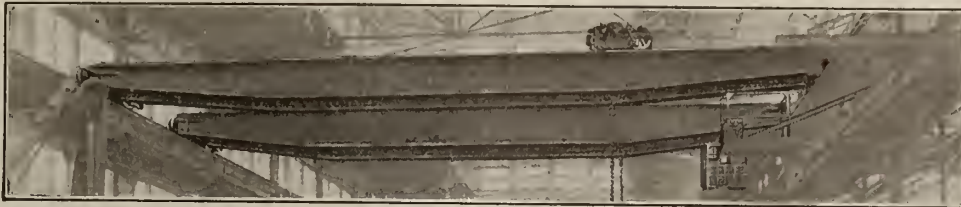
If you do not have above clearances, kindly advise, giving full particulars



10-TON FOUNDRY CRANE
34-foot span



30-TON, 4-MOTOR GANTRY CRANE, PENNSYLVANIA R. R. LINES, CLEVELAND, OHIO
42-foot span

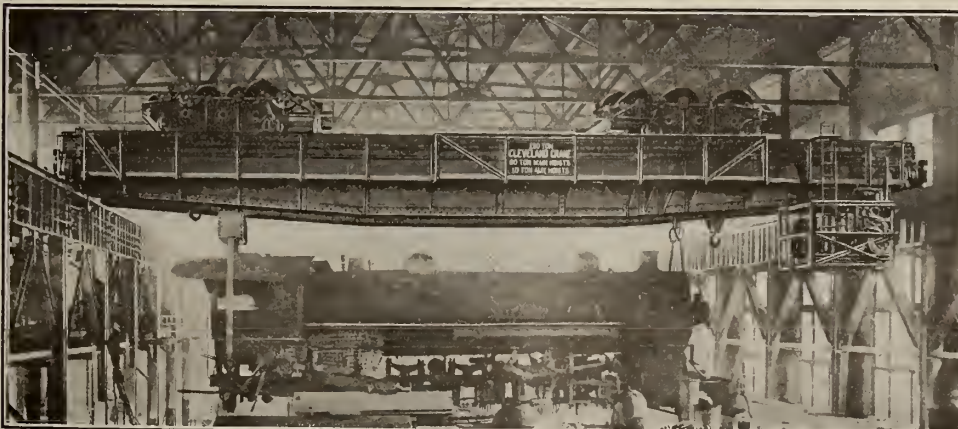


TWO 10-TON, 3-MOTOR, ELECTRIC TRAVELING CRANES, BLAW STEEL CONSTRUCTION CO., PITTSBURGH, PA.
68-foot span



THREE SAND UNLOADER CRANES, INSTALLED FOR THE U. S. GOVERNMENT FOR USE ON THE PANAMA CANAL
Equipped with 4-yard buckets.

This equipment handled all the sand used in building locks at the Pacific end of the Canal.
This type of crane is suitable for handling any material with grab bucket



120-TON DOUBLE TROLLEY CRANE, NEW YORK CENTRAL LINES, WEST ALBANY, N. Y.
60-ton main hoists, 10-ton auxiliary hoists, 70-ft. $\frac{3}{4}$ -in. span

NILES-BEMENT-POND COMPANY

Manufacturers of Electric Traveling Cranes, Machine Tools and Steam Hammers

111 Broadway
NEW YORK, N. Y.

BRANCH OFFICES AND AGENCIES

BOSTON, 93 Oliver Street
ROCHESTER, 116 South Avenue
PHILADELPHIA, 405 N. Twenty-first
Street
BIRMINGHAM, 2015 First Avenue

PITTSBURGH, 425 Seventh Avenue
CINCINNATI, 328 W. Fourth Street
CLEVELAND, 730 Superior Street, N. W.
DETROIT, 120 Beaubien Street
CHICAGO, 571 W. Washington Boulevard
LONDON, ENG., 23-25 Victoria Street, S. W.

ST. LOUIS, 516 N. Third Street
SAN FRANCISCO, 16 Fremont Street
LOS ANGELES, 454 E. Third Street
SEATTLE, L. C. Smith Building

FOR CANADA: THE JOHN BERTRAM & SONS Co., LTD., Dundas, Toronto, Montreal, Winnipeg and Vancouver

Products.

NILES ELECTRIC TRAVELING CRANES, TROLLEYS and HOISTS; GRAB BUCKET TROLLEYS and CRANES.

Hand Cranes, Gantry Cranes, Jib Cranes, Wall Cranes; Machine Tools and Steam Hammers.

Electric Traveling Cranes.

The Niles cranes are built to operate continuously, and approved safety devices are incorporated in their design. All parts are accessible for examination or removal, and delays for repairs are reduced to a minimum.

The cage is built of heavy angles and plates and thoroughly braced to eliminate vibration and distortion. It is connected with a platform extending entirely across the crane, affording easy access to the bridge motor, gears and bearings.

The controllers, located in the cage, give perfect regulation and are equipped with liberal wearing parts, ventilated contacts, carbon brushes, powerful magnetic blow-outs—all accessible from the front.

The mechanical load brake is of the double disk type, automatic in action and self-contained; it will not chatter under any condition of service and will not permit the load to run down unless the motor is revolved by power in the lowering direction. The electric brake is of the ironclad solenoid type—safe, powerful and accessible.

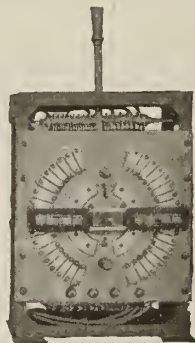
The Niles dynamic braking system can be supplied when desired, eliminating the mechanical load brake

and its friction, and at the same time insuring perfect regulation, safety and absolute control of the board.

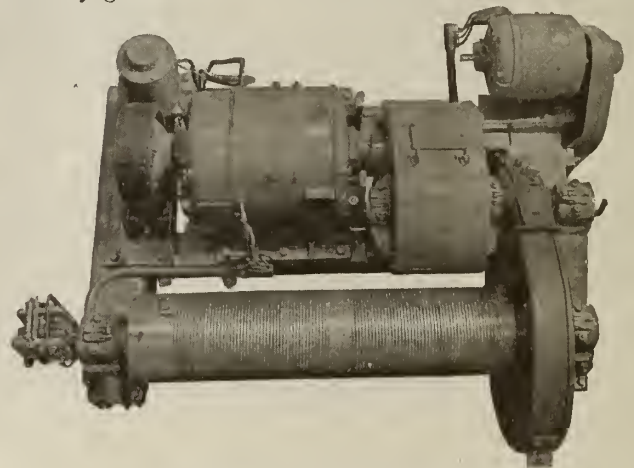
Bridge girders are made either of box section or I-beam with auxiliary braces, depending upon the capacity and the span. Both types have great lateral rigidity. Standard box section girders are built up of two web plates, four heavy angles and universal mill top and bottom cover plates. I-beam bridge girders are of heavy I-beam section with specially wide flanges.

Standard Crane Trolley.

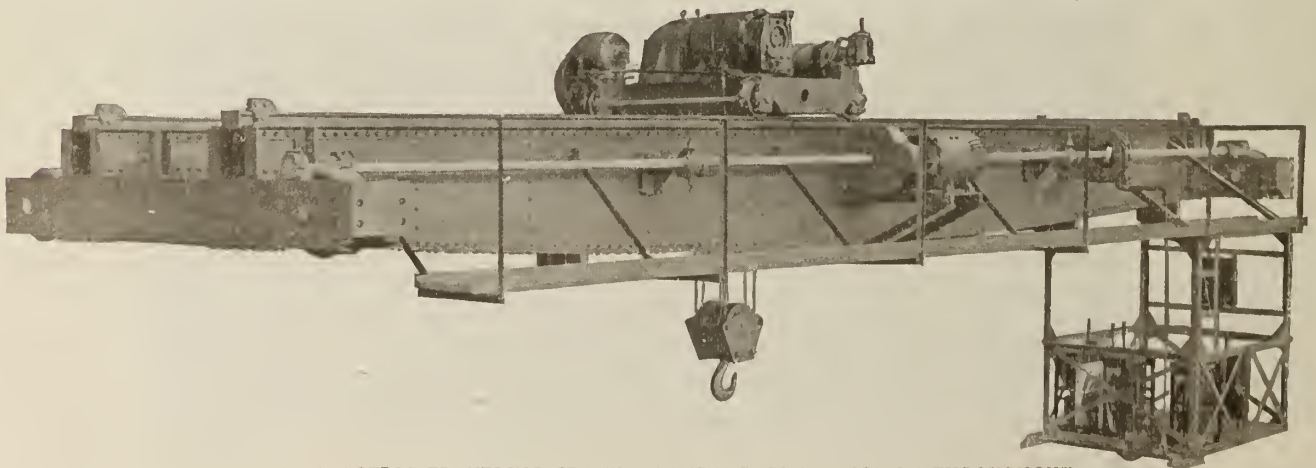
Framing consists of two double web sides connected by a built-up all-steel girt. Hoisting drum is finished all over and grooves cut right and left hand so as to always lift the load vertically, without twisting. All gears are enclosed in cast iron or steel cases, or carefully guarded.



STANDARD CRANE
CONTROLLER
Face plate type



STANDARD CRANE TROLLEY
Without auxiliary hoist



NILES ELECTRIC TRAVELING CRANE—STANDARD CONSTRUCTION THROUGHOUT



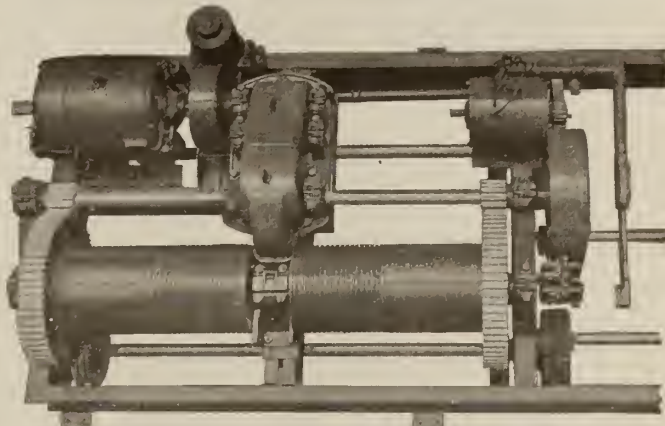
160-TON TRAVELING CRANE IN POWER PLANT OF PHILADELPHIA ELECTRIC CO.



200-TON ELECTRIC TRAVELING CRANE
75-ft. 6-in. span. Weight of suspended locomotive is 540,000 lbs. or 270 tons



STANDARD CRANE TROLLEY
With independent auxiliary hoist



STANDARD GRAB BUCKET CRANE TROLLEY

Designed for operation with a 2-rope grab bucket, one rope being attached to the bail of the bucket and the other to the closing mechanism. The entire trolley frame forms a rigid self-contained construction on which the hoisting mechanism is mounted

Directions for Inquiries.

When sending inquiries for cranes, the class of service for which they are to be used should be stated: whether for machinshop, boiler shop, foundry, stone-yard, power plant or whatever the case may be. If crane is for outdoor use, enclosed cage, if desired, should be mentioned. In addition to the above, we should have the following data, in order to properly make up a quotation:

(a) Capacity of crane in tons of 2000 lbs. (b) Span from center to center of runway rails. (c) Either the distance from top of runway rails to ground, or the maximum lift desired.

(d) Distance from top of runway rails to lowest point of roof truss or other obstruction. (e) Distance from center of runway rails to side walls of building. (f) Capacity of auxiliary hoist, if one is required. (g) Voltage and type of current. (If alternating current is to be used, advise number of cycles and the phase.) (h, i, j, k) If building contains wind braces. (l) Size of runway rail.

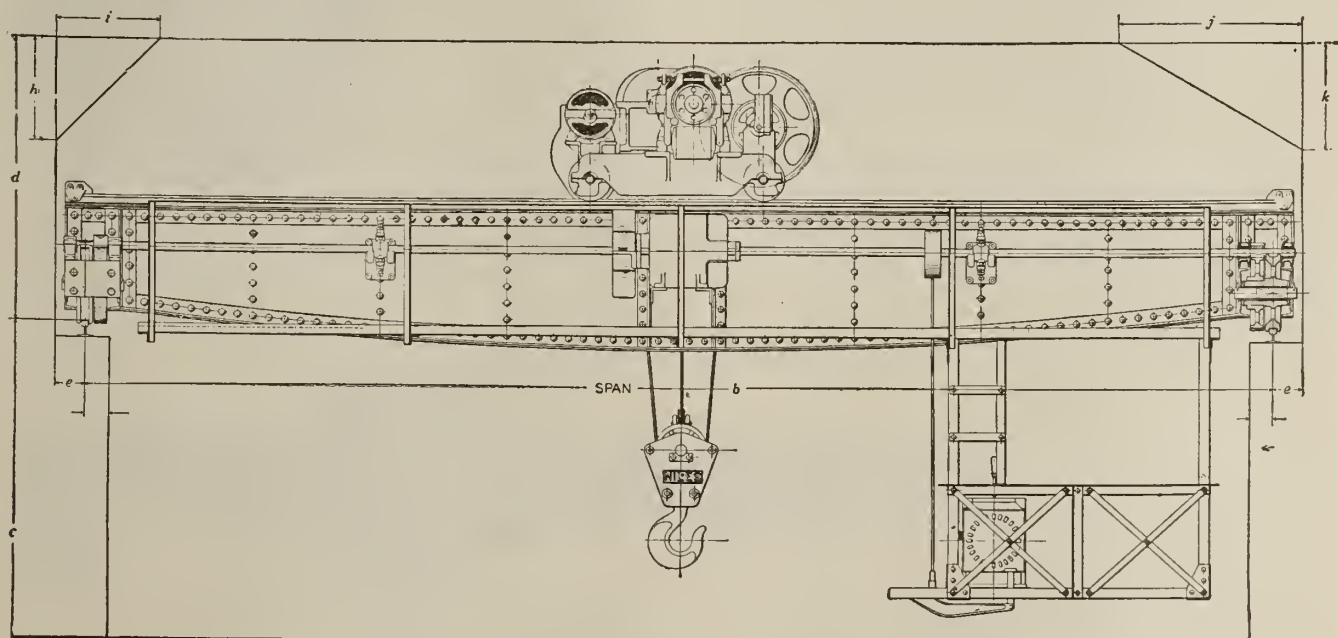


DIAGRAM NILES ELECTRIC TRAVELING CRANE

PAWLING & HARNISCHFEGER CO.

Manufacturers of Travelling Cranes and Hoists

MILWAUKEE, WIS.

BRANCH OFFICES

PITTSBURGH, PA., GEO. L. MEAD, Fidelity Building
CHICAGO, ILL., R. A. S. JOHNSON, Monadnock Block
PHILADELPHIA, PA., WALTER PRICE, Stephen Girard Building

NEW ORLEANS, LA., T. W. WADDELL, Whitney Central Building
NEW YORK, N. Y., WALTER PRICE, 50 Church Street
PORTLAND, ORE., R. K. MORSE, Pittock Block

Products.

TRAVELLING CRANES and HOISTS.
For Excavating Machinery, see page 46.

Type "H" Cranes.

In designing the new type "H" crane particular attention has been paid to the installation of proper safeguards for protection of machinery as well as workmen.

Rugged construction, and entirely enclosed gears, none of which are overhung, and the most approved design of all wearing parts, are among the most important points. The following list of important features will give a clear idea of just how the type "H" crane differs from practically all other cranes.

Important Features.

- (1) Accessibility of all parts.
- (2) Each shaft lifting out independently.
- (3) Durability obtained by liberal design.
- (4) No overhung gears or pinions.
- (5) All gears of cast steel.
- (6) All pinions of forged steel.
- (7) All trolley bearings bronze bushed.
- (8) M.C.B. type bearing on both trolley and bridge.
- (9) Through bolts used throughout.
- (10) All gears running submerged in grease and enclosed in oiltight cases, thus insuring constant lubrication, except bridge truck gears which are provided with guards only.
- (11) Drum and running sheaves are not less than thirty times diameter of rope.
- (12) Dynamic braking for direct current cranes.
- (13) Motor and bridge brakes of heavy clamshell type.
- (14) Trolley sides and bridge trucks of box section.

Bridge End Trucks.

Built from structural steel of a box section, at each end is a single casting riveted to both webs which carries the axle bearings, also the end bearings for the cross shaft. Machined lugs on the truck castings against the structural end trucks relieve the rivets almost entirely of vertical shear.

Truck bearings consist of heavy flanged bronze bearings of semi-octagon shape held in place by oil waste boxes of ample size to insure perfect lubrication at all times.

Truck gear is keyed to axle and is located between main bearings. Pinion is located on cross



TYPE "H" CRANE, 15-TON HOIST, 3-TON AUXILIARY, SPAN 47 FT. 10 INS.

American Tool Works, Cincinnati, Ohio

shaft between two bearings, caps of which are joined by a housing which encloses the pinion. Extension of truck gear outside of truck is enclosed in a sheet steel casing.

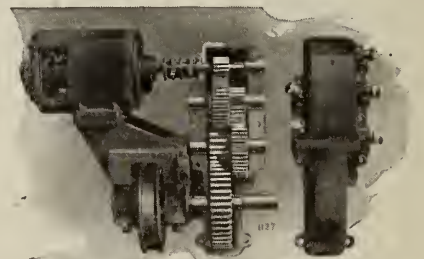
Bridge Motor.

Located near center of bridge and is attached to either web, or bolted to a structural bracket. Bridge brake is of clamshell type with removable asbestos lined shoe, mounted on armature shaft, and is operated through tension rods by a foot lever in operator's cage.

Motor gears are enclosed in oiltight casing which excludes dust and grit.

Trolley.

This modern enclosed type of trolley was designed to meet the most exacting requirements of crane service, and it is of rugged construction, approved design and very accessible.



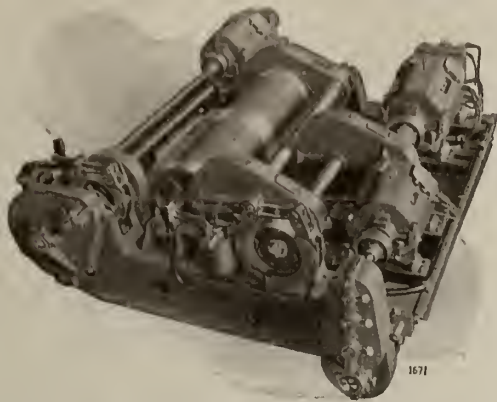
TROLLEY DRIVE WITH GEAR CASE OPEN TO SHOW POSITION OF GEARS



TYPE "H" CRANE COMPLETE

Built in sizes ranging from 5 to 75 tons.

All gears are enclosed in oiltight cast iron cases which exclude dust and grit and enable gears to operate



TYPE "H" MILL TROLLEY, 75-TON CAPACITY WITH 15-TON AUXILIARY

Used by The Bethlehem Steel Company

in lubricant bath of oil or soft grease. All cases are provided with large covers that can be easily and quickly removed.

DRUM—Hoisting drum is of cast iron, drum and sheaves are not less than thirty times the diameter of rope, and are of sufficient size to take full run of ropes for specified lift without overlapping.

All shafting is of steel turned and ground at bearings, with forced fit wherever gears, truck wheels, etc., are placed. Each shaft is accessible, lifting out separately with gears mounted on them.

BEARINGS—All bearings are of phosphor bronze, those for the truck axles are flanged semioctagon type and held in place with oil waste boxes of sufficient size to secure ample lubrication.

All other caps are of cast iron, machined to fit between planed lugs on frame. They are supplied with compression grease caps.

BRAKES—Both main and auxiliary hoists are provided with powerful automatic electric brake of clamshell type. In addition to this, dynamic braking is furnished on all direct current cranes, or if alternating current a mechanical load is supplied.

Load brake is of disc type with automatic retaining band; it is located on the trolley side between two bearings which are integral with trolley side.

Motors.

DIRECT CURRENT MOTORS—Designed electrically and mechanically for these cranes only. Have large starting torque, and speeds are lower than those of other crane motors, so that a minimum of time is lost in starting and stopping. Rated on basis of 40° C. rise in 30 minutes, and will withstand 100% overload without undue heating or sparking.

ALTERNATING CURRENT MOTORS—Standard slip ring type, of same excellent design as direct current motors and rated on same temperature basis.

Squirrel cage type of motor is not recommended as speed control is unsatisfactory.

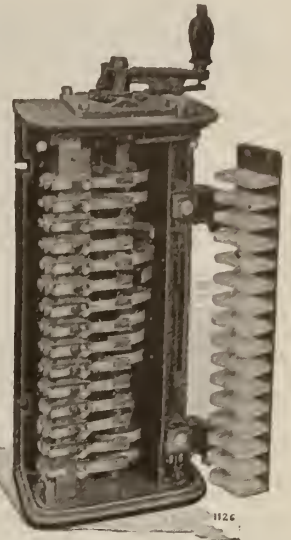
CONTROLLERS—Each motor has its own reversible controller of drum type. This type has proved superior to face plate type.

Limit Switch.

Each hoisting mechanism is provided with a limit switch which interrupts current if bottom block is raised too high. Limit switch is operated directly by the bottom block, and therefore is positive and reliable in action.

Switchboard.

A neat substantial switchboard is mounted in rear of the operator's cage. It consists of slate panels, mounted on an angle iron frame and contains a fused knife switch and fuses for the individual motor circuits.



DRUM TYPE CONTROLLER WITH CRANK

Dynamic Braking.

On direct current cranes dynamic braking has been adopted as standard, the load brake being omitted and the motor being provided with a large capacity clamshell brake fully ample to sustain full load with safety. This system of dynamic braking will therefore give reliable speed control, offer a high degree of safety and eliminate completely all load brake difficulties.

Tests.

Every motor and controller is subjected to a rigid factory test, comprising speed torque, temperature, insulation and high voltage tests, as recommended by the Institute of Electrical Engineers. After crane is completely assembled and wired up it is tested once more, and speeds of different motions are ascertained to insure its coming up to specifications in every respect.

Ordering Information.

The following data will greatly facilitate the work of our engineers in submitting complete specification:

Capacities (in tons of 2000 lbs.): main hoist; auxiliary hoist; auxiliary trolley.

Number of and movements to be operated by electric motors, and what movements to be operated by hand power.

Span, center to center of runway rails.

Weight of runway rails per yard and method of fastening to girders.

Maximum lift from floor line to hook in highest position.

Distance from top of runway rails to lowest point of roof truss.

Distance from center of runway rail to wall or face of column. Dimensions of wind braces if any. Distance from floor line to top of runway rail.

Distance from floor line to top of any obstruction which might interfere with bottom of cage or crane.

Service indoors or out. Intermittent (powerhouse). Moderate (machineshop, foundry, erecting shop). Heavy (steel foundry, mill, magnet, ladle).

Control from cage, floor or pulpit.

Cage located at end of bridge, center of bridge or trolley.

Direct or alternating current. Voltage or cycles and phases.

If magnet is to be used give size and character of material to be handled.

If two or more points of lift are desired, distance center to center should be given, and whether at right angles or parallel with crane bridge.

Gantry crane: single or double leg; single or double cantilever. Distance from top of runway rail to lowest point of bridge. If cantilever type, give distance of center of hook beyond center of runway rail at each end.

SHEPARD ELECTRIC CRANE & HOIST CO.

MONTOUR FALLS, N. Y.

BRANCH OFFICES

NEW YORK, N. Y. PHILADELPHIA, PA. CHICAGO, ILL. BALTIMORE, MD. SAN FRANCISCO, CAL.
 BOSTON, MASS. CLEVELAND, OHIO PITTSBURGH, PA. SEATTLE, WASH. CINCINNATI, OHIO
 MONTREAL, CAN. LONDON, ENGLAND CHRISTIANIA, NORWAY
 MELBOURNE, AUSTRALIA BARCELONA, SPAIN

Products.

ELECTRIC CRANES and HOISTS for every lifting service; DOUBLE MONORAIL TRACK; TROLLEYS; ELECTRIC BACK GEARED WINCHES; CARGO HANDLING WINCHES.

Co-operative Service.

The variety of the Shepard line permits the selection of efficient apparatus specialized to particular needs. This company will be glad to plan, design and help in any way to determine where real savings can be made.

Electric Cranes.

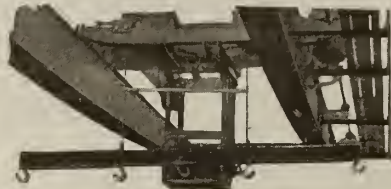
During the 16 years of crane building, no fundamental changes have been made in the original Shepard design which has proved so satisfactory.

This design, when introduced, was entirely unique in its provision for complete dirt exclusion, thorough automatic lubrication and permanence of alignment, secured by locating steel gearing and multiple disc type brakes within cylindrical frames, completely protected, and protecting operators and workmen.

The Shepard line specializes on fully developed cranes of the highest quality in capacities of from 1 to 30 tons. The 1-ton capacity is as complete in

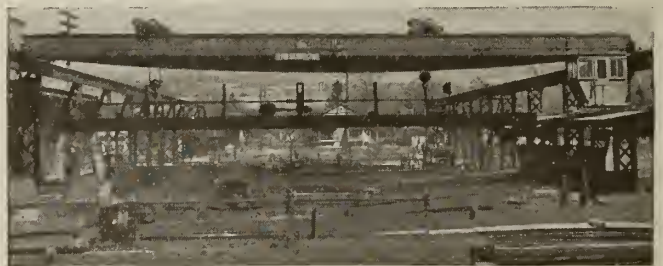


TRADE-MARK



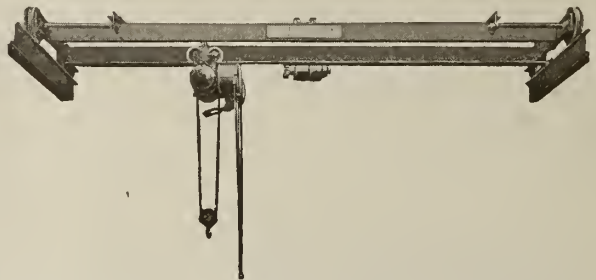
FORM 9 OR DOUBLE HOOK CRANE

Peculiarly fitted to handle tubing, rods and bars in tube mills, rolling mills and pickling departments



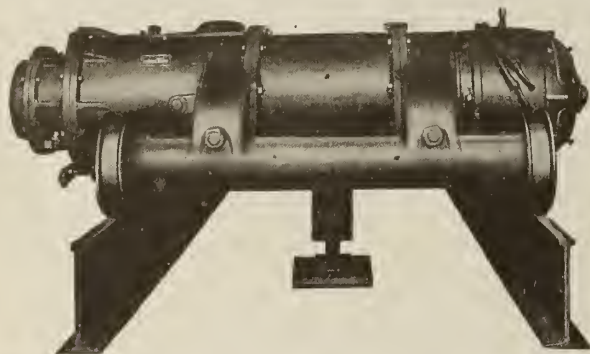
SHEPARD ELECTRIC TRAVELING CRANE

Equipped with two Form 6 crane trolleys operating independently; prove flexible and efficient for loading, unloading and storing structural steel



SINGLE I-BEAM WITH FORM 1X HOIST

Shepard single I-beam cranes with latticed outrigger construction combine double girder rigidity with single I-beam lightness. Widely used over foundry and machinshop side floors for capacities of 1 to 5 tons, and for medium and short spans



STANDARD TYPE CRANE TROLLEY

Provides bath lubrication, complete dirt exclusion, and permanent alignment for gearing brakes and motor



3-MOTOR PLATFORM CONTROLLED JIB CRANE WITH FORM 8 HOIST

Provides efficient service under conditions illustrated; assures continuous service irrespective of weather



JIB CRANE WITH FORM 1X HOIST

Front braced type, affords maximum lift with given height of mast. Used to good advantage in locations where traveling cranes can not be employed

every detail as any heavier crane; groups of small units can be handled as profitably as heavy single units.

STYLES—Standard 3-motor cage controlled and double hook traveling cranes; grab bucket, single I-beam, jib, bracket and transfer cranes, and a variety of special types.



FORM 19 HOIST

This type of hoist has two hooks which operate independently. Illustration shows hoist carrying a box of hides, and a section of the runway including a switch and spur track

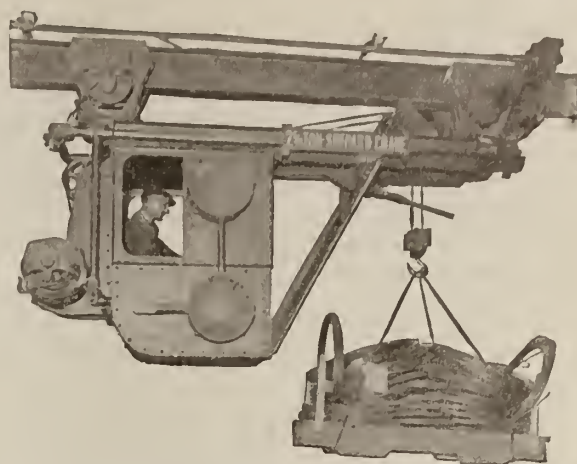


TOP BRACED BRACKET CRANE WITH FORM 1 HOIST

Provides simple, efficient apparatus for many foundry and machinshop locations and ably assists main crane. For transferring work from one to another, and for jobs which tie up a crane for long periods, this is a most profitable piece of apparatus



GRAB BUCKET MONORAIL HOIST, FORM 19-13



FORM 24 CAGE CONTROLLED HOIST

This type of hoist is adapted to general material handling where heavy monorail service is required. Furnished also with two hooks making it adaptable for handling long flexible loads



FORM 24 HOIST OPERATING ON TRANSFER CRANE

Form 24 hoist used in conjunction with a Shepard transfer crane. This combination is wide in its range of operation and may be worked out to touch any point in or out of the plant



TWO FORM 19-13 MONORAIL HOISTS OPERATING ON TRANSFER CRANES

This type of hoist provides a flexible efficient and labor saving means of unloading, storing and carrying coal into powerhouses

Electric Hoists.

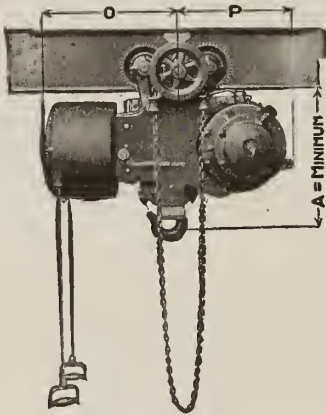
To meet the various handling requirements of more than 70 industries, many types and capacities have been developed during the past 16 years, including 1- and 2-motor floor controlled hoists, and 2-, 3- and 4-motor cage controlled hoists, ranging in capacities from ½ to 10 tons.

Hoists for stationary service, and for electrifying the hoist motion of hand cranes, are built in capacities up to 20 tons.

Thorough automatic lubrication, dirt exclusion, and permanence of alignment, all so necessary in hoisting apparatus, are provided.

The compact construction of Shepard apparatus permits the use of crane gearing and brakes in electric hoists, and back geared motors, providing a great variety of types and wide interchangeability with a minimum number of parts.

Under average conditions, it costs approximately 26¢ per working day to operate a 1-ton hoist.

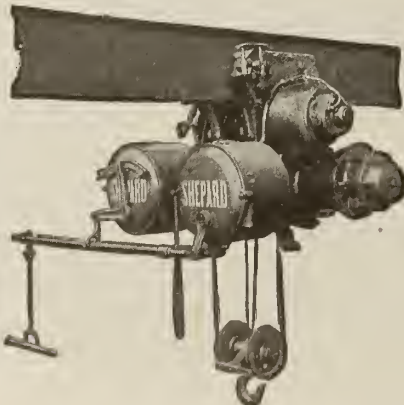


FORM 23 HOIST WITH GEARED TROLLEY

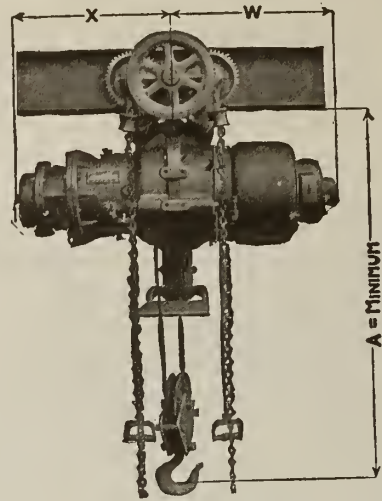
A special combination of hoisting unit, controller and trolley, which permits maximum lift; cuts in half normal distance from hook in its highest position, to runway beam

CAPACITIES AND DIMENSIONS

Class or frame, size	Capacity, tons	Hoisting speed, f.p.m.	No. of ropes	Hgt. of lift	Dimensions				Wgt., lbs.
					A	O	P	Extreme width	
A2	½, 1, 2	40, 20, 10	2	20'	2' 7"	1' 8¾"	1' 6¼"	3' 10"	1170
A4	1, 2, 3	40, 20, 13	2	20'	2' 7"	1' 8¾"	1' 6¼"	3' 10"	1220
B6	3, 4, 5	20, 15, 12	2	28'	3'	2' 4¾"	1' 11"	5' 4"	2470
B10	4, 5, 6	25, 20, 17	2	28'	3'	2' 8¾"	1' 11"	5' 4"	2770



FORM 23 HOIST WITH MOTOR DRIVEN TROLLEY
Can be equipped with outrigger control

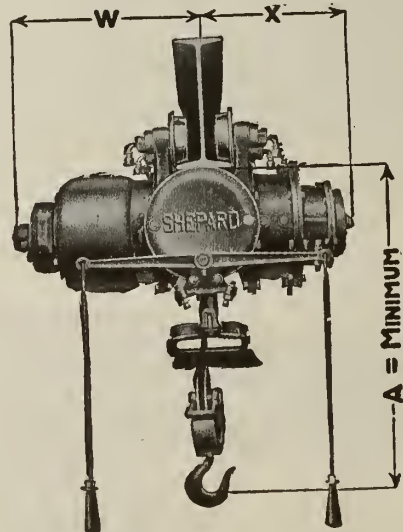


FORM 1 HOIST WITH GEARED TROLLEY

Built in capacities of from 1 to 20 tons and furnished with plain, geared, or motor driven trolley. Most frequently used type for runway and single I-beam crane service

CAPACITIES AND DIMENSIONS

Class or frame, size	Capacity, tons	Hoisting speed, f.p.m.	No. of ropes	Hgt. of lift	Dimensions				Wgt., lbs.
					A	X	W	Extreme width	
A2	½, 1, 2	40, 20, 10	2	20'	3' 4½"	1' 9¾"	1' 7¼"	3' 1½"	1090
A4	1, 2, 3	40, 20, 13	2	20'	3' 4½"	1' 9¾"	1' 10"	3' 1½"	1140
B6	3, 4, 5	20, 15, 12	2	22'	4' 2½"	2' 5½"	2' 1"	1' 11½"	2350
B10	4, 5, 6	25, 20, 17	2	22'	4' 3¾"	2' 5½"	2' 2¼"	2' 3½"	2650
C12	5, 7½, 10	26, 17, 13	2	23'	5' 5¾"	3' 2"	2' 5¾"	2' 6¼"	4220
C20	7½, 10, 12½	30, 24, 20	2	23'	5' 5¾"	3' 2"	2' 7¾"	2' 6¼"	4470

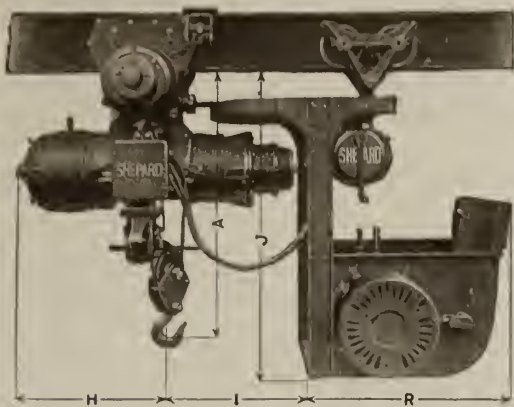


FORM 2 X S HOIST

CAPACITIES AND DIMENSIONS

Class or frame, size	Capacity, tons	Hoisting speed, f.p.m.	No. of ropes	Hgt. of lift	Dimensions				Wgt., lbs.
					A	X	W	Extreme width	
H½	¼	25	2	14'	2' 1"	1' 3"	1' 6"	2' 6"	520
H1	½	28	2	14'	2' 1"	1' 3"	1' 7"	2' 6"	520
I2	1	20	2	18'	2' 5½"	1' 5"	1' 8"	2' 8"	580

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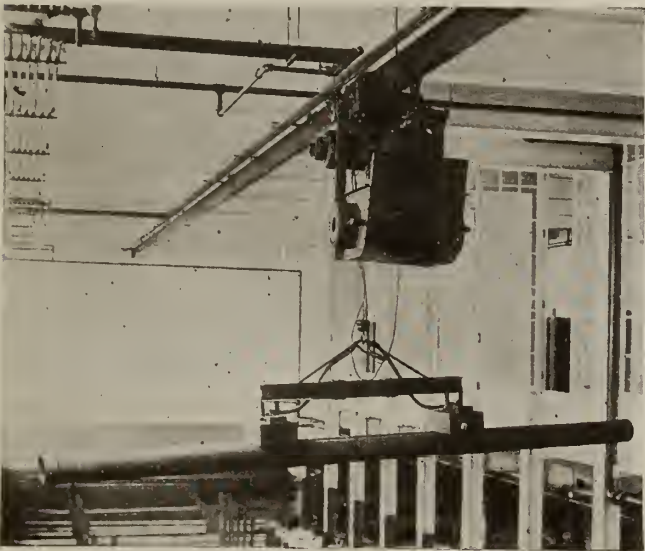


FORM 25-1 D. C. MONORAIL HOIST

For light and normal monorail duty; cage can be enclosed where necessary
Short over all length of distinct advantage on short transfer cranes

CAPACITIES AND DIMENSIONS

Class or frame size	Capacity, tons	Hoisting speed, f.p.m.	Trolley speed, f.p.m.	Hgt. of lift	No. of ropes	Dimensions						Wgt., lbs.
						A	J	H	I	R	Ex- treme width	
A2	1/2, 2	40, 20, 10	225, 350	20'	2	3'8 1/2"	5'	1'5 1/4"	2'2"	3'	3' 6"	2580
B6	3, 5	20, 15, 12	225, 350	22'	2	4'8 1/2"	5' 6"	1'10 1/4"	3'3"	3'6"	5'	4550
C12	5, 10	26, 17, 13	225, 350	23'	2	5'11 1/2"	6'	2'2 1/2"	4'3"	3'9"	6'	7580



FORM 25 HOIST EQUIPPED WITH ELECTRO MAGNET

Extra controllers can be mounted on special orders for magnets and buckets

Electric Cargo Winches.

The electric cargo winch is a recent development for use on ships and piers. Because of its closed-in



ELECTRIC CARGO WINCH

construction, it is especially desirable for this purpose, and no further waterproofing is necessary. The mechanical features of the Shepard hoist are embodied in this winch which is equipped with the Shepard mechanical load brake.

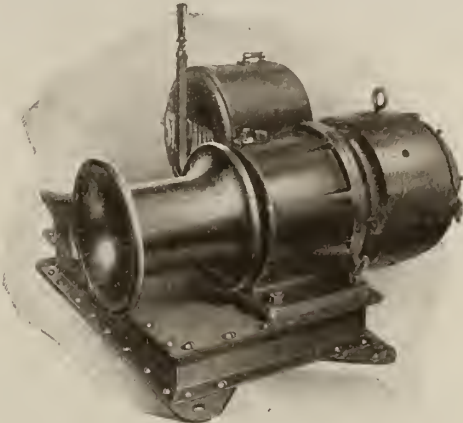
As shown in the illustration, the pier winches are mounted on wheels so as to make them portable.

These winches can be furnished for both alternating and direct current.

Dimensions and complete information will be furnished on request.

Electric Back Geared Winch.

A compact weatherproof winch, with running parts completely enclosed. Its uses are manifold in and about industrial plants.



ELECTRIC BACK GEARED WINCH

CAPACITIES AND DIMENSIONS

Class or frame size	Pull on single line, lbs.	Speed of overhaul, f.p.m.	Proper size manila rope	Shipping wgt., lbs.	
				With base	Without base
A4	800	125	7/8"	820	650
B10	1800	140	1 1/4"	1890	1630
C20	3500	140	1 5/8"	3360	3010

Shepard Double Monorail Track.

T-rails may be provided for the hoist to run upon, thus giving a hard steel wearing surface, rather than the soft steel, the kind from which I-beams are made.

The track is attached to the I-beams by means of bolts and spreader castings, which make it unnecessary to drill the beam for the reception of this track. It also permits of using larger area bearings in the trolley wheels, thus insuring greater durability and longer life.



SHEPARD DOUBLE MONORAIL TRACK

ERIE STEEL CONSTRUCTION COMPANY

Manufacturers of Traveling Cranes and Steel Structures

ERIE, PA.

Products.

ERIE ELECTRIC TRAVELING CRANES.

Also Steel Structures of all Descriptions.

Erie Cranes.

A satisfactory crane must be smooth in action and capable of accurate control, designed to facilitate inspection, lubrication and the renewal of worn parts, and liberally proportioned to eliminate unusual stresses and deep deflections and bearing pressures within moderate limits. These considerations govern the design of Erie cranes and skilled workmen build them from carefully selected materials. Erie cranes are simple in operation, accessible for maintenance and durable under most severe service.

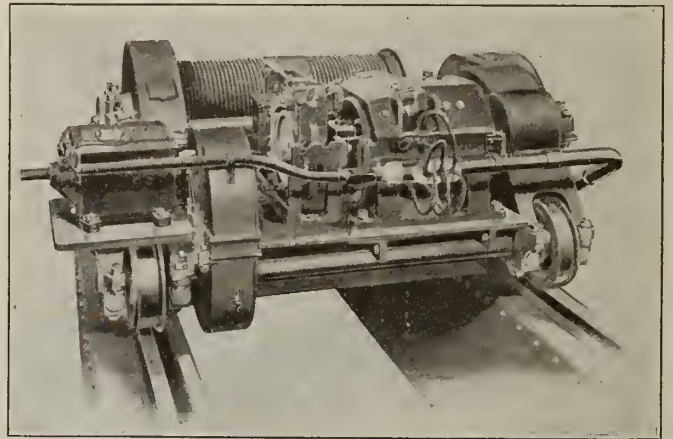
All gears are of cast steel and pinions of forged steel, with teeth cut from the solid stock. All gearing, except bridge wheel gears, runs in an oil bath, and is completely enclosed in a dustproof case. The gear covers are provided with easily opened inspection covers, which encourage frequent attention and oiling. All bushings are of high grade bronze. Through bolts are used for all connections and gear covers and bearing caps can be quickly removed. Any shaft, with its gears, can be moved without disturbing any other shaft.

TROLLEY—Of the entirely enclosed type, with gear cases cast integral with the frame. Frames are tied together by structural cross girt of heavy section, and such depth that the alignment does not depend on the shafting. Wheels are of chilled cast iron, ground to a uniform circumference. Drums and sheaves are thirty times the rope diameter, with deep machined grooves to receive the extra flexible plough steel cable. The axle boxes are of the MCB type, with oil waste pockets, and bronze boxes held by double flanges, affording easy means of shimming down to compensate for wear.

Dynamic braking lowering is recommended with direct current motors, because of the improved regulation and control, and the elimination of wear. The mechanical brake used with alternating current motors is of the multiple disk type, and runs in oil, enclosed in one of the gear cases. All hoist motors are equipped with full torque brake. Lower block is of plate construction, with a forged cross bar and hook, swiveling on ball bearings.

BRIDGE—Up to 15-ton cranes of 60-ft. span, a plate and channel box section, rigidly diaphragmed at short

intervals, is standard. The girders are fastened to the end trucks by notched construction. Alignment is preserved by heavy gusset plates connecting the two, fitted through bolts being used in both cases. End trucks are of beam or channel girders, heavily diaphragmed, with plates top and bottom. Wheels are of cast steel, with bronze bushings turning on fixed pins.



ERIE CRANE TROLLEY

BRIDGE DRIVE—The motor is located on horizontal bracket attached at center of one girder. There is one reduction of gearing to the cross shaft, which runs in split bronze bearings carried on horizontal brackets. The driving pinions mesh with gears pressed directly on the hubs of drive wheels. A foot brake operated from the cab acts on a wheel on the armature shaft to control the bridge movement. A platform, with standard hand rail and toe board, extends the full length of the bridge on the drive side. Beneath this is the operator's cab, rigidly braced to prevent vibration.

ELECTRICAL EQUIPMENT—Erie cranes can be equipped with any standard make of crane motor and control equipment. A large stock of direct current motors, controllers, solenoid brakes and limit switches is carried. The switchboard may be furnished with knife switch, fuses and pilot light; or overload relays may be substituted for fuses. Wiring throughout is in conduit. Bridge conductors may be of copper wire, or of soft steel angles or bars. The collectors are of an improved type, preventing arcing, and of low resistance.



INSTALLATION OF AN ERIE CRANE

LANE MANUFACTURING COMPANY

Electric Cranes
MONTPELIER, VT.

Products.

ELECTRIC TRAVELING CRANES.

Also manufacturers of Stone Working Machinery including Radial Polishing Machines, Boom Derricks and equipment for the finishing of granite and other stone.

Wood Working Machinery including Saw Mills, Edgers, Planers, Automatic Novelty Turning Lathes, Universal Saw Benches, Lath, Shingle and Clapboard Machinery, etc.

Distinctive Features of Lane Electric Traveling Cranes.

A notable distinguishing feature of these cranes is the employment of two motors for the three movements. Both motors are the constant speed, non-reversing type which eliminates the use of controllers and complex wiring. Control of all movements, including that of direction by means of a series of friction cones, is mechanical.



LANE ELECTRIC CRANE FOR LONG SPANS, BRIDGE OF STEEL GIRDER, LATTICE BOX TYPE

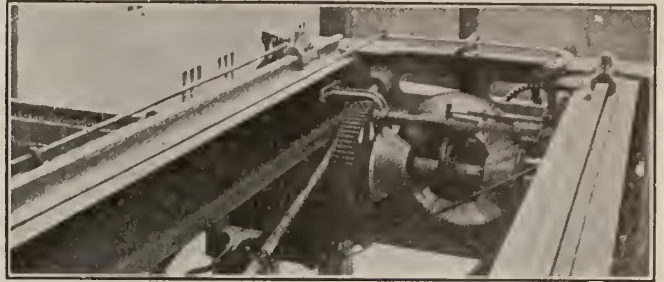
Other commendable features inherent in Lane electric traveling cranes are the capacity for large overloads and the unhampered control of all movements by the operator. Seated comfortably on the trolley, he always has a clear view over the hook as well as of all the other points below the crane.

Construction and Operation.

Originally, Lane cranes were furnished with timber bridge girders, stayed with steel truss rods fastened to cast iron bridge trucks and having a safety factor of about 7. This construction has the advantage of being exceptionally light for a given capacity. Where desired, we still furnish timber bridge girders of long leaf yellow pine reinforced to give strength and rigidity. The two other types of bridges for Lane cranes are (1) Rolled steel I-beams reinforced with inverted channels riveted to the top flanges when necessary, adapted for short spans. (2) Steel girders of the lattice box section type especially designed for long spans.



MECHANISM OF LANE ELECTRIC CRANE
Showing accessibility and ease of operation



LANE ELECTRIC CRANE FOR SHORT SPACES, ROLLED STEEL I-BEAM BRIDGE

Bridge girders are supported by cast iron end trucks provided with cast iron double flange chilled wheels which have steel axles running in renewable bearings. The trolley is cast iron, designed for rigidity, compactness, accessibility of all parts and is amply reinforced with steel tension rods. The sides are securely joined together by several large steel shafts.

Power for hoist and trolley movements is transmitted by friction cones through steel worms engaging bronze gears running in oil. Worm gear drive is a simple and effective load brake being controlled by convenient hand wheel. Two speeds of the hook are furnished with one part of rope. A luff block is provided with a hook and hinged house sheave so that by running the line through this sheave and attaching the single rope hook to a girt on the underside of the trolley a two-part reaving of the rope is effected, thereby dividing the first two speeds by two and doubling the power, supplying four hoist speeds.

Through the same power cones, the hoist motor operates the trolley motion on the bridge at approximately 100 ft. per minute. The reverse is obtained in the same manner as with the hoist movement. The movements are controlled by hand wheels. There is no complicated wiring system, no large controllers and no hot resistance. Therefore no ability to handle delicate electrical apparatus is required of the operator.

Bridge motor drives a friction disk by transmission through a pair of opposed cones, alternately contacting therewith. Control of bridge travel movement in either direction is effected by shifting the cones by means of a lever connected to a rod running the full length of the bridge convenient to operator's left hand.

Floor control can be furnished at extra cost.

CAPACITY, DIMENSIONS AND SPEED OF LANE ELECTRIC TRAVELING CRANES

Capacity of crane in tons	5	10	20	40
Speed, feet per minute:				
1st hoist full load	10	5	4	3
2nd hoist half load	20	10	8	6
3rd hoist quarter load	40	20	16	12
4th hoist no load	80	40	32	24
Bridge travel full load	250	200	180	170
Trolley travel full load	125	100	100	100
Horsepower of each motor	10	10	15	20
Actual height over all from top of runway rail	5'	5'	5'2"	5'8"
Vertical distance from rail to bearing point of single line hook	even	even	even	6"
Ditto with luff block and double line	17"	17"	28"	38"
End projection of bridge beyond center of rail:				
At gear end	10'8"	10'8"	12'8"	14'8"
At opposite end	9'3"	9'3"	11'3"	13'3"
Gage of trolley, or, center to center bridge girders	4'7"	4'7"	5'3"	5'11"
Diameter "chilled" bridge and trolley truck wheels	15"	15"	16 1/2"	18"
Wheel base of bridge trucks	7'4"	7'4"	8'4"	9'2"

All wheels on bridges and trolleys grooved for 60 lb. A. S. C. E. standard rail. Speeds may be changed to meet requirements. Dimensions may be reduced by employing reversing motor bridge drive when required.

WHITING FOUNDRY EQUIPMENT CO.

Cranes of all Types

HARVEY, ILL.

For addresses of Branch Offices and Sales Agents, see page 1150

Products.

CRANES for every service: Electric Traveling, Gantry, Handpower Traveling, Jib, Pillar and Bracket.

For Foundry Equipment, see pages 1150-51.

Types of Whiting Cranes.

ELECTRIC TRAVELING CRANES—From 1- to 250-ton capacity and for every class of service, inside and outside. Designs are based on over 35 years' engineering and manufacturing experience and cranes can be depended on for safe, reliable operation. Built for practically any span, alternating or direct current; cage or floor control. Trolley may be arranged for handling clamshell bucket or lifting magnet.

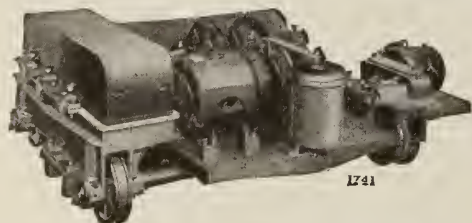
Main Features—No overhanging gears. All gears on trolley run in oil in dustproof cases. All gears of steel, cut teeth. Bearings on trolley all bronze bushed. Through bolts used throughout. Wiring in iron conduit. Dependable electric and mechanical brakes. Positive limit switch prevents overtravel of hook. Footwalk with hand rail full length of bridge. All wearing parts readily accessible. Substantial rigid construction throughout.

Data for Quotations—In requesting prices please give the following:

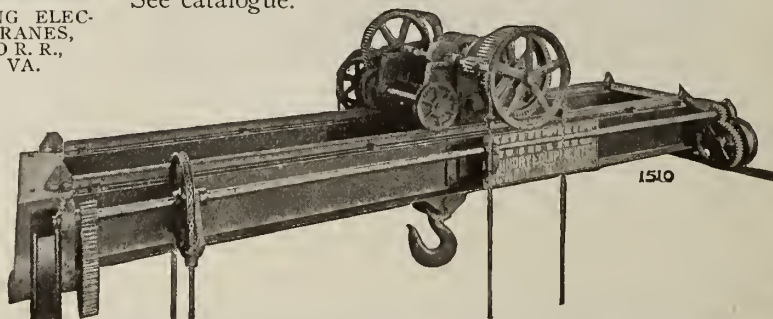
- (1) Capacity in net tons.
- (2) Class of service and whether inside or outside.
- (3) Kind of electric current available.
- (4) Clearance dimensions (refer to diagram



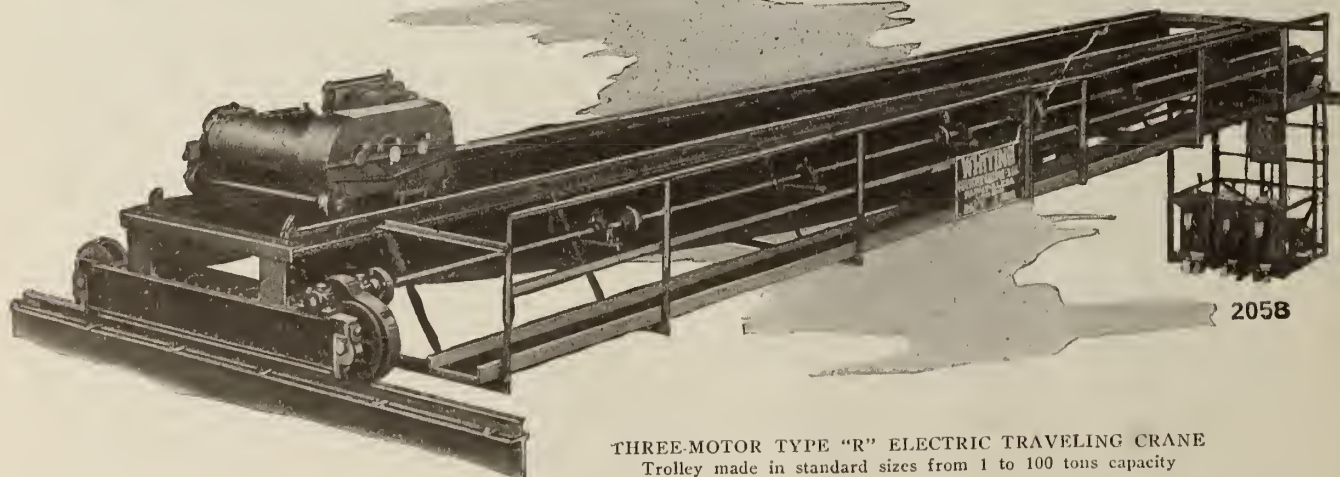
TWO 150-TON WHITING ELECTRIC TRAVELING CRANES, CHESAPEAKE & OHIO R. R., HUNTINGTON, W. VA.



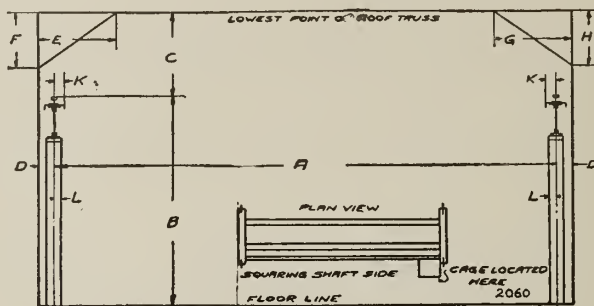
TYPE "R" ELECTRIC CRANE TROLLEY
All gears totally enclosed, running in oil



DOUBLE I-BEAM HANDPOWER TRAVELING CRANE
Rope drum trolley. Operated by hand chains. Two hoisting speeds



THREE-MOTOR TYPE "R" ELECTRIC TRAVELING CRANE
Trolley made in standard sizes from 1 to 100 tons capacity



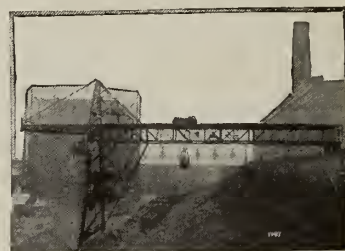
CLEARANCE DIAGRAM, ELECTRIC TRAVELING CRANE

above): (a) Span, center to center runway rails; (b) Lift, floor to rails; (c) Overhead clearance; (d) End clearance; (e, f, g, and h), if there are any braces.

GANTRY CRANES—Numerous designs; varying capacity and span.

HANDPOWER TRAVELING CRANES—Various types, 1- to 40-ton capacity, both single and double I-beam bridges.

JIB, PILLAR AND BRACKET CRANES—Wide variety, both handpower and electric. See catalogue.



WHITING BUCKET HANDLING GANTRY CRANE UNION GAS & ELECTRIC CO., CINCINNATI, OHIO

138 ft. 9-in. span with 43 ft. 9-in. cantilever

THE BARBER-FOSTER ENGINEERING CO.

Manufacturers of Cranes and Hoists

602-603 Sweetland Building
CLEVELAND, OHIO

SALES OFFICES

DETROIT, MICH., 423 Dime Bank Building
NEW YORK, N. Y., 39 Cortlandt Street

SAN FRANCISCO, CAL., 720 Merchant's Exchange Building

CHICAGO, ILL., 343 South Dearborn Street
PITTSBURGH, PA., 5086 Jenkins Arcade Building

Products.

MONORAIL HOISTS, BUCKET HOISTS and MONORAIL SYSTEMS; ELECTRIC TRAVELING CRANES, Wall, Jib and Gantry.

Special hoisting equipment designed to suit unusual needs.

Advantages.

American electric hoists and cranes are built for the hardest service under the most severe conditions.

The hoisting unit is so constructed that it is readily adaptable to any standard monorail runway or crane, as well as an infinite variety of special mountings and crane combinations with capacities ranging from $\frac{1}{2}$ to 10 tons.

With a wide range of hoisting and traveling speeds there is an economical hoist and crane for every need.

Single I-beam Crane with Floor Control.

The end trucks are of semisteel or steel castings as may be required of I-beam section with U-shape ends, having a bearing on both sides of track wheel. Bearings are fitted with Hyatt rollers with caps so that they are easily removable, and the load is supported equally on the two bearings of each wheel.

Standard Monorail Hoist.

The totally enclosed construction renders the hoist especially adaptable to outside service or in places where the machine is exposed to acid fumes and dust. All gears and pinions are cut from solid bar stock or forgings, heat treated and hardened. Shafting is hardened

and ground at the bearings, which are equipped throughout with standard type Hyatt roller bearings, eliminating friction, and increasing the lift of the hoist many fold. The gear case is filled with transmission grease and provided with inspection covers. This hoist is furnished in 1- or 2-motor for floor operation or remote control, with an operator's cab attached.

3-Motor Bucket Hoist.

Consists of a structural framework with two 4-wheeled supporting trucks mounted at each end and arranged to swivel on ball bearings. The rear or driving truck is arranged to drive through all four wheels.

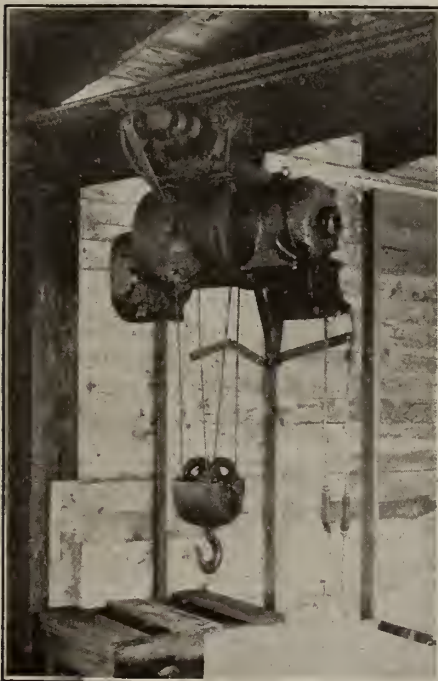
The hoisting mechanism consists of two standard hoisting units, base mounted on the top of the structural frame. One unit arranged for closing the bucket and the other for hoisting by means of 1 or 2 lines. Capacities, $\frac{3}{4}$ to 2 yds.

3-Motor Traveling Crane.

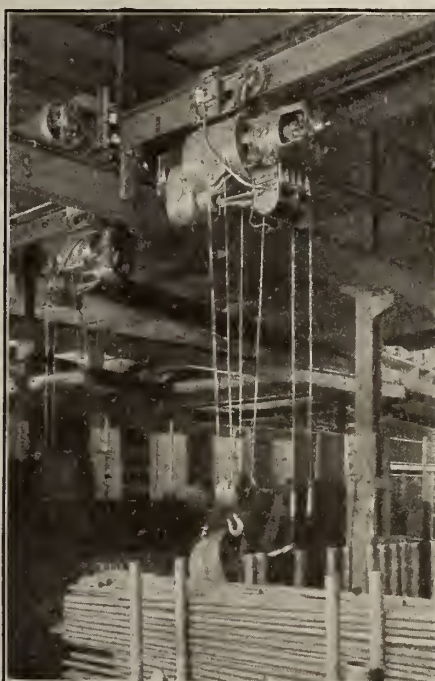
Equipped throughout with Hyatt bearings running on hardened and ground shafting and wheel axles. Machine totally enclosed, including motors, both A. C. and D. C.



2-MOTOR HOISTING TROLLEY USED ON 3-MOTOR TRAVELING CRANE



STANDARD MONORAIL HOIST



SINGLE I-BEAM CRANE WITH FLOOR CONTROL



3-MOTOR BUCKET HOIST

THE EUCLID CRANE & HOIST CO.

EUCLID, OHIO

Products.

ELECTRIC HOISTS; ELECTRIC MONORAIL TROLLEYS;
ELECTRIC TRAVELING CRANES.

Hand Power Traveling Cranes; Electric Wall and Jib Cranes.

Euclid Hoists.

Designed and built by men who have spent their lives in the study and manufacture of hoisting machinery. The result of their experience is shown in the simplicity, strength and durability of their output.

The use of Euclid electric hoists has become practically universal. Machine and structural shops, foundries, warehouses, railways and all sorts of industrial plants are installing these labor saving devices.

FRAME—A single casting, containing all the shaft bearings, insuring permanent alignment of the shafts, as there are no loose bearings bolted on.

GEARS—Large and substantial, all of steel with machine cut teeth. There are three reductions of gears, all being entirely enclosed with oil bath lubrication.

BEARINGS—Ample size to prevent heating or rapid wear under hardest service. Bushed with renewable phosphor bronze. All hoist shaft bearings are provided with compression grease cups.

BRAKE—Disc type, and so designed that no motor brake is required on the smaller sizes. Pawls or retaining band are not required as the center plate is stationary during hoisting and lowering movements. A patented arrangement of gear and cam plate causes motor gear to drive intermediate gearing direct with brake released while hoisting. No strain on brake. Intermediate pinion acting on cam automatically sets brake immediately, when hoisting movement ceases. The load brake is entirely enclosed and runs in an oil bath.

HOISTING DRUM—Heavy iron casting, machine cut grooves, of sufficient size to take all hoist cable without overwinding.

A LIMIT ATTACHMENT—Of the lever type, furnished on all floor control hoists. Acts on controller, returning to neutral position, or automatically reversing before hook block can run high enough to do any damage.

CONTROLLER—This is the drum type, which has proven most satisfactory for hoist work. Drum is mounted on a square shaft, furnished with renewable phosphor bronze bushings; one in each end of frame. Contact segments are exceptionally large and heavy and reversible; when one end is worn so as not to operate satisfactorily, the other end can be used. These segments are made from pure copper, thoroughly insulated, which eliminates short circuits or grounds.

Fingers consist of heavy rolled brass contact tips secured to flat spring steel strips. Fingers are of the non-stubbing type and are rigidly mounted on an asbestos wood base, giving thorough insulation from the frame.

All controller parts are jugged and interchangeable.

All direct current controllers have a powerful blow-out magnet to prevent injurious arcing when circuit is opened.

With variable speed controllers, resistance made up of individual coils in cartridge form, is furnished. A special high resistance non-corroding wire is used,

wound on heavy, hard asbestos tubes. No inflammable material used in either controller or rheostat.

ADVANTAGES—All Euclid hoist details are strictly interchangeable and are made from the highest grade materials by skilled workmen.

All parts of the machine are accessible.

Substantial *through* bolts in carefully reamed holes are used.

As all parts of standard hoists are carried in stock, shipments are made promptly.

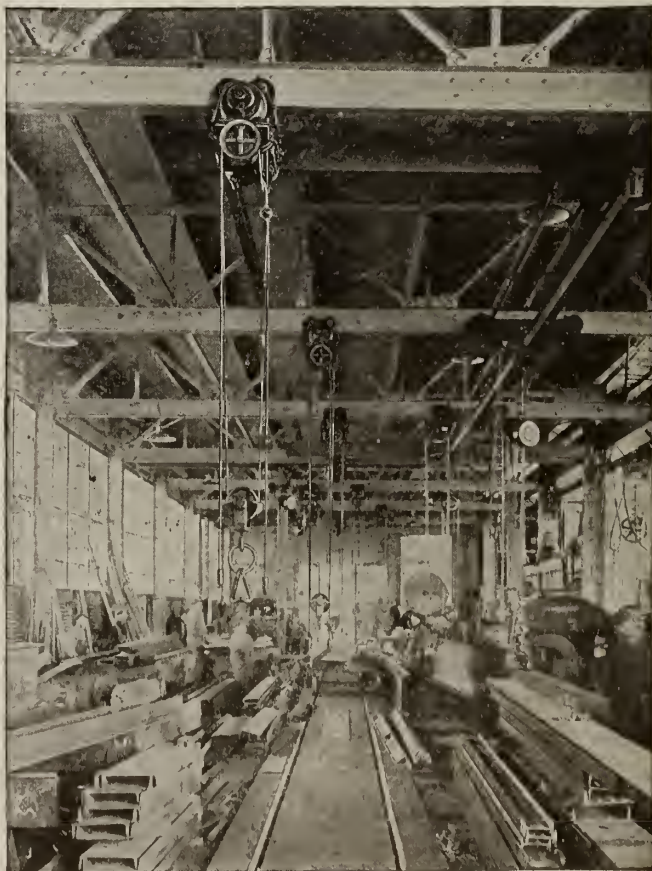
QUOTATION DATA—When writing for quotations, give as complete information as is possible. The following data is essential:

Maximum load and usual working load. Current to be used; if direct, state the voltage; if alternating, the voltage, phase and cycles. Capacity, maximum height of lift. Size of I-beams comprising the monorail track. State whether there are curves, switches, or turntables in the monorail track. Whether single speed or variable speed control of the hoist motor is needed. Style of hoist wanted and service required of same.

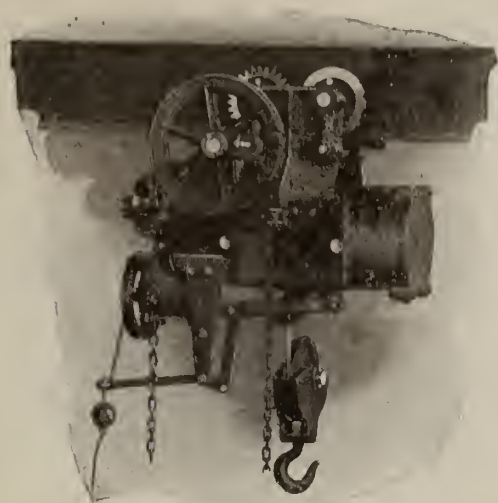
Euclid Cranes.

This company also manufactures electric traveling cranes from $\frac{1}{2}$ to 15 tons capacity, in spans not exceeding 70 ft. This line comprises 1-, 2- and 3-motor cranes, single and double girder types and both floor and cab control.

High grade material, sturdy, rugged design, simplicity, accessibility and elimination of all complicated and unnecessary parts are features of Euclid cranes. Crane literature will be mailed on application.

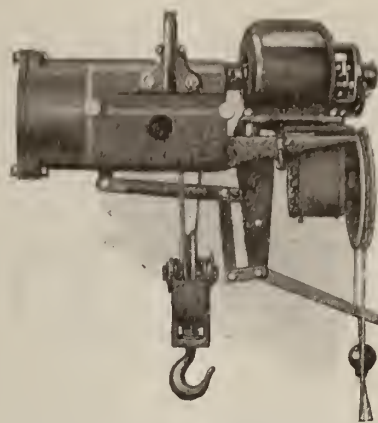


A TYPICAL EUCLID HOIST INSTALLATION IN A LARGE STRUCTURAL PLANT



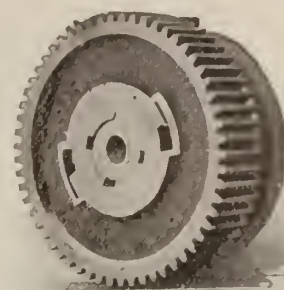
EUCLID STANDARD TYPE "D" GEARED TROLLEY ELECTRIC HOIST

Antifriction roller bearings in track wheels make this hoist travel very easily



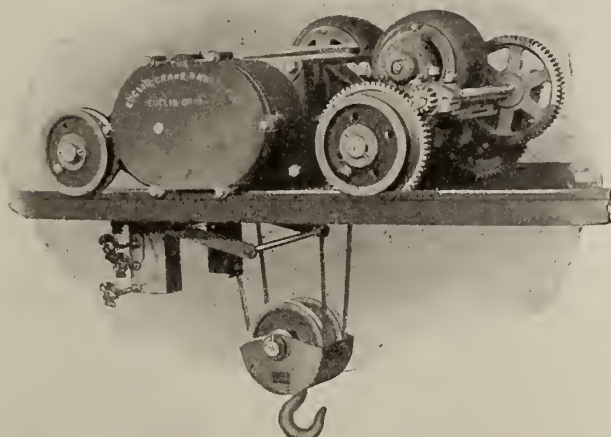
EUCLID STANDARD TYPE "A" ELECTRIC HOIST

Can be installed wherever an ordinary chain block can be used



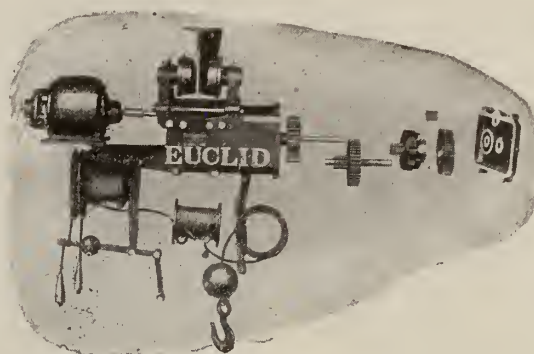
EUCLID AUTOMATIC LOAD BRAKE

Note coarse pitch, wide face gearing and rugged construction

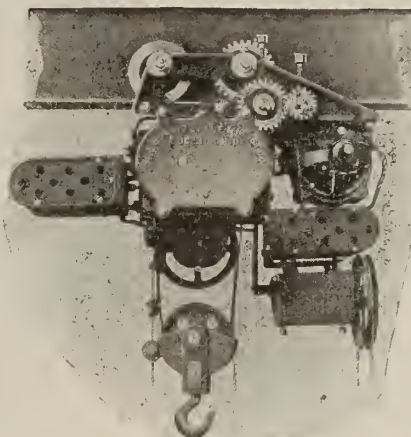


EUCLID STANDARD TYPE "C" TROLLEY HOIST OR CRANE

Oil bath lubrication of all hoist gears. Phosphor bronze bushed throughout

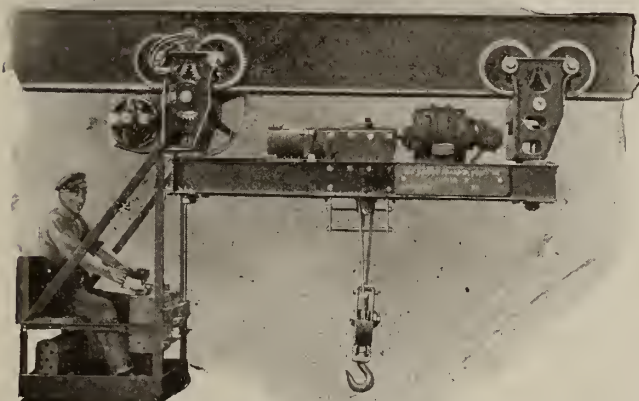


VIEW OF STANDARD EUCLID HOIST, SHOWING ACCESSIBILITY OF ALL PARTS



EUCLID STANDARD TYPE "F" MOTOR DRIVEN TROLLEY HOIST

Traveling movement, as well as hoisting, electrically driven



STANDARD TYPE "G" DOUBLE TRUCK MONORAIL HOIST

Trolley frames heavy steel casting. Bearings phosphor bronze bushed, and lubrication provided by compression grease cups

Service and Guarantee.

The purchaser of a Euclid hoist has the assurance that he is buying the most modern type of hoisting equipment, backed by a sound, permanent organization that is in a position to render the service demanded by progressive manufacturers.

THE EUCLID CRANE & HOIST Co. agree to replace without charge f.o.b. their plant at Euclid, Ohio, any part of a Euclid hoist or crane that proves defective in material or workmanship within one year from date of putting machine in operation.

THE YALE & TOWNE MFG. CO.

Manufacturers of Hoisting Equipment, Locks and Hardware

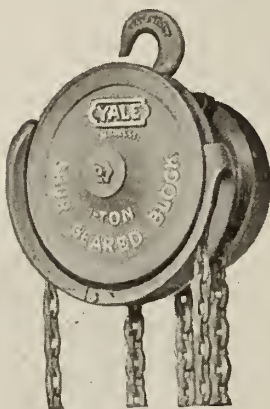
NEW YORK, N. Y.

Products.

CHAIN BLOCKS; ELECTRIC HOISTS; BUILDERS' HARDWARE: PADLOCKS, NIGHT LATCHES, CABINET and TRUNK LOCKS, DOOR CLOSERS, BANK and SAFE LOCKS, POST OFFICE LOCK BOXES.

Yale Chain Blocks.

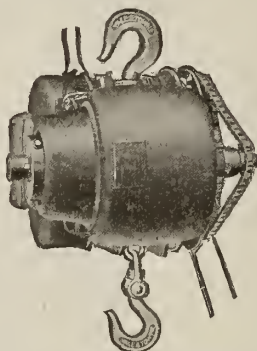
This company is the largest maker of chain blocks in the world. The line includes the Yale Spur-gear, Screw-gear and differential types, in sizes ranging from ¼ to 20 tons capacity. Absolute safety in operation and ease of handling due to the mechanically sound design, make the Yale Hoists superior. Every Yale Block must pass the final test of 50% overload in long tons before it is shipped.



CHAIN HOIST

Yale Electric Hoists.

In sizes of ½ to 5 tons capacity inclusive, Yale Electric Hoists give 5 to 10 times the speed of hand hoists at small cost. Made for all standard electrical specifications with wire rope suspension for especially heavy service.



ELECTRIC CHAIN HOIST

Yale Builders' Hardware.

Embraces every kind of a lock and nearly every article of hardware required for the equipment of buildings, from a cottage to the highest type of residence and office or public building work.

Yale Padlocks.

Include all grades from the highest to the lowest which are fit for use, in bronze, brass, steel and iron, including padlocks for every purpose.

The cheaper types have from 6 to 36 key changes; medium grades up to 144 changes; the highest grade upwards of 25,000 changes, the difference representing one of its greatest elements of security.

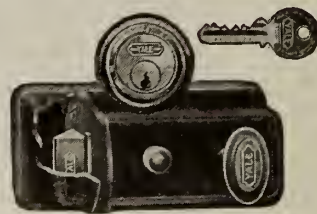
Yale Night Latches.

Embrace a variety to meet all conditions. For entrance doors as added security, or the sole lock on doors of outbuildings, construction houses, closets, etc. Made



in inexpensive
warded construction
with few key
changes up to

the cylinder type with practically unlimited changes, and with the deadlocking device as added security.



NIGHT LATCH

Yale Cabinet and Trunk Locks.

Include a grade and size adapted for every use and locks of special design on motor cars.

For desks, chests, cupboards, lockers, etc., where greatest security is desired, the pin-tumbler lock is to be preferred. The lever tumbler type offers satisfactory security against picking or accidental interchange of keys and is also largely used for similar purposes in cabinet work of all kinds.



CABINET LOCK

Yale Door Closers.

The best known and longest established in the world. The line includes overhead closers of all sizes, single and double acting floor hinges and screen door closers suitable to apply to either right- or left-hand doors without adjustment.



DOOR CLOSER

Yale Bank and Safe Locks.

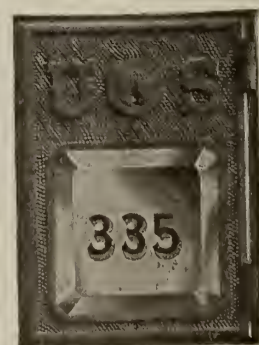
The oldest makers of bank locks in America and the largest in the world. The line includes time locks, combination and dial locks, safe deposit locks, Sub-Treasury locks and every form of lock used by safe makers and bank vault engineers.



SAFE LOCK

Yale Post Office Lock Boxes.

The original manufacturers of metallic front post office lock boxes for the U. S. Government. Their use has extended to the postal service of nearly all civilized countries, and they are also extensively used in club houses.



POST OFFICE LOCK BOX

Factory Equipment.

Planning for industrial plants can best be accomplished in consultation with this company's experts, whereby the fullest advantages of a Yale master key system can be secured.

Catalogues, etc.

THE YALE & TOWNE MFG. CO. will furnish catalogues, estimates and information to anyone interested in Yale products.



ESCUTCHEON



PADLOCK

ALVEY MANUFACTURING COMPANY

Conveying and Elevating Machinery

ST. LOUIS, MO.

BRANCH OFFICES

NEW YORK, N. Y. DETROIT, MICH.
LOS ANGELES, CAL. CLEVELAND, OHIO

CHICAGO, ILL. •
SEATTLE, WASH.

BOSTON, MASS.
BUFFALO, N. Y.

SAN FRANCISCO, CAL.
PHILADELPHIA, PA.

Products.

AMCO BALL BEARING GRAVITY CONVEYORS;
AMCO BELT CONVEYORS; AMCO ROLLER SPIRALS;
AMCO ALL-STEEL OPEN and ENCLOSED TYPES SPIRAL
CHUTES; AMCO AUTOMATIC VERTICAL ELEVATORS;
AMCO APRON CONVEYORS; AMCO POWER CONVEYORS;
AMCO PORTABLE ADJUSTABLE INCLINE CONVEYORS.

Ash Hoists, Bucket Conveyors, etc.

TRADE
AMCO
MARK

Amco 'Conveying and Elevating Machinery.

Designed and built to meet the individual conditions of practically any industry. Will handle rapidly, safely and economically any product in any form. Every part made of best material, by expert mechanics, under experienced engineers, in a modern plant.

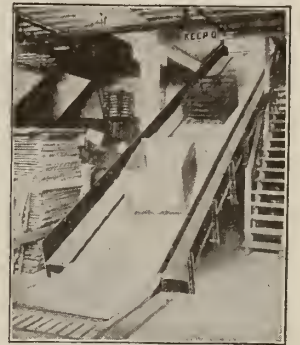
Amco trained conveyor experts are at the disposal of those interested.



AMCO GRAVITY CONVEYOR AND
BOOSTER APRON ELEVATOR



AMCO BALL BEARING PORTABLE GRAVITY
CONVEYOR



AMCO AUTOMATIC RE-
VERSIBLE INCLINE
APRON CONVEYOR FOR
RAISING AND LOWERING



AMCO SPIRAL CHUTE
Single blade, open type. Also
made in enclosed type and with
multiple blades in either type



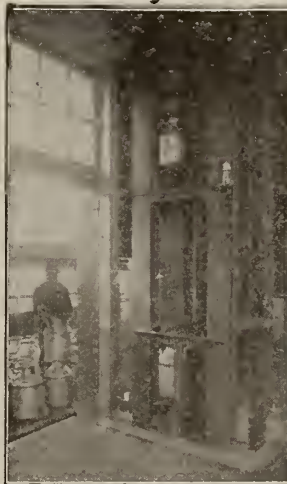
AMCO PORTABLE ADJUSTABLE INCLINE BELT
CONVEYOR FOR COAL, SAND, GRAVEL, ETC.



AMCO ROLLER SPIRAL
Note large storage capacity on conveyor
This installation is in a prominent glass
factory



AMCO POWER APRON CONVEYOR



AMCO AUTOMATIC VER-
TICAL ELEVATOR



AMCO BELT CONVEYOR

THE ALVEY-FERGUSON COMPANY, INC.

Gravity and Power Conveyors and Coal and Ash Handling Machinery

CINCINNATI, OHIO

BRANCH OFFICES

NEW YORK, N. Y., 1501 World's Tower Building

BOSTON, MASS., 713-14 Old South Building

CHICAGO, ILL., 748 Railway Exchange Building

ROCHESTER, N. Y., 727 Chamber of Commerce Building

LONDON, ENGLAND, 147 Holborn, E. C. I.

DETROIT, MICH., 762 Book Building

LOS ANGELES, CAL., 234 Marsh-Strong Building

ATLANTA, GA., 510 Gould Building

MONTREAL, CANADA, 416 Phillips Place

Products.

Manufacturers of CONVEYING MACHINERY:

Gravity Conveyors; Power Conveyors; Apron and Belt Conveyors; Portable Horizontal and Inclined Apron Conveyors and Pilers; Stackers; Wagon Loaders; Coal and Ash Conveying Systems; Automatic Inclined and Vertical Elevators; Ash Elevators; Spiral Conveyors and Steel Merchandise Chutes; Complete Package or Bulk Conveyors of every description.



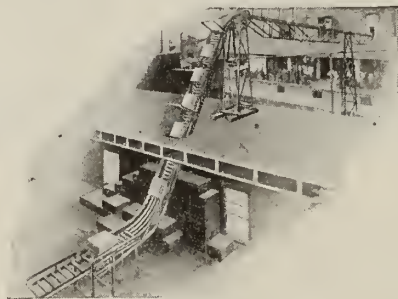
Designing and Co-operative Service.

A complete Engineering Department in charge of experienced and capable conveyor experts is at the disposal of engineers, architects, contractors and plant owners. Plans are made without obligation covering individual requirements and suggestions with estimates freely furnished

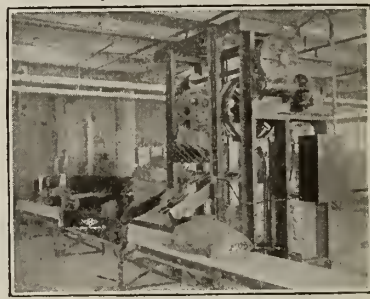
on efficient and complete handling systems for any factory, warehouse, pier, powerhouse or industrial plant. Write the nearest Branch or the Home Office, Cincinnati, Ohio.



AF CONVEYORS IN NAILING DEPARTMENT



AF AUTOMATIC INCLINED ELEVATOR



AF VERTICAL ELEVATOR AND BELT CONVEYOR



AF OPEN SPIRAL CHUTE



AF APRON WASH-TANK CONVEYOR



AF PORTABLE APRON CONVEYOR
Moving sacks of sugar in a warehouse



AF PORTABLE ADJUSTABLE APRON CONVEYOR



AF COAL AND ASH HANDLING SYSTEM



AF PORTABLE STACKER AND PILER

AMERICAN STEAM CONVEYOR CORPORATION

Ash Handling Engineers

326 West Madison Street
CHICAGO, ILL.

110 West 40th Street
NEW YORK, N. Y.

ENGINEERING AND SALES OFFICES IN ALL PRINCIPAL CITIES

Products.

AMERICAN STEAM ASH CONVEYORS.

Ash Pit Doors, Locomotive Cinder Pit Ejectors, Locomotive Sand Handling Systems, Marine Ash Ejectors, Special Hard Metal Castings.

Scope of Use.

For the economical handling of ashes, combustion ashes, soot, blast furnace dust, coal siftings, etc., from boiler or furnace room to any point desired.

Construction and Operation.

An American Steam Ash Conveyor consists of a heavy pipe line made of hard new pig iron and special patented fittings with removable hard metal wear parts. This pipe line is installed in the boiler house and ash intakes are located at the most convenient points. The installation requires only enough space for a 6-in. or 8-in. pipe line.

Systems are made in units, 4, 6 and 8 in. in diameter. 6-in. diameter and smaller sizes are used for conveying soot from economizers, breechings, combustion chambers of boilers, and coal siftings from stokers.

One man rakes the ashes into an intake conveniently located. He turns a valve, the suction of a steam jet shoots the ashes through a pipe, 100 ft. up if required, 100 to 300 ft. away, to pit, pile, overhead hopper, car, wagon—anywhere desired.

Advantages.

Old and new plants, hand and stoker fired, are easily equipped with American Steam Ash Conveyors. Little space is

required and installation in every condition can be met. Delivery of ashes may be vertically, horizontally, or around corners to any point desired.

The use of an American Steam Ash Conveyor releases from 1 to 6 men to engage in labor more productive to their employer.

Cost.

The first cost is low. Installation is simple, and valuable space is not taken up. The steam consumption is inconsiderable and the stamina of the conveyor is such that repairs or replacements of parts are seldom necessary and entail very little work, which can be quickly and easily done under the direction of the house engineer.

Service.

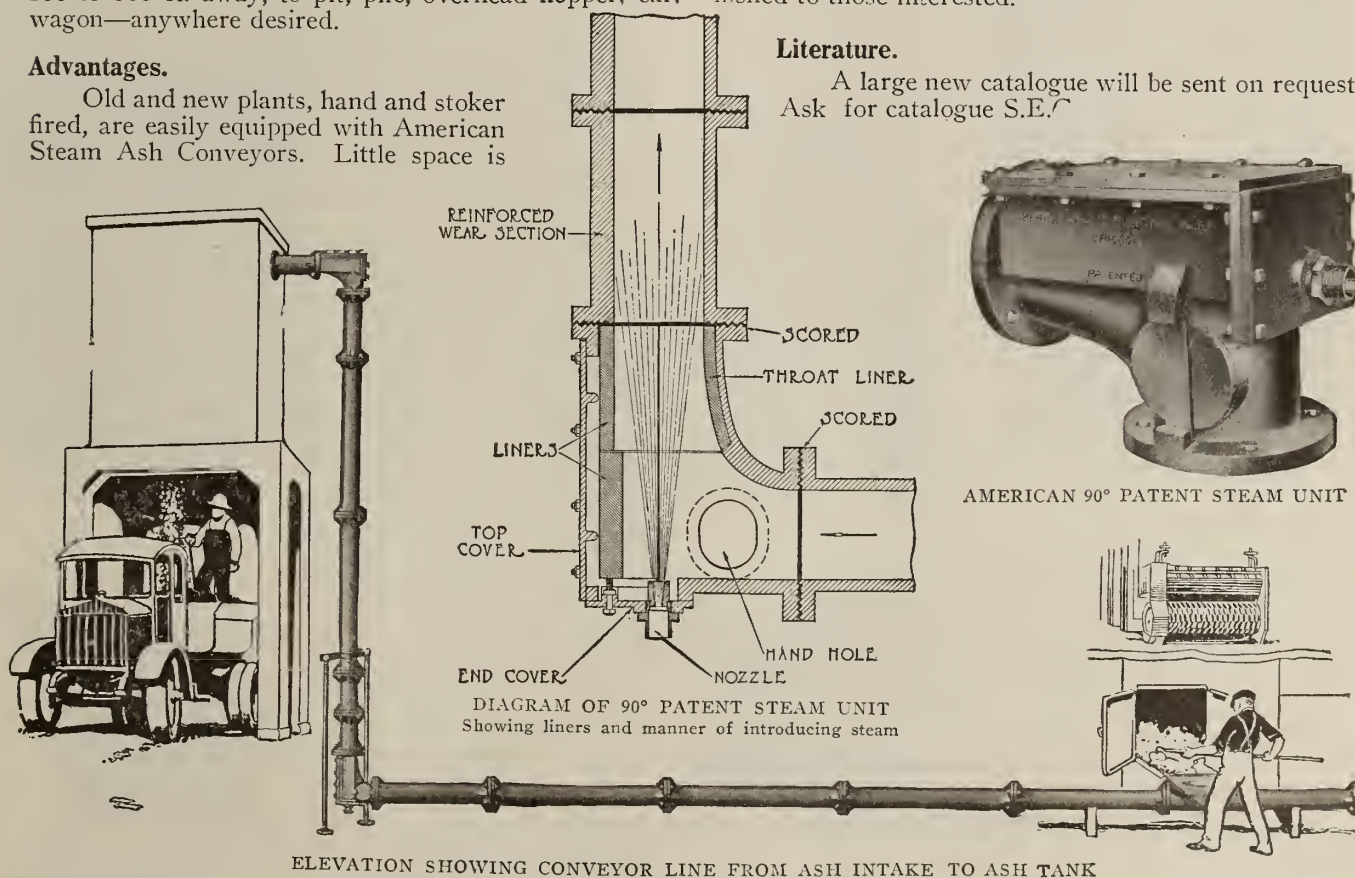
The great success of American Steam Ash Conveyors is the direct result of scientific experiment and exhaustive tests by the engineers of this corporation. Experts in ash handling give each contract personal attention.

Installations.

1000 American Steam Ash Conveying Systems are in daily use in this country and Canada. One of these plants is located near you, and the address will be furnished to those interested.

Literature.

A large new catalogue will be sent on request. Ask for catalogue S.E.



THE C. O. BARTLETT & SNOW CO.

Equipment for the Handling and Preparation of Material

MAIN OFFICE AND WORKS
CLEVELAND, OHIO

Products.

ELEVATING and CONVEYING MACHINERY; DRYERS; SKIP HOISTS; CRUSHERS; PULVERIZERS.

Feeders, Screens, Mixers, Sintering Plants, Oil and Grease Extraction Equipment, Garbage Reduction Plants, Paint Making Machinery, Car Hauls, Special Cars.

Elevating and Conveying Machinery.

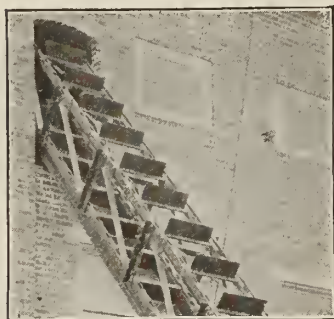
Bartlett & Snow elevating and conveying machinery



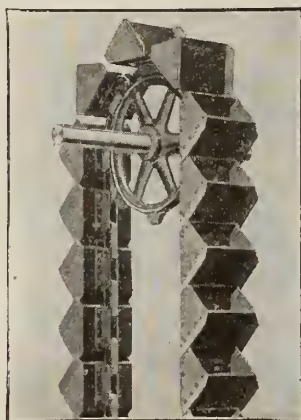
BOILER ROOM OF EASTMAN KODAK CO. EQUIPPED WITH BARTLETT & SNOW CONVEYORS

is well fitted for all conditions which demand economy and dependability.

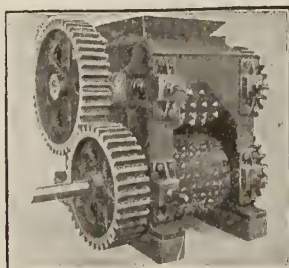
We build bucket elevators and conveyors, flight conveyors, and apron, belt and screw conveyors.



FLIGHT CONVEYOR



BUCKET ELEVATOR

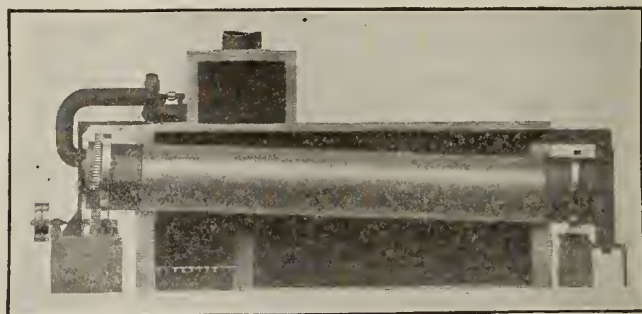


FOUR ROLL COAL CRUSHER

Dryers.

Bartlett & Snow dryers comprise 13 distinctly different types, each one of which has been developed for the proper and economical drying of a certain class of materials.

Among these 13 types there are direct fired direct heat dryers, direct fired indirect heat dryers, direct fired single pass dryers, direct fired double pass dryers, steam heated dryers and hot air dryers.



STYLE D DRYER, ONE OF THE 13 TYPES

Skip Hoists.

When conditions are severe, and bucket elevators may be subject to excessive wear and to breakdowns, or where lifts are high or capacities large, skip hoists, because of their ruggedness, simplicity, and low power consumption, will be found remarkably economical and dependable.

Power plants, steel mills, sintering plants, mines, and chemical plants can use Bartlett & Snow skip hoists to advantage for elevating coal, coke, ashes, limestone, flue dust, slag, ores, and other gritty material.



INCLINED SKIP HOIST

Coal Crushers.

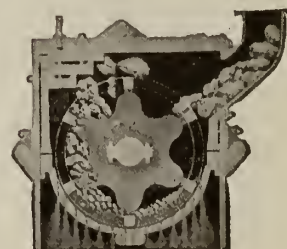
Bartlett & Snow coal crushers include single-roll crushers, two-roll crushers, and four-roll crushers. Wherever you find Bartlett & Snow coal crushers used, you will also find low crushing costs, uniformly crushed coal, few replacements, and absolutely no breakdowns.

Bartlett & Snow coal crushers are described in Bulletin 42.

Gardner Crusher Pulverizers.

These pulverizers are built for crushing materials of medium hardness. They take relatively little power, most of the crushing being done by the impact of the material against the crusher blocks.

Gardner crusher pulverizers are built in 4 sizes and are fully described in Bulletin 42.



GARDNER CRUSHER PULVERIZER

FOUNDED 1880

THE BROWN HOISTING MACHINERY CO.

Manufacturers of Coal and Ash Machinery and Bins

MAIN OFFICE AND WORKS
CLEVELAND, OHIO

BRANCH OFFICES

NEW YORK, N. Y., 50 Church Street
CHICAGO, ILL., 208 South La Salle Street

PITTSBURGH, PA., Oliver Building
SAN FRANCISCO, CAL., Monadnock Building
EUROPEAN REPRESENTATIVE, H. E. HAYES, 12 Rue de Phalsbourg, PARIS, FRANCE

Products.

BROWNHOIST PATENT SUSPENDED BIN;
BROWNHOIST COAL AND ASH HANDLING MACHINERY; BROWNHOIST WEIGHING LARRY.

For Locomotive Cranes, see pages 48-49; for Grab Buckets, see pages 64-65.

Brownhoist Patent Suspended Bin.

The Brownhoist patent suspended bin is a concrete bin for storing coal and ashes. It consists of two horizontal steel plate girders supported by upright columns, and from these girders the bin structure is suspended. At intervals of from 3 to 5 ft. steel straps, which are parabolic in shape, are hung from these girders. To the inside of these straps, our patent solid-sheet-steel reinforcement Ferroinclave is bolted, a wooden strip being placed between the Ferroinclave and the straps to prevent corrosion.

When the Ferroinclave is in place, the inside is first coated with concrete, a mixture 1:2:4 of cement,

BROWNHOIST

TRADE-MARK

sand and broken stone, all stone to pass a $\frac{1}{2}$ -in. mesh. The thickness of this lining varies with the span and loading. When this has set, the outside is covered with a mixture 1 to 2 of cement and sand with an addition of a little goat hair.

CAPACITIES—The capacities depend upon the requirements of the customer, but they range from 1 to 15 tons per lin. ft.

ADVANTAGES—This bin lasts a lifetime, as all the steel is protected by the concrete; is fireproof; holds a maximum amount of coal in minimum space; is practically self-emptying; low cost of operation; makes a clean and neat boiler room.

GATES AND SPOUTS—The bin is equipped with Brownhoist gates and spouts. The gates are easily operated from the floor, and are automatically locked when closed and when opened the full width. There are three kinds of spouts: the swinging, the stationary, and the stationary angle—which one to use depends upon requirements of the plant.



VIEW OF BROWNHOIST COAL BIN
SHOWING DISTRIBUTING
SPOUTS

Weighing Larry.

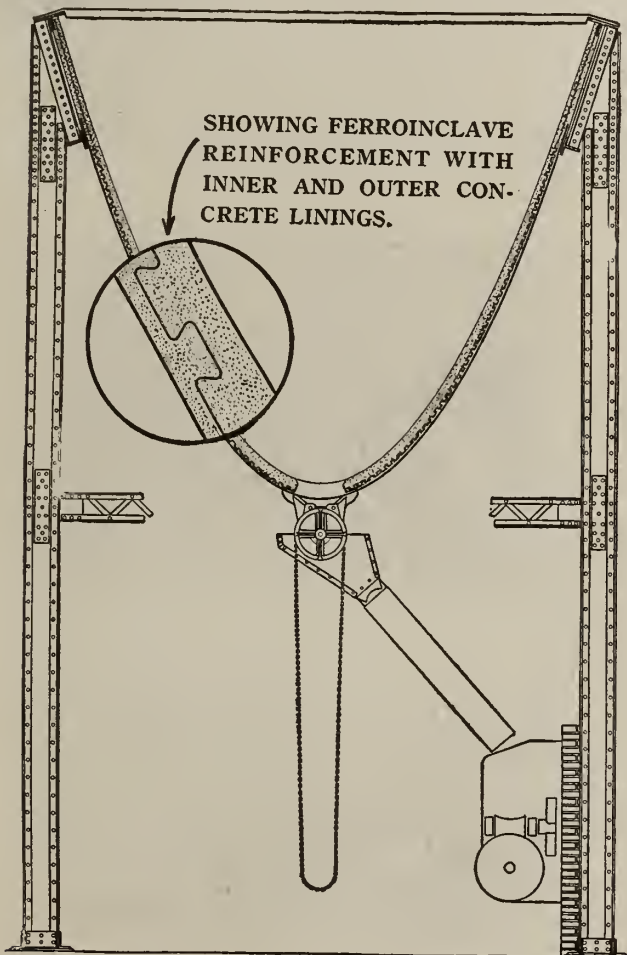
A Brownhoist weighing larry can be put beneath the bin, and it will weigh every pound of coal as it passes to the stokers.

Coal and Ash Handling Machines.

Brownhoist coal and ash handling machines, of various types and designs, consist of the locomotive crane, man trolley, overhead traveling crane, gantry crane, and bridge crane—all used with Brownhoist buckets or tubs.

Estimates, etc.

On receipt of plans and requirements, we will submit estimates on the entire installation in new or old plants. Many views of the bin and machines in use are shown in our catalogue "S."



SECTIONAL VIEW OF BROWNHOIST CONCRETE COAL BIN

BROWN PORTABLE CONVEYING MACHINERY CO.

Portable and Sectional Elevating, Loading and Unloading Machinery

10 South La Salle Street
CHICAGO, ILL.

BRANCH OFFICES

NEW YORK, N. Y.
BOSTON, MASS.

PHILADELPHIA, PA.
SAN FRANCISCO, CAL.

NEW ORLEANS, LA.
CLEVELAND, OHIO

Sales Representatives in the principal cities of the United States and in Foreign Countries

Products.

BELT CONVEYORS for loose materials; PORTABLE and STATIONARY CONVEYORS and ELEVATORS for package freight; VERTICAL TIERING MACHINES for heavy and bulky packages; BOAT, CAR, WAGON and TRUCK LOADERS and UNLOADERS for packed and loose materials.

Scope of Use.

"Brown-Portable" continuous motion machines for the rapid and low-cost handling of packed and loose materials are designed "to fit the job," to handle the general run of sizes and weights of any kind of packed, tied, wrapped, boxed or rolled materials. The "Hand-I-lift" (vertical tiering machine) handles the heavier, bulkier and more irregularly shaped packages; and the belt conveyor practically all forms of loose and bulk materials, such as coal, coke, sand, gravel, crushed stone, loose scrap, broken tile, ashes (not hot), etc.

"Brown Portable" Performance.

Reduces cost of handling from 50% to 80%.

Always ready for use; no expense when not working.

Insurance against scarcity of labor and strikes.

Delivers packages to any height at same cost.

Eliminates danger of breakage of goods in handling.

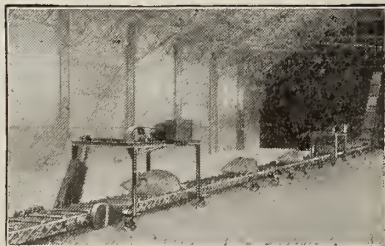
Does not tire men by over-exertion.

Adjustable in delivery height without cutting off power.

Economizes floor space and increases output of plant.



PORTABLE ELEVATOR
PILING BAGS
No handlers between floor
and top of pile



PORTABLE SECTIONAL CONVEYOR
AND ELEVATOR OPERATING
AS ONE MACHINE
Eliminating truckers and stackers

Few wearing parts; simple in mechanism and operation.

Adaptable to all industries handling packed goods.

Power.

Self-contained, either electricity, gasoline, kerosene, air or steam.

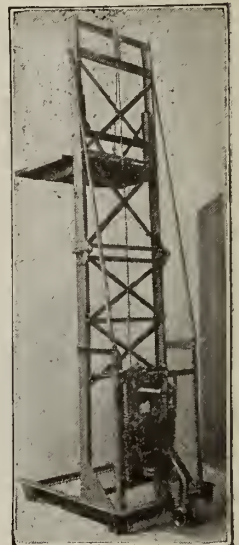
Prices.

Quoted *without obligation* on receipt of details of handling conditions. Ask for Bulletin 140.

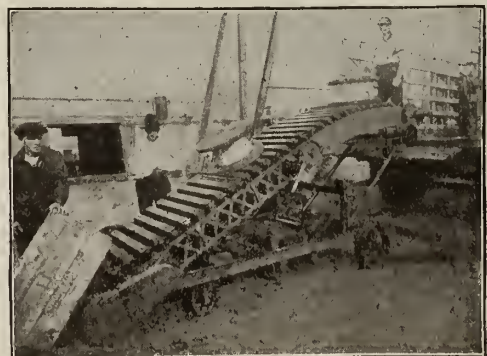
Guarantee and References.

Every machine fully guaranteed.

Used in forty different countries by nationally known industries, by steamship and railroad companies, by municipalities and governments. Names of users in *your industry* on request.



VERTICAL TIERING
MACHINE ("HAND-I-
LIFT") FOR HEAVY
AND BULKY
PACKAGES
Frame folds to permit
passage through door-
ways



TRUCK OR CAR LOADER
Made in many forms to suit local conditions



SELF-PROPELLED ELEVATOR
("AUTO-PILE") FOR
STACKING HEAVY
PACKAGES

Handles all forms of packed goods



SMALL BARGE UN-
LOADER TRANSFER-
RING BAGS FROM
BARGE TO
WAGON



LARGE SELF-PROPELLED BOAT UNLOADER FOR HANDLING
GENERAL CARGO BETWEEN BOATS AND CARS

THE COLUMBUS CONVEYOR COMPANY

Manufacturers of Unloaders, Elevating and Conveying Machinery
COLUMBUS, OHIO

Products.

RECIPROCATING FEEDERS, and CONTINUOUS BUCKET ELEVATORS.

Loading, Unloading, Elevating and Conveying Machinery.

Services.

This company maintains an Engineering Department which is prepared to inspect plants or jobs and render advantageous recommendations and quotations without any obligation on the part of the prospective buyer.

Full and detailed information will be gladly sent on request.

Saving in Expense.

Owing to the low cost of installation, the "Columbus" system of unloading and conveying is within reach of both small and large plants.

The operation of the "Columbus" unloaders is quick and inexpensive, being able to unload at the rate of 40 to 50 tons per hour at an average expense of 3¢ per ton or less on any loose materials.

"Columbus" Reciprocating Feeder.

CONSTRUCTION—The frame is constructed of heavy steel channel and angles with all parts securely riveted together. The feeder box is of heavy steel plate and angles, and oscillates 9 in. through 2½-in. drop forged crank shaft and 3-in. connecting rod.

POSITION—The feeder is placed directly beneath the railroad rails between ties, and the material is gravitated into same through hopper of railroad car.

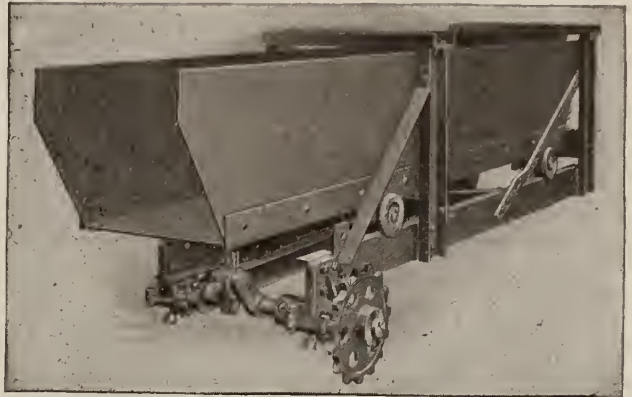
SAVING IN WEAR—By its use the load is automatically regulated and the material is fed directly into the continuous bucket elevator, thus eliminating the excessive wear incident to the buckets scooping their load, as well as relieving balance of machinery from much strain.

SIZES—Made in different sizes to accommodate the grade of materials handled and the capacity desired.



COKE BEING FED DIRECTLY INTO BUCKETS OF CONTINUOUS BUCKET ELEVATOR BY THE "COLUMBUS" RECIPROCATING FEEDER

The all-steel service chute gives wider distribution



"COLUMBUS" RECIPROCATING FEEDER

"Columbus" Continuous Bucket Elevator.

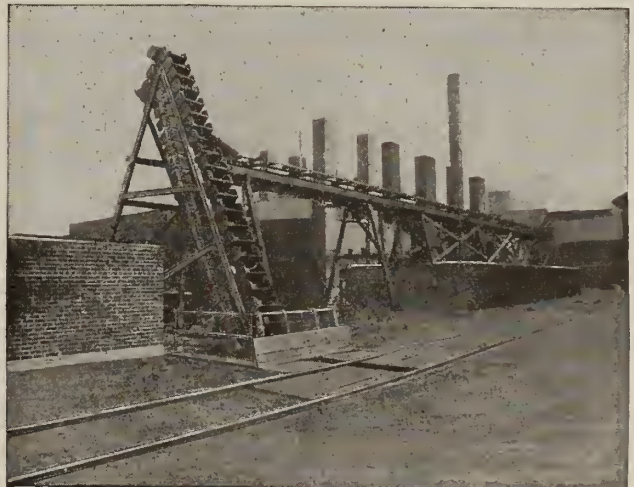
FRAME—All-steel construction side frames and cross members of 6-in. 8-lb. channel, securely riveted. Fitted with all necessary take-ups, bearings, idler pulleys, etc.

The jack shaft is equipped with jaw clutch which allows feeder to remain idle, if desired, while elevator is in operation.

Elevators are constructed in standard sections with ample provision for extensions as desired. They can be operated satisfactorily on incline from horizontal 45° to 70°, and can be adapted to almost any condition.

BUCKETS—Made of Armco iron for handling lump or steam coal, as much longer service is insured than if they were made of steel. Size of bucket, as well as the grade of material handled, governs gauge of stock. All buckets are carried by two strands of heavy chain, each link of which has a working test of better than 3000 lbs. Each bucket is bolted to chain through two attachments carrying four bolts each. When steeper incline of elevator is necessary, specially designed buckets are provided.

CONVEYOR—Made in different sizes and any lengths to meet all conditions. All-steel construction used throughout, and built exceptionally strong for long, continuous service.



"COLUMBUS" CONTINUOUS BUCKET ELEVATOR FEEDING INTO ALL-STEEL DRAG CONVEYOR WHICH CONVEYS MATERIAL IN FRONT OF STILL'S FOR THE OIL REFINERY

DOW WIRE AND IRON WORKS

Engineers and Manufacturers of Gravity and Power Conveyors

Franklin, Buchanan and Pocahontas Streets

LOUISVILLE, KY.

Products.

GRAVITY ROLLER CONVEYORS, STEEL SPIRAL CHUTES, BELT CONVEYORS, SLAT CONVEYORS; INCLINED and VERTICAL ELEVATORS.

Apron Conveyors, Chain Conveyors, Portable Pilers and Special Conveyors.

Service.

This company places at the disposal of engineers, architects and prospective users, the services of a skilled Engineering Department experienced in all manner of conveying problems. There is no charge for drawings and detailed information covering individual conveyor layouts.

Scope of Use.

Dow conveyors speed up production, eliminate expensive and uncertain labor, and save valuable floor space.

Used by factories, foundries, warehouses, whole-

sale houses, department stores, canning and packing plants, lumber and brickyards—in fact, any place where quantities of materials or merchandise of any description must be handled from one place to another.

Gravity Conveyors.

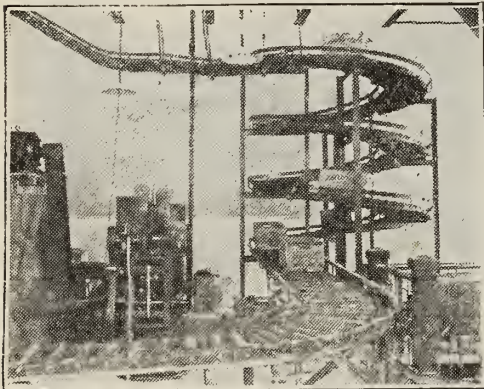
Furnish the ideal means of handling goods wherever they can be used. A grade of 3% to 5%, depending on the nature of the merchandise, is necessary for the operation of gravity conveyors. They require no power or attention of any kind.

Power Conveyors.

Of all descriptions, usually designed to operate in conjunction with gravity conveyors.

Estimates.

In writing for estimates or other data, state dimensions and weights of largest and smallest packages and send drawing or sketch with dimensions indicating points between which goods must be handled.



DOW ROLLER SPIRAL FOR LOWERING PACKAGES FROM ONE FLOOR TO ANOTHER



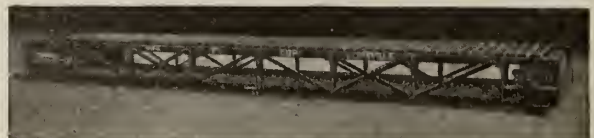
DOW GRAVITY CONVEYOR AND BOOSTER ELEVATOR IN COMBINATION
Elevator receives from and delivers onto, gravity conveyor automatically



PIG IRON HANDLED BY DOW GRAVITY CONVEYOR



DOW BELT CONVEYORS AND OVERHEAD GRAVITY CONVEYORS



DOW PORTABLE SLAT CONVEYOR FOR HANDLING ALL TYPES OF PACKAGES
Particularly useful for sacks



DOW GRAVITY CONVEYOR ON SHIPPING PLATFORM
Note hinged sections

ESTABLISHED 1814

GIFFORD-WOOD CO.**Manufacturers of General Elevating and Conveying Machinery and Ice Tools**

MAIN OFFICE AND WORKS

HUDSON, N. Y.

OFFICES AND STOCK ROOMS

BOSTON, MASS., 51 North Market Street

CHICAGO, ILL., 565 West Washington Street

SALES OFFICES

NEW YORK, N. Y., 30 Church Street

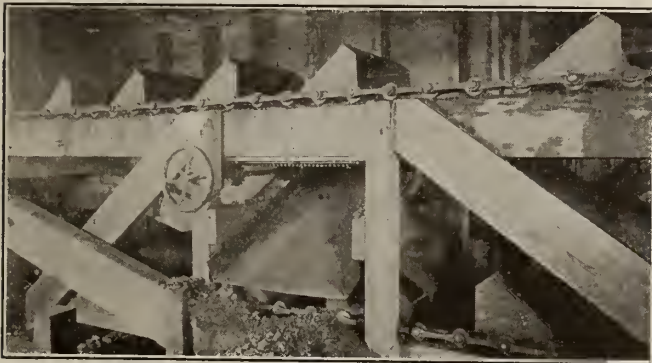
PHILADELPHIA, PA., Widener Building

BUFFALO, N. Y., Electric Building

Products.

ELEVATING and CONVEYING MACHINERY for handling coal, ashes, stone, sand, gravel, ice (natural and manufactured), and bulky materials of all kinds: Coal Handling Machinery, Wagon Loaders, Locomotive Coaling Stations, Ice Elevators, Conveyors and Ice Tools, Apron Conveyors, Warehouse Conveyors.

Also, G-W Pivoted Bucket Carriers, Grain Elevator Machinery, Car Unloaders, Coal Pockets, Bagging Machines for coal and coke, Screens of all kinds, Friction Clutches, Hoists, Icing Station Equipment, Crushed Ice Carts, etc.

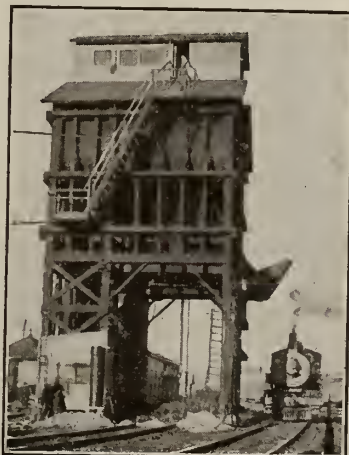
Coal Handling Machinery.

DOUBLE RACK AND PINION GATE WITH TILTING CHUTE, AS INSTALLED FOR ROCKAWAY COAL AND ICE CO., BROOKLYN, N. Y.

Locomotive Coaling Stations.

Dependability is the prime factor in locomotive coaling station equipment. As a breakdown means delay and disruption of the schedule, railroads are careful to choose equipment of a dependable make. Railroad engineers have made an exhaustive study of the various makes of equipment in order to secure the maximum of satisfactory service.

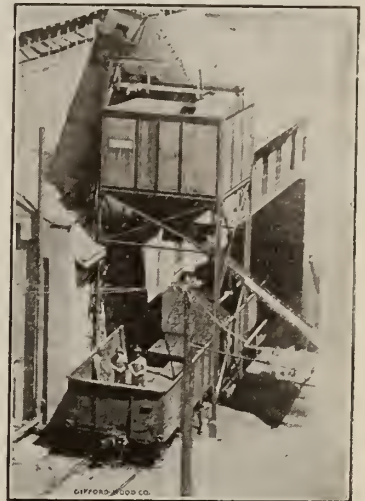
The dependability of Gifford-Wood equipment has led to its adoption by the following representative railroads: New York Central; Canadian Pacific; Boston & Albany; Boston & Maine; Rutland; Ottawa & New York; Chicago, West Pullman & Southern.



ELEVATOR CONVEYOR COALING STATION, INSTALLED FOR THE BOSTON & MAINE R. R. AT NASHUA, N. H.

Coal and Ash Handling Machinery.

The illustration at the right shows the ashes elevator and storage tank. The coal car in the background is placed over the track hopper. An apron conveyor delivers from the hopper to a run-around elevator-conveyor, which in turn delivers to storage bunker and stoker spouts.



ASHES ELEVATOR AND STORAGE TANK, FRENCH LICK SPRINGS HOTEL, FRENCH LICK SPRINGS, IND.

Wagon Loaders.

Handle anthracite and bituminous coal, crushed stone, gravel, sand, clinker, lime, coke, ashes, etc.

The machine illustrated is used for broken (egg, stove, and smaller sized) coal. It reduced the loading time to two minutes, and the handling cost from 25c to 4c per ton.



TYPE "B-6" LOADER WITH FEEDER, ELEM COAL CO., NEW YORK, N. Y.

Warehouse and Factory Equipment.

The wide application of inclined and platform conveyors makes them a valuable asset in any industrial plant, factory, or warehouse.



INCLINED CONVEYOR HANDLING CASED BOTTLE GOODS

Ice Handling Equipment.

CONVEYOR AND ROPE DRIVE CHIP CONVEYOR
The run on the gallery is wide and is provided with two single chains with flights side by side

Services.

This company offers you, free, a distinctive and helpful engineering service in the selection of proper equipment to meet your individual requirements.

THE GODFREY CONVEYOR CO.

Manufacturer of Conveyors

ELKHART, IND.

Products.

COAL and ASH HANDLING MACHINERY.

Engineering Service.

This company maintains an engineering department composed of experts who have had many years' experience in designing coal and ash handling equipment.

Send rough pencil sketch of railroad siding, storage grounds and bins and the engineering department of this company will show exactly what a Godfrey conveyor can do to cut costs.

This service is without obligation on the part of the prospective purchaser.

Adaptability of Godfrey Conveyors.

Godfrey conveyors are adapted for handling all sizes of coal, coke, etc., in an economical and highly efficient manner.

The illustrations show several types, but Godfrey conveyors are equally efficient and adaptable to practically every condition.

They can be successfully installed at any angle or parallel to the railroad siding in heavy cableway or I-beam types, according to conditions.

Coal may be fed into the conveying bucket by gravity through a steel track chute (as illustrated) and then elevated and conveyed to point of dumping. For this method of conveying, a pit is installed. A special pit of this company's design is recommended, which has an opening beneath the rails 6 ft. wide, to take all coal from both sides of side dump cars, as well as hopper bottom cars.

Distinctive Features of Godfrey Conveyors.

ECONOMICAL INSTALLATION AND OPERATION—Godfrey conveyors handle the coal mechanically, thus they greatly reduce labor cost.

Cost of installation is not prohibitive and they effect large savings over other types of conveying systems.

NO BREAKAGE OF FUEL—Godfrey conveyors can

handle all sizes of coal, coke, etc., with practically no breakage or degradation.

This is an exclusive Godfrey feature and saves from 20¢ to 25¢ per ton on this one item alone.

CENTRALIZATION OF CONTROL—Hoist operator controls the entire operation of filling, elevating, conveying, dumping and returning the bucket to the pit for re-loading.

ELIMINATION OF CAR DEMURRAGE—Godfrey conveyors eliminate costly car demurrage due to their speedy and efficient operation.

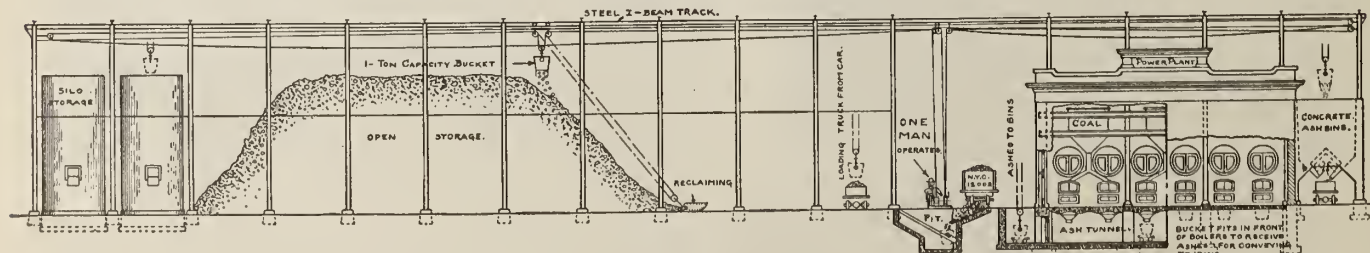
They will unload and store coal practically as fast as received.

HOISTS—These are of Godfrey special design, constructed so as to handle loads at any practical speed.

They are simple, of rigid construction and are mounted on a base, ready to be attached to power, which may be either electric motor, gasoline engine or steam power.

The "new heart" of the Godfrey conveyor is this company's latest hoist, its "fourteen points" being:

- (1) Extreme ease of operation and perfect control by operator.
- (2) Large hoisting drum driven by raybestos-faced cone clutch.
- (3) Wide reversible traction drum driven in either direction by friction pinions.
- (4) Both drums revolve on heavy stationary steel shaft.
- (5) Heavy coil spring for disengaging hoisting drum clutch.
- (6) Adjustable sleeve for taking up clutch wear.
- (7) Wide raybestos-lined brake bands operated from foot pedals.
- (8) All castings carefully milled in the Godfrey factory.
- (9) All gears machine cut.
- (10) Quietness of operation due to elimination of ratchet brake and chain driven gears.



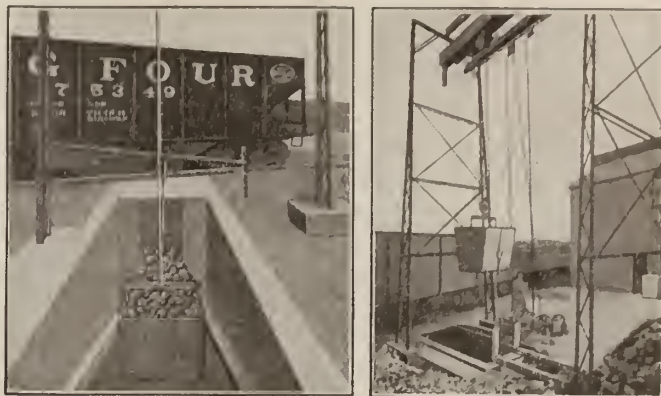
TYPICAL INSTALLATION OF GODFREY COAL AND ASH CONVEYOR

Operator at hoist controls flow of coal through steel railroad track chute to bucket in pit by means of a double action gate. Bucket is quickly filled and without danger of overflow. By means of the hoist, operator elevates bucket (containing 1 ton) to a point beneath trolley above and is then conveyed along a monorail system of I-beam or heavy cableway to point of dumping. Bucket is dumped automatically, a trip releasing the bi-section bottom by coming in contact with the coal pile, or, where speed is of more importance than breakage of coal, bucket can be tripped from movable trip member overhead, allowing coal to fall from bucket.

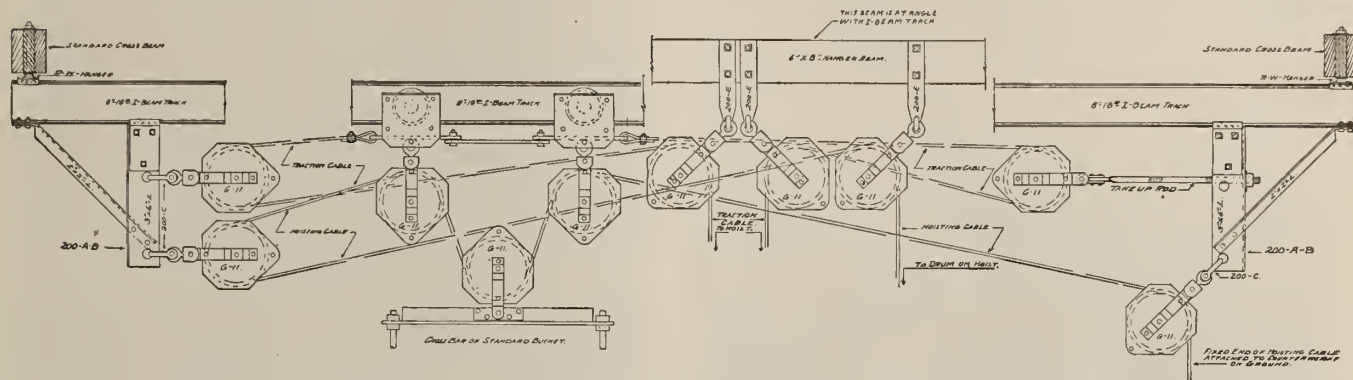
- (11) Both hoisting and traction levers at operator's finger tips.
- (12) Compact, yet far heavier and more durable than any other hoist used with the Godfrey conveyor.
- (13) Excess factor of safety in every part.
- (14) Practically "foolproof."

Deliveries.

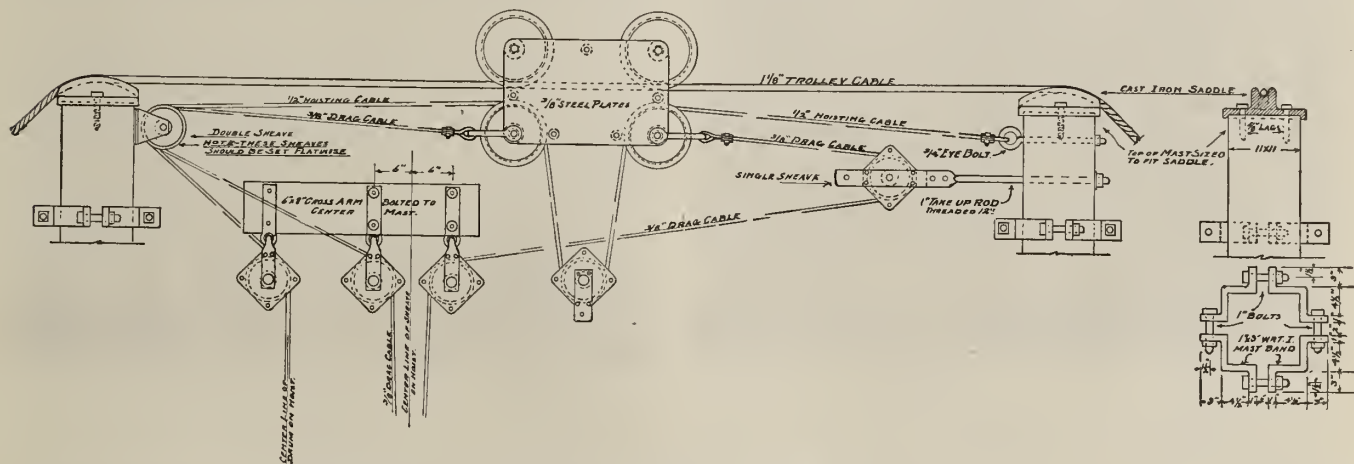
This company is in a position to make deliveries of its conveyor systems in from 30 to 60 days, and this fact, added to the low cost of installation and operation, has made possible a quick solution of conveyor problems for many industrial and coal handling plants.



SHOWING GODFREY METHOD OF TAKING COAL FROM HOPPER BOTTOM CARS



DETAIL OF I-BEAM INSTALLATION OF GODFREY COAL CONVEYOR



DETAIL OF CABLE INSTALLATION OF GODFREY COAL CONVEYOR



I-Beam Installation



Cableway Installation

TYPICAL GODFREY COAL CONVEYOR INSTALLATIONS

C. L. INSLEE

W. G. HUDSON

EDWARD BURNS

W. W. RICKER

GUARANTEE CONSTRUCTION COMPANY

Coal and Ash Handling Equipment

144 Cedar Street
NEW YORK, N. Y.

BRANCH OFFICE: CHICAGO, ILL., Old Colony Building

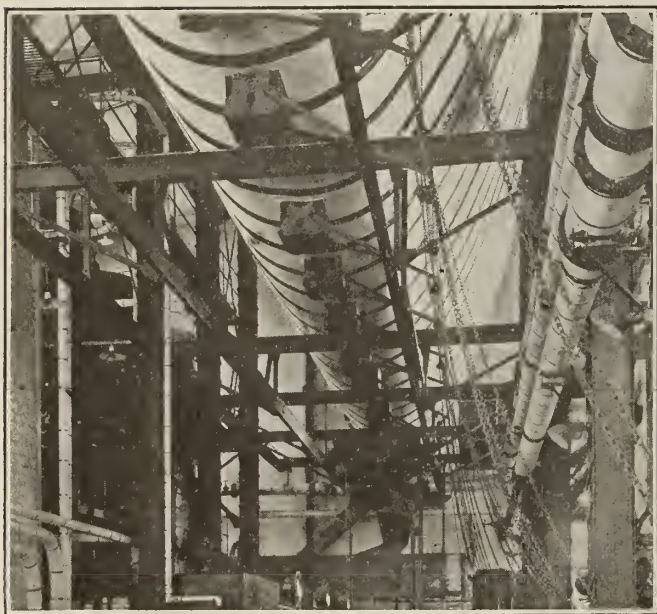
Products and Services.

COAL, ASH, and MATERIALS HANDLING EQUIPMENT; SKIP HOISTS; PNEUMATIC CONVEYORS.

Storage Bins and Bunkers of Timber, Steel and Reinforced Concrete.

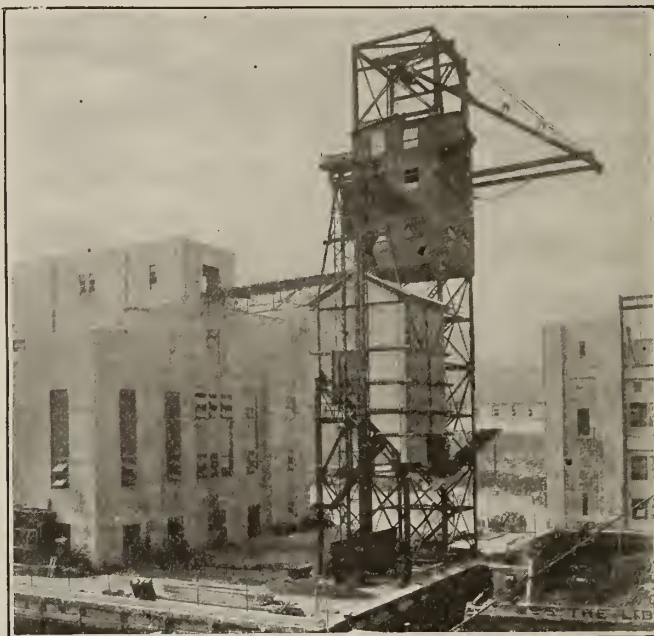
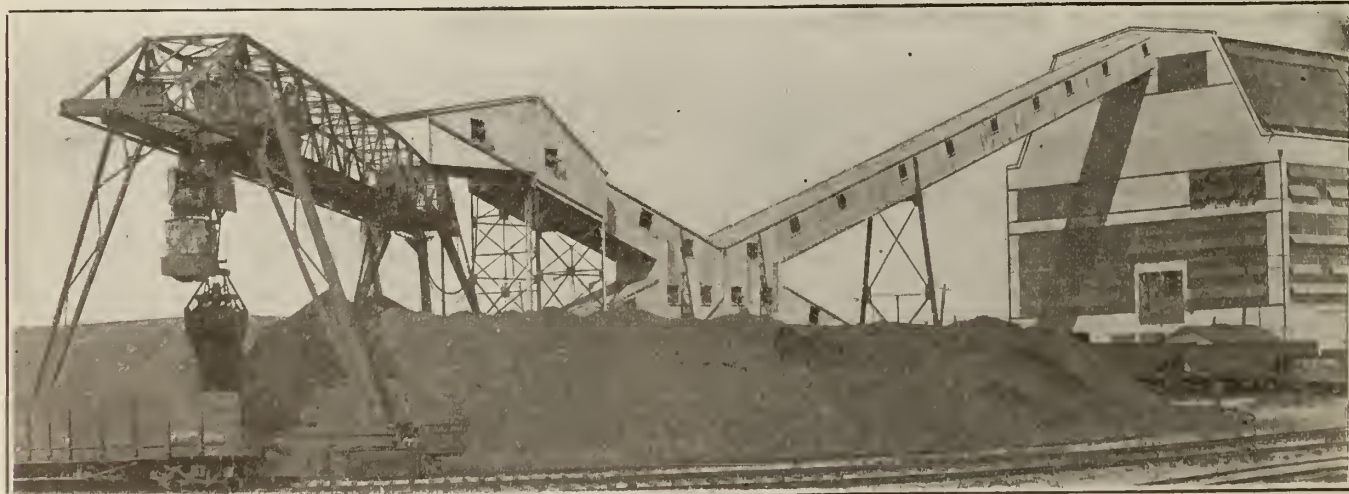
Seventeen years' experience in handling and storing materials has taught this company how to design storage bins for maximum capacity at lowest cost; how to use conveyors and hoists to save labor; and how to arrange the buildings and equipments so that the simplest and most efficient conveyors can be used.

For Mill, Power Plant and Factory Construction, see page 15.



HEWITT RUBBER CO., BUFFALO, N. Y.

Interior of boiler room with concrete suspension coal bunker; coal handled by elevator and belt conveyor, and ashes by an 8-in. pneumatic conveyor

U. S. GOVERNMENT POWERHOUSE, NEW YORK, N. Y.
Inclined boom coal tower and automatic skip hoist for ashesPUBLIC SERVICE CORPORATION, PERTH AMBOY, N. J.
Electric hoisting tower with inclined belt conveyor to bunkers. Capacity on acceptance test, 240 tons per hour

PHILADELPHIA NAVY YARD

Powerhouse, coal handling system, and pivoted bridge with grab bucket for reserve ground storage; capacity 150 tons per hour

The Airveyor (Pneumatic Conveyor).

The most efficient means of handling and conveying pulverized and granular materials such as lime, cement, soda ash, coke, charcoal, ashes, wheat, corn, grains, food products, etc.

With the Airveyor the nuisance and hazard of dust are eliminated, and labor costs greatly reduced.

It has no moving parts except the motor and exhaustor, and the cost of upkeep is exceptionally low.

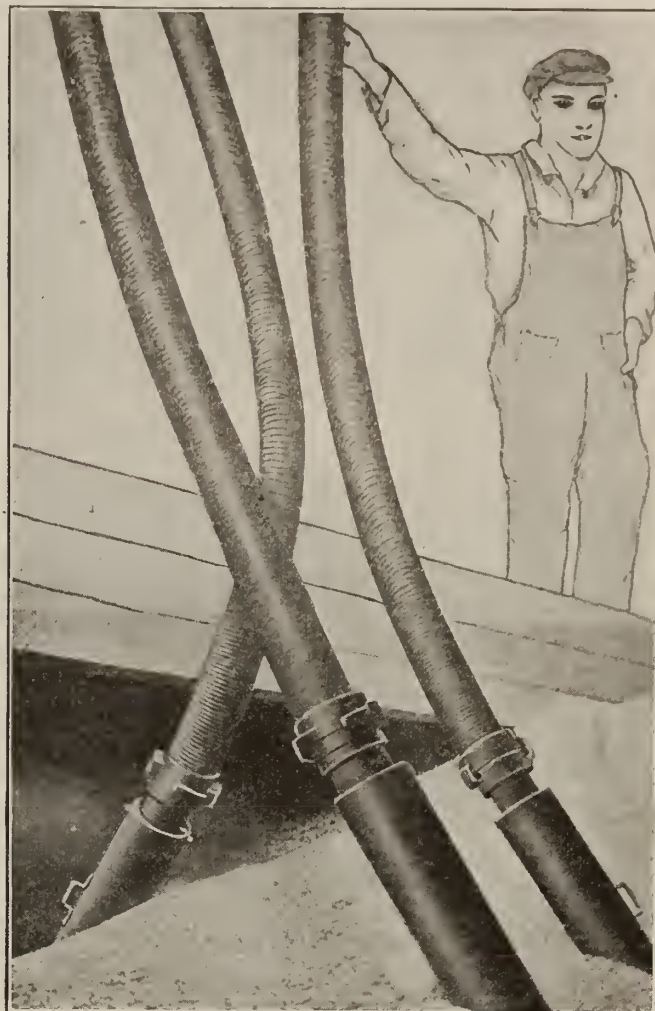
Literature.

Separate bulletins—"The Economical Handling and Storage of Coal, Ashes and Other Materials," and "The Airveyor"—will be sent on request.



AIRVEYOR USED AS A PNEUMATIC CAR UNLOADER HANDLING SODA ASH

Solving a most difficult problem in handling material; capacity 8 tons per hour.

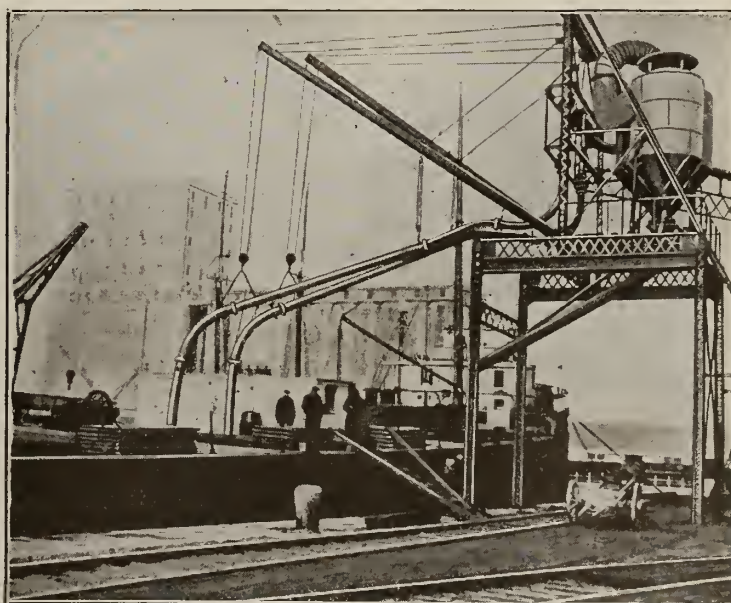


AIRVEYOR UNLOADING GRAIN FROM BARGES

Capacities up to 150 tons per hour



PNEUMATIC CONVEYOR FOR HANDLING ASHES FROM BOILER HOUSE TO STORAGE TANK OUTSIDE



REVERSIBLE PNEUMATIC CONVEYOR FOR TRANSFERRING GRAIN FROM BOATS OR CARS TO STORAGE ELEVATOR AND FROM STORAGE ELEVATOR BACK TO BOATS

Capacity, 100 tons per hour

GIRTANNER ENGINEERING CORPORATION

The Standardized Steam Conveyor

1400 Broadway
NEW YORK, N. Y.

Product.

GIRTANNER STANDARDIZED STEAM CONVEYOR for removing ashes by the shortest route.

**GIRTANNER
STANDARDIZED
CONVEYOR**
TRADE-MARK

Standardization.

This ash conveyor is the first to be completely standardized. No special pipe lengths are necessary either for installation or subsequent replacement after long service.

Intake Tee.

A special feature of the tee (patents pending) makes it possible to locate the intake at the proper point in front of the boiler without the use of odd pipe lengths. The opening is out of center 3 in., so that by turning the tee end for end it can be brought to the desired position. Should this fail, the cover plate, the opening of which is also out of center, can be reversed, permitting any adjustment within 1 in. at any part of 6 ft.

The intake cover is level with the floor when in place. Inside surface is curved, and concentric with the pipe, eliminating pockets.

Air Intake.

The gross area of the air intake is 100% larger than the pipe, insuring ample supply of air.

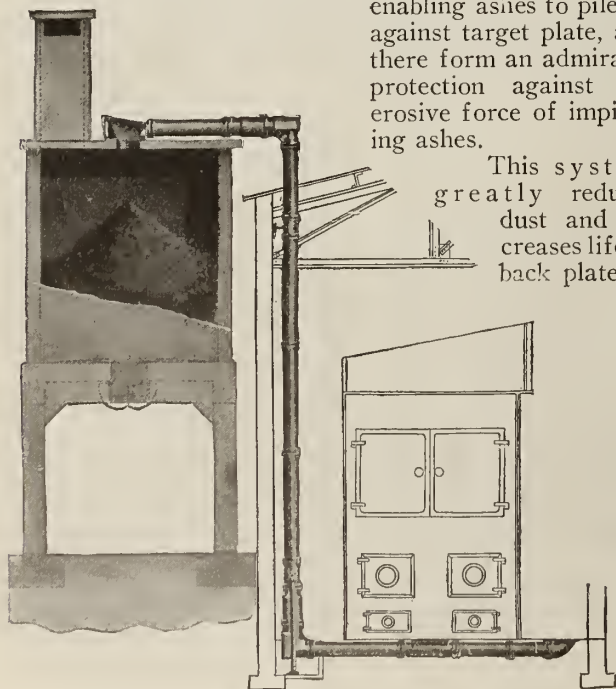
An iron grating prevents foreign materials from falling in. This leaves a net area excess of 50% over the pipe area.

Target Box

The box is provided with a detachable hardened back plate, making replacement easy.

A special shelf is cast on the inside bottom of box, enabling ashes to pile up against target plate, and there form an admirable protection against the erosive force of impinging ashes.

This system greatly reduces dust and increases life of back plate.



GIRTANNER STANDARDIZED STEAM CONVEYOR

Liners.

The special carbo-metal liners act as a protection to the pipe, eliminating the necessity for constant replacement of pipes.

These liners are guaranteed to stand 5,000 tons of ash, and usually last for 10,000 tons or more.

All vertical and horizontal liners are respectively interchangeable and are easily replaced through the intake tees or 90° steam units.

Pipe.

All white metal pipe is used throughout, furnished in standard lengths of 18, 24, 30, 36, 48, 60 and 72 in. Special flanging and gasket grooving makes installation a simple matter, and renders the entire system free from any leakage.

90° Steam Units and Wear Section.

This 90° unit furnishes the support of the vertical columns of pipe.

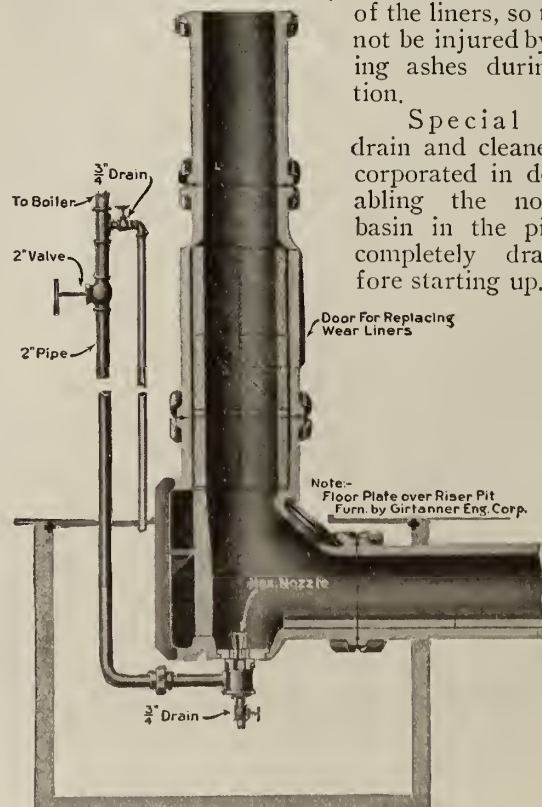
Fitted with 2 upright columns held by bolts in fitting on upper pipe section, being supported on a suitable foundation.

If it becomes necessary to remove the lower sections or the elbow, the riser section is slightly lifted and section removed.

Lower rear door gives access to the steam nozzle at the bottom of the elbow. Nozzle removal can be effected from the inside in a few minutes without disturbing the steam connections in any way. Nozzle is below the level

of the liners, so that it can not be injured by the passing ashes during operation.

Special automatic drain and cleaner are incorporated in design, enabling the nozzle and basin in the pipe to be completely drained before starting up.



SECTION OF 90° STEAM UNIT AND WEAR SECTION

ESTABLISHED 1892

THE GEORGE HAISS MFG. CO., INC.

Digging, Rehandling and Conveying Machinery

TELEPHONE:
MELROSE 241

Canal Place and East 141st Street
NEW YORK, N. Y.

CABLE ADDRESS:
"COAL-HOIST, NEW YORK"

Products.

"PATH DIGGING" SELF-FEEDING WAGON LOADERS.

Car Unloaders; Bag Loaders; Portable and Bucket Elevators and Conveyors; Belt Conveyors.

For Contractors' and Coal Dealers' Machinery, see page 61.

Uses.

Wagon loaders are used for loading and unloading trucks and cars quickly. They will dig and elevate coal, ashes, sand, gravel, crushed stone, chemicals, coke, ore, etc., and can also discharge on ground storage adjoining railroad tracks.

Advantages.

The most desirable of all wagon loaders is the famous "Path Digging" loader, patented. In this machine are provided all the automatic features required, thus reducing the number of men otherwise needed to just one, namely, the operator, who can control this machine so that it will give an uninterrupted discharge of 1 cu. yd. of material per minute all day.

The "Path Digging" wagon loader is self-propelling, self-feeding, and self-crowding. In moving about from place to place and digging all kinds of materials, all through means of its own power, it so strongly appeals to most contractors, engineers and coal dealers that after comparison with other wagon loaders the purchase price of the "Path Digging" machine becomes a secondary matter, while the time of delivery takes first consideration.

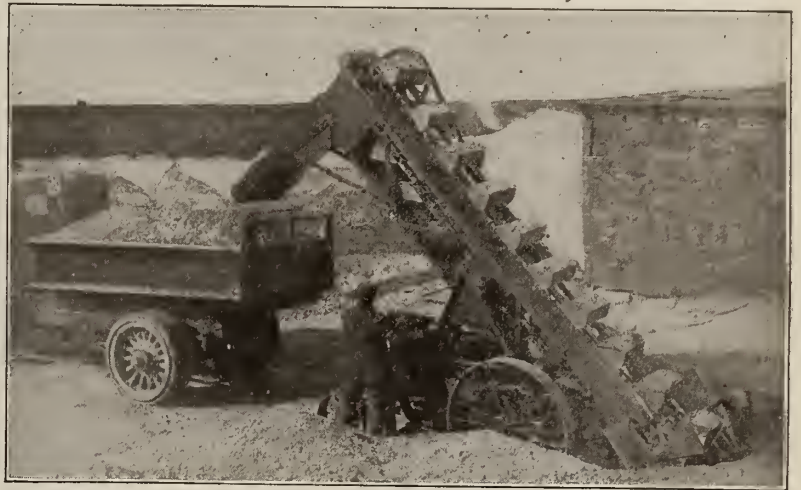
The patented revolving feeding propellers have made the "Path Digging" wagon loader a huge success.



TRADE-MARK

The blades on this device are so fixed along the wide spreading elevator shaft that when they revolve they force the material from both extremes of the propeller towards the middle point where the buckets fill up. By the same operation the blades cut open a wide pathway to permit the wagon loader wheels to follow automatically in their wake, leaving no material to obstruct the slow, smooth progress of the machine.

The illustrations on this page show why a bucket can not go by without taking its proper load each time.



"PATH DIGGING" WAGON LOADER LOADING 5 CU. YDS. OF GRAVEL IN 5 MINUTES

Operation.

Having been moved under its own power into a position at the foot of some material pile, the operator connects, by means of a clutch, the bucket elevator and the feeding propeller mechanism, and then, when these are in motion, he pushes into mesh a very slow traction gear, which "crowds" the entire loader at a speed of 30 in. per minute against the face of the material pile. After the propellers undermine a pile sufficiently to cause small avalanches, the slow speed drive is thrown out, and comes into use again only when the feeding propeller blades have dug out all material within reach.

Equipment.

Equipped with 10 h. p. gas engine, weight 6800 lbs.; or with 10 h. p. electric motor, weight 5900 lbs. The elevator unit is collapsible. It extends 8 ft. 6 in. from ground to chute, but may be increased if necessary.

Catalogues.

Sent free on application, covering the equipment in which one is interested.



"PATH DIGGING" WAGON LOADER LOADING 5 CU. YDS. OF 2-IN. CRUSHED STONE IN 5 MINUTES

THE HASLETT SPIRAL CHUTE CO.

MAIN OFFICE AND FACTORY
Allegheny and 20th Streets
PHILADELPHIA, PA.

SAN FRANCISCO OFFICE, 228 Pine Street

BALTIMORE OFFICE, 523 Calvert Building

Products.

SPIRAL CHUTES; DIVERTING SWITCHES; VERTICAL LIFTS; BELT and CHAIN CONVEYORS.

Gravity Roller Conveyors, Inclined Elevators, Automatic Hoists, Wagon Loaders, etc.

Chutes.

HASLETT PATENTED CONCAVE SPIRAL CHUTES—The patented Haslett concave bottom is designed to control the speed of merchandise so as to prevent damage. The rise of the concave toward the outside balances centrifugal force. The grade of the chute and the centrifugal force decrease with increase of radius. Therefore, when packages tending to travel fast are carried toward the outer rim by centrifugal force, the decreased grade reduces their speed. Packages can not clog in the chute because slow packages losing their centrifugal force are carried by the concave slope

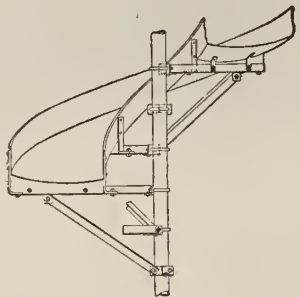
buildings drawings are furnished by which builder can leave properly designed openings in the correct positions.

FLAT BED CHUTES FOR LIGHT MERCHANDISE—This company also builds common flat bed chutes for use in department stores and mail order houses, etc. These can be either of the open outer rim type or cylindrically enclosed type.

These are supported by the central column consisting of standard wrought steel water pipe to which the sheet metal is bolted with cap screws in tapped holes.

SIZES OF STANDARD FLAT BED CHUTES

Diameter	Trough width	Pipe column
3 ft. 4¾ in.	12 in.	4 in. internal
5 ft. 6¾ in.	30 in.	6 in. internal
6 ft. 6¾ in.	36 in.	6 in. internal
7 ft. 8¾ in.	42 in.	8 in. internal



STANDARD CONSTRUCTION HASLETT SPIRAL CHUTE

STYLES—Both styles of chutes can be built in single, double, triple or quadruple blade construction.

EQUIPMENT—Open chutes are furnished with hinged, counterweighted floor traps, and enclosed chutes with vertical sliding fire doors all constructed so as to meet the approval of the National Board of Fire Underwriters.

DIVERTING SWITCHES—In addition to the patented combination fire door and diverting switch, several special types of switches for discharging goods at intermediate floors are built.

STANDARD SIZES OF HASLETT PATENT CONCAVE CHUTES AND MAXIMUM SIZES OF PACKAGES HANDLED

Diameter	Trough width	Packages		
		Length	Width	Weight
3 ft.	12 in.	15 in.	9 in.	40 lbs.
4 ft.	19 in.	22 in.	14 in.	75 lbs.
6 ft.	24 in.	30 in.	18 in.	200 lbs.
*7 ft.	30 in.	36 in.	23 in.	350 lbs.
†9 ft.	36 in.	48 in.	28 in.	400 lbs.
9 ft. 10 in.	42 in.	52 in.	32 in.	600 lbs.
12 ft.	48 in.	60 in.	36 in.	1000 lbs.
15 ft.	60 in.	72 in.	46 in.	1400 lbs.

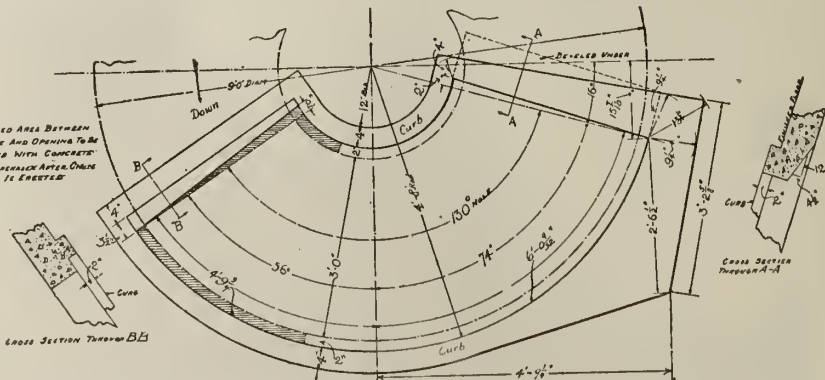
*Generally supplied to grocery jobbers.

†Generally supplied to hardware jobbers.

Special strength chutes can be built for especially heavy work in all sizes.

nearer the center where the chute is steeper. Successful results are dependent upon proper relationship between trough width, diameter, pitch and concave formation.

FLOOR OPENINGS FOR CHUTES—In completed buildings the floors can be cut and finished, but in new



TYPICAL FLOOR OPENING FOR 7-FT. DIAMETER CHUTE FOR CONCRETE BUILDING

Vertical Lifts, Belt and Chain Conveyors, etc.

These are built to meet requirements. In addition to standard types, special forms for all kinds of warehouse, jobbing and factory needs are designed.

LOWERATOR COMPANY, INC. Manufacturers of Special Conveying Machinery 110-112 West Fortieth Street NEW YORK, N. Y.

Products.

THE LOWERATOR; VERTICAL TRAY ELEVATOR-LOWERATOR.

Gravity Rollers, Roller Spirals, Power and Gravity Inclines, Special Conveying Machinery.

The Lowerator.

This device lowers merchandise from upper floors, by gravity. There is no expense for power, no need of operators. Discharges automatically.

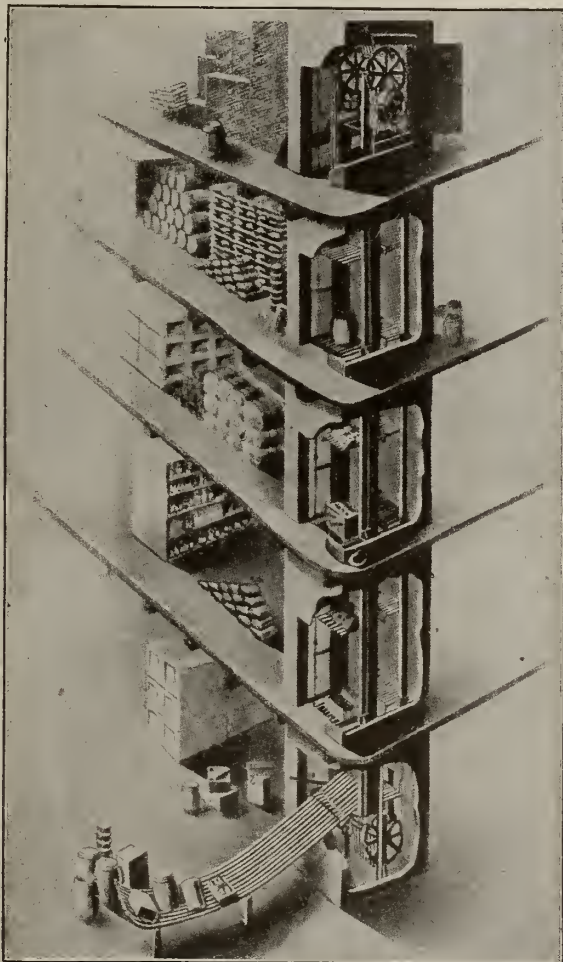
It is built in 5 standard sizes, or specially designed to answer requirements. Articles, packages, barrels, tote-boxes, containers or cases up to 48 by 52 by 72 in. and weighing up to 1500 lbs. each can easily be handled by this machine.

Machine is simple, strong, and fully guaranteed. It operates by means of the loading of trays or carriers attached to endless steel cables passing around upper and lower sheave wheels.

The car spacing is approximately 6 ft., thus affording two cars at each floor at all times.

Speed is regulated and controlled by automatic governor brake. A Lowerator occupies considerably less space than a freight elevator and handles under test four times the volume per hour.

Used in factories, warehouses, wholesale establishments, etc.



VIEW SHOWING INSTALLATION OF THE LOWERATOR

Vertical Tray Elevator-Lowerator.

This is an elaboration of the Lowerator principle wherein the upper terminals are equipped with electric motor for carrying merchandise up as well as down, at the same time in the same shaft.

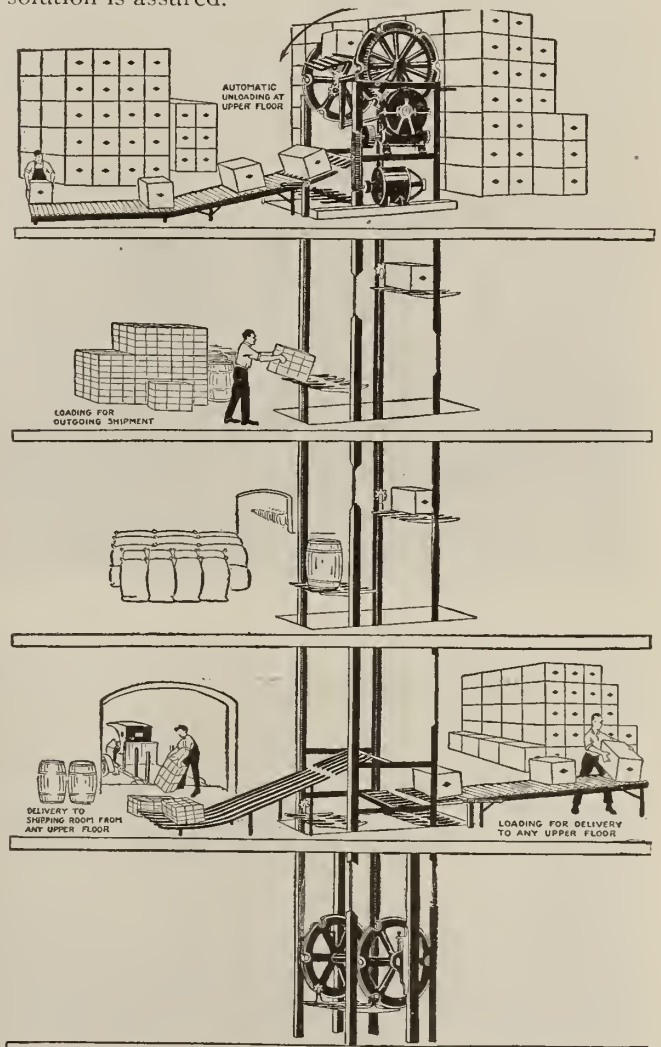
Goods may be sent from lower floors to any upper floor and automatically discharged. The reverse operation is also provided for. Complete and positive push button control on each floor.

No operator is needed. Requires small space and handles large volume per hour. Small horsepower required as machine is balanced.

Co-operative Service.

The LOWERATOR COMPANY, INC. designs and builds special conveying machinery to meet unusual and difficult conditions. Its Engineers have had years of experience in this particular field, and their services are free to engineers and architects for consultation.

When planning a new building write for detailed drawings of shaft or hatchway. State conditions in client's plant, especially as to floor heights and size of packages to be handled, and a practical and economical solution is assured.



VERTICAL TRAY ELEVATOR-LOWERATOR

ESTABLISHED 1887

HEYL & PATTERSON, INCORPORATED

Contracting Engineers for Elevating and Conveying Equipment

PITTSBURGH, PA.

BRANCH OFFICE: 90 West Street, NEW YORK, N. Y.

Products and Service.

This company maintains an Engineering Organization, Machine Shop, Structural Shop and Field Organization fully equipped for the *design, fabrication and installation* of CONVEYING and ELEVATING EQUIPMENT, and of the STEEL, CONCRETE or WOOD STRUCTURES and BINS required in connection therewith.

In addition to all types of conveyors and elevators, the company builds:

For Dock and Storage Yards.

Man-trolley bridges; rope system bridges; unloading towers; anthracite storage sheds; screening plants; grab buckets; rope haulage systems.

For Wharves and Shipbuilding Yards.

Wharf cranes; portal type cranes; roof cranes; tower cranes; racking cantilever cranes; floating cranes.

For Steel Mills and Powerhouses.

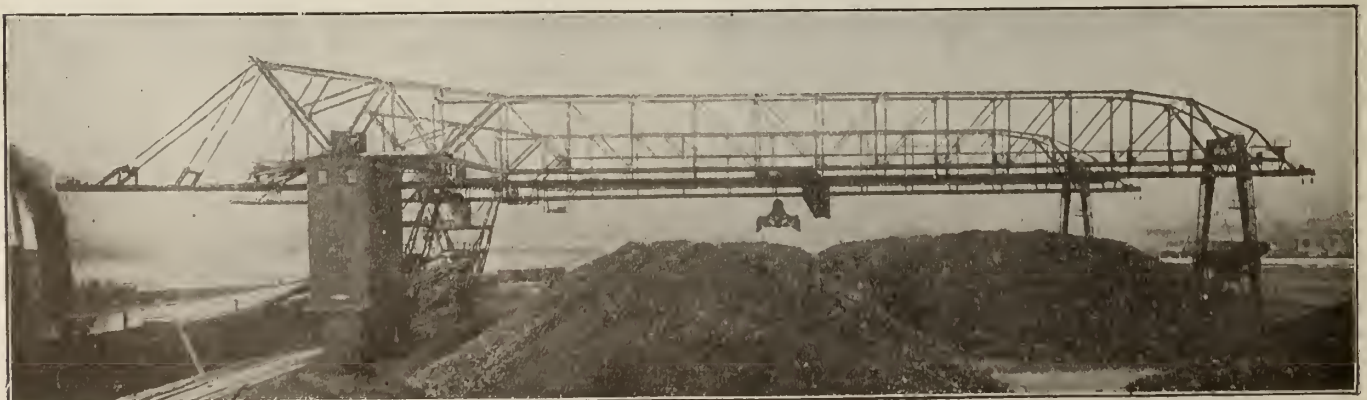
Pulverized fuel equipment; coal and ash handling equipment; coal crushing plants; ore, coal and ash cars; pig iron casting machines; monorail hoists; coal and coke crushers.

For Coal Mines.

Complete tipples; car hauls; revolving dumps; picking tables; Bradford breakers; storage bins; refuse stacking cars; coal washing plants.



PORTAL TYPE WHARF CRANES



COAL DOCK EQUIPMENT

For By-product Coke Ovens.

Coal preparing plants; coke screening and loading plants; car haulage equipment; Bradford breakers; coal and coke crushers; storage equipment.

For Glass Factories.

Batch mixing plants; traveling batch mixers; storage tanks;lehr conveyors; pulverized fuel equipment; telphers.



BY-PRODUCT COKE OVEN COAL HANDLING PLANT



CAR FOR WASTING MINE ROCK



CIRCULAR PICKING TABLE FOR COAL MINES

THE JEFFREY MANUFACTURING COMPANY

Elevating, Conveying, Crushing and Power Transmission Machinery

966 North Fourth Street
COLUMBUS, OHIO

BRANCH OFFICES

NEW YORK, 50 Dey Street
BOSTON, 141 Milk street
PHILADELPHIA, 1126-28 Real Estate
Trust Building
ST. LOUIS, Railway Exchange Building

CHICAGO, McCormick Building
DENVER, First National Bank Building
PITTSBURGH, Farmers Bank Building
CLEVELAND, Leader-News Building
DETROIT, Book Building

MILWAUKEE, M. & M. Building
SEATTLE, L. C. Smith Building
MONTREAL, Power Building
BIRMINGHAM, Brown-Marx Building
DALLAS, Western Indemnity Building

Products.

CARRIERS; CRUSHERS; SWING HAMMER PULVERIZERS and SHREDDERS; LOADERS; ELECTRIC TROLLEY and STORAGE BATTERY LOCOMOTIVES; ELEVATORS; CONVEYORS: Belt, Scraper, Pan and Apron.

Jeffrey Improved Pivoted Bucket Carriers.

(1) Double bushings in chains—glass hard and tough.

(2) Steel cross rods—connect carrier chains at the bucket lips; do not obstruct bucket opening.

(3) High carbon steel side bars—shockproof.

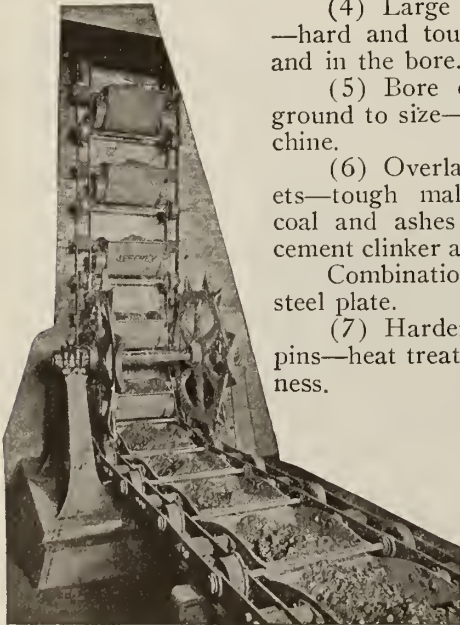
(4) Large roller in chains—hard and tough on the tread and in the bore.

(5) Bore of chain rollers ground to size—too hard to machine.

(6) Overlapping lip buckets—tough malleable iron for coal and ashes; gray steel for cement clinker and hot materials.

Combination cast ends and steel plate.

(7) Hardened steel pivot pins—heat treated to glass hardness.



JEFFREY IMPROVED BUCKET CARRIER

Buckets		Chains		Carrying capacity for coal in tons per hour at 50 f. p. m.
Width, ins.	Length, ins.	Pitch, ins.	Diam. rollers, ins.	
16	18	18	5	30
18	24	24	6	50
24	24	24	6	70
30	24	24	6	85
30	30	30	7	130
30	30	30	7	160

AVERAGE RATING FOR MEDIUM BITUMINOUS COAL FOR STOKER SIZES

Size crusher, ins.	Tons per hour	Approx. h. p.	Pulley, normal speed r. p. m.	All dimensions in inches																							
				A	B	C	D	E	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U'	V	W	Y	Z
18	30	15	300	14½	47	91	203½	25	22	24	16	26½	17¾	23	8	⅞	4½	2 ⅞	41½	231½	251½	34	61½	2	1	91½	19
24	60	30	240	17½	55½	121½	231½	32½	30	27½	22	33	21	26	10½	1	6½	4 ¼	41¼	283¼	309¼	42	81½	2½	1 ½	11	25
30	85	40	200	22½	65	14	27	37	36	32½	28	39½	25½	30¾	12	1	6	3 ⅞	4¾	35¾	36½	48	101½	3	1 ¾	13¼	31
36	125	60	160	27½	76	16¾	31¼	44¾	43¼	40	35½	52¾	30½	37	15	1	6	3 11⁄16	5½	44¾	45	60	151½	3½	2	17½	37

(8) Pivot blocks in chains—of hard white iron.
(9) Tripping cams on buckets—glass hard and hot riveted to bucket ends.

(10) Traveling and stationary trippers—deep chilled wearing surfaces; easy to operate.

(11) Bucket acme of efficient design—every edge and corner reinforced for long service.

(12) Absolute reliability under all conditions of service. Loaded buckets can not be carried around to filling point without first being dumped. Conveyor safeguarded throughout its entire course against improper action.

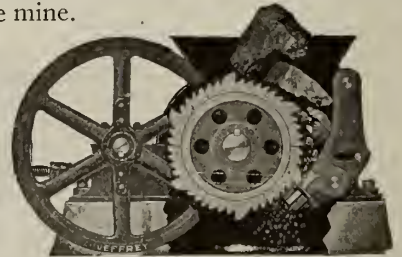
Write for Pivoted Bucket Catalogue No. 210-F.

Single Roll Crusher.

This machine is designed for use at the powerhouse, coaling station, and the mine.

It reduces large lump and run-of-mine coal to stoker size in a single operation.

For run-of-mine or hard lump coal this company recommends using the 30x30-in. size as it



JEFFREY SINGLE ROLL CRUSHER

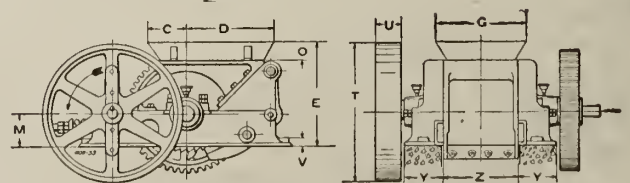
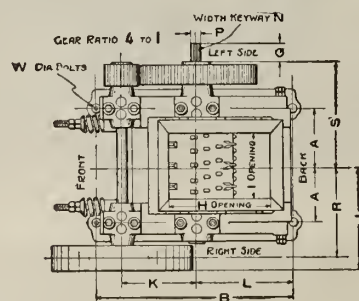


DIAGRAM JEFFREY SINGLE ROLL CRUSHER

has proved the best suited for maximum lumps. (See table at foot of preceding page for sizes.)

Receives coal in any volume direct from a track hopper, grab bucket or mine car without the use of any mechanical device for regulating the feed. Feeder is often used simply to limit the crusher output to the smaller capacity of a receiving conveyor beneath the crusher.

It can be started up under full load and can not be flooded or choked down.

Easily adjusted and has large range for size and capacity.

Consumes but little power. Costs little to install.

Occupies small space in proportion to its capacity.

All joints are machined. Gears are of steel with cut teeth.

Provided with an efficient safety device which protects against shock and accidents. Send for bulletin.

The long teeth do not interfere with the adjusting of the breakerplate up close to the roll when a fine product is required, slots being provided in the breakerplate through which they pass freely and still prevent large pieces of coal getting through without being crushed.



DIGGING AND LOADING HARD ACID PHOSPHATE IN FERTILIZER PLANT WITH JEFFREY TYPE "G" LOADER

Locomotives.

Storage battery locomotives are used extensively in industrial plants and mines. Trolley type locomotives are also built.

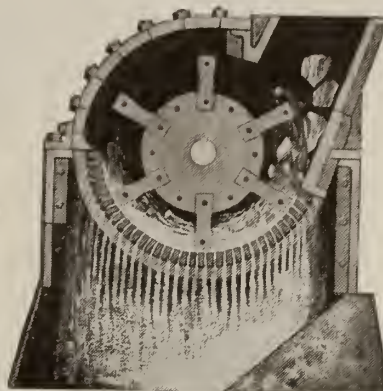


JEFFREY STORAGE BATTERY LOCOMOTIVE

Jeffrey Swing Hammer Pulverizer and Shredder.

Of various types and sizes for reducing large quantities of granular and fibrous materials. Complete details on application.

Write for Catalogue No. 147-N.



JEFFREY SWING HAMMER PULVERIZER

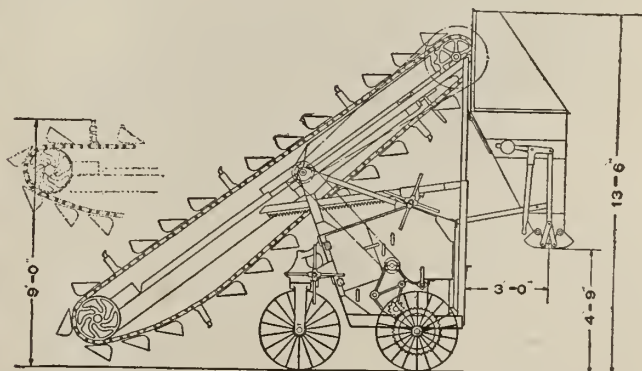
Type "G" Loader.

The Jeffrey Type "G" loader is a large wheeled powerfully geared machine, capable of handling, per minute, 1 to 1½ cu. yds. of loose materials, such as crushed stone, sand, gravel, coal, coke, ashes, cinders, acid phosphate, fertilizer, salt, etc. The machine is self-propelling, having two speeds forward and two reverse, the fast speed to carry it from pile to pile and the slow speed suitable for feeding into the material.

The boom is narrower than the buckets, hence it will dig 8 ft. straight back into the pile without meeting an obstruction. The buckets are malleable iron, very heavy and protected by renewable serrated steel digger edge, operating over a large diameter foot wheel, thereby enabling the machine to handle large lumps successfully.

The machine is mounted on three large wheels forming a 3-point support which causes the machine to set solid on any uneven ground, to travel over rough ground, to run over obstacles without harm and to go over moderately soft ground without sinking. The machine will turn short and readily and will sweep the ground in wide circles. The boom is adjustable for depth of cut or to collapse to pass obstructions.

For loading wagons, automobiles, trucks, cars, etc., a swivel chute is supplied. When handling loose materials which are carted, such as, salt, fertilizer, acid phosphate, etc., the machine is fitted with large capacity storage hopper and quick acting clamshell valve for loading wheelbarrows and small carts, thus keeping a string of wheelers busy.

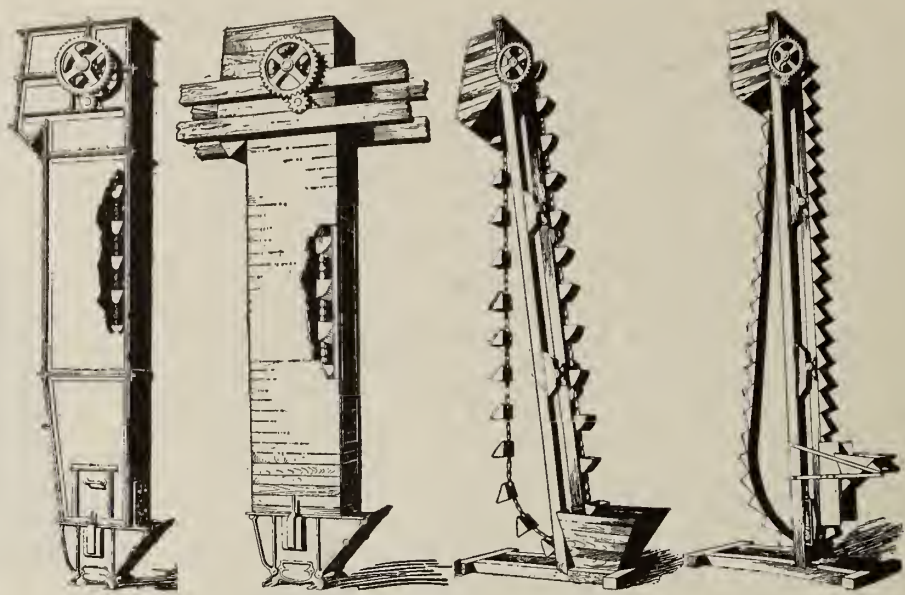


CONSTRUCTION OF THE JEFFREY TYPE "G" LOADER

Standardized Elevators.

Years of close personal contact with the industrial field in the building of conveying and elevating equipments have made it possible to select 40 elevators out of numerous styles for the handling of a wide range of materials—these being known as Jeffrey standard elevators.

Jeffrey standard elevators are made vertical or upon an incline and can be furnished with or without steel casings. Capacities range from 6½ to 80 tons of material per hour with vertical lifts of from 10 to 75 ft. The nature of the materials handled may vary from non- or semi-gritty materials, such as grains and coal, to gritty substances, such as ashes, coke, sand, gravel and stone. The size of the material may vary from dust to 4½-inch cubes. These elevators consist of



Style 1 Style 2 Style 3 Style 4
JEFFREY STANDARDIZED ELEVATORS

CAPACITIES AND HORSEPOWER OF JEFFREY STANDARDIZED ELEVATORS

	Capacity, tons per hour	Max. size pieces, ins.	0-40-ft. Centers				41-80-ft. Centers				Style
			Elevator number	Chain number	Size of bucket, ins.	H.p.	Elevator number	Chain number	Size of bucket, ins.	H.p.	
Coal, or similar material, weighing ap- prox. 50 lbs. per cu. ft. Centrifugal Discharge Type.....	6.5	2.5	103	88J	6 x 4	.55	132	88J	6 x 4	1.1	1
			1103	88J	6 x 4	.55	1132	88J	6 x 4	1.1	2
			108	82R	8 x 5	1.3	137	82R	8 x 5	2.5	1
	12.2	3	1108	82R	8 x 5	1.3	1137	82R	8 x 5	2.5	2
			115	82R	12 x 7	2.2	144	82R	12 x 7	4.2	1
	23.2	4	1115	82R	12 x 7	2.2	1144	82R	12 x 7	4.2	2
			119	110H	14 x 7	2.5	149	110H	14 x 7	4.8	1
	25	4	1119	110H	14 x 7	2.5	1149	110H	14 x 7	4.8	2
			122	110H	16 x 8	3.3	152	110H	16 x 8	6.6	1
	36	4.5	1122	110H	16 x 8	3.3	1152	110H	16 x 8	6.6	2
Ashes, 40 lbs. per cu. ft. Centrifugal Discharge Type.....	14.4	4	166	110H	12 x 7-A	2.0	179	111H	12 x 7-A	3.6	1
	24	4	169	110H	14 x 7-A	2.5	182	111H	14 x 7-A	4.8	1
Stone, 100 lbs. per cu. ft. Centrifugal Discharge Type.....			208	82R	8 x 5	2.1	233	82R	8 x 5	4.1	2
	24.5	3	1208	82R	8 x 5	2.1	1233	82R	8 x 5	4.1	3
			216	110H	12 x 7-A	3.2	241	110H	12 x 7-A	6.2	2
	36	4	1216	110H	12 x 7-A	3.2	1241	110H	12 x 7-A	6.2	3
			220	110H	14 x 7-A	4.8	245	111H	14 x 7-A	9.4	2
	60	4	1220	110H	14 x 7-A	4.8	1245	111H	14 x 7-A	9.4	3
Stone, Continuous Bucket Type.....			0-30-ft. Centers.				31-60-ft. Centers				
	39	3.5	258	82R	12 x 6	2.6	283	110H	12 x 6	5.2	4
	80	4.5	266	110H	14 x 8	5.0	290	111SP-H	14 x 8	9.3	4

endless chains provided with buckets of steel or malleable iron, spaced at short intervals or close together, designated in the table accompanying as centrifugal discharge types and continuous bucket type, respectively.

DELIVERY—These elevators are kept in stock, and by specifying same a much shorter delivery may be obtained than is the case with a special elevator requiring layouts and complete shop details.

PRICES—The home office or any one of the branches is in a position to furnish immediate prices on any of these standard elevators. Just state the number of the elevator and the distance from center of head shaft to center of foot shaft. Catalogue No. 244-D.

Belt Conveyors.

A belt conveyor, where properly installed and operated, forms one of the most flexible and economical type of mechanical handling devices.

The range of materials which the belt conveyor will handle satisfactorily includes nearly all bulk materials, from the lightest of grains to the heaviest of ores, as well as packages of all kinds. It is well adapted to carry fragile materials without undue breakage.

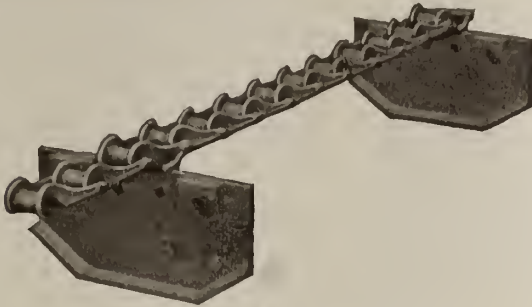
The space occupied by the belt conveyor is small and the power consumption and cost of upkeep are low, making it an ideal conveyor covering a very wide range of application.

Jeffrey belt conveyors are so standardized that the selection of the proper conveyor is very simple.

They have a range of 36 to 1724 tons per hour on any length up to 600 ft. Catalogue No. 175-R.

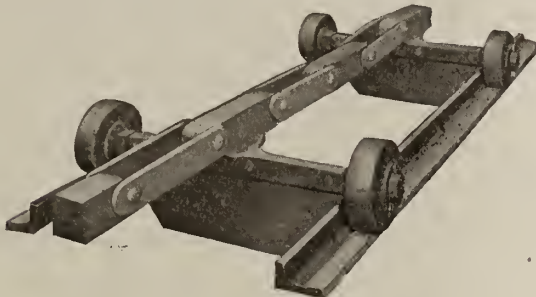


JEFFREY STANDARD BELT CONVEYOR

Standard Scraper Conveyors.

NO. 1 TYPE SCRAPER CONVEYOR

The smallest standard conveyor of No. 1 type has plain cast iron scrapers 10 by 5 ins. for handling material 3 ins. and under with a maximum capacity of 42 tons of coal per hour, and a maximum length of 150 ft. Four other standard conveyors of this No. 1 type are offered for material up to 5-in. diameter with a maximum capacity of 63 tons of coal per hour and up to 150 ft.



NO. 2 TYPE SCRAPER CONVEYOR

Standard conveyors of No. 2 type or similar to No. 1 type, except the scrapers are larger, made of steel and are equipped with rollers and heavier chains. Capacity of 48 tons per hour for 3½-in. coal up to 70 tons per hour maximum coal of 5 in. and are made up to 200-ft. centers.



NO. 3 TYPE SCRAPER CONVEYOR

Double strand plain chain steel standard conveyors of No. 3 type come in four sizes to handle maximum size coal of 9, 12, 14 and 16 ins. with capacities of 60, 92, 167, 241 tons per hour respectively, and in lengths up to 200 ft.



NO. 4 TYPE SCRAPER CONVEYOR

No. 4 type is made in the same general sizes as the double strand No. 3 type and in most respects is the same, except the various styles of chain are provided with rollers to reduce friction.

Catalogue 257-A.

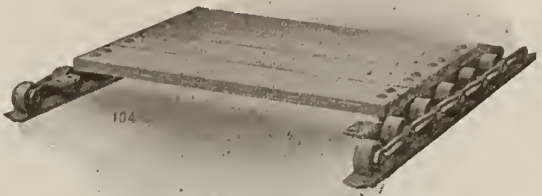
Standard Apron Conveyors.

Standard wood apron conveyors handle large bulk materials, such as packages, bags, boxes, kegs, barrels, etc.



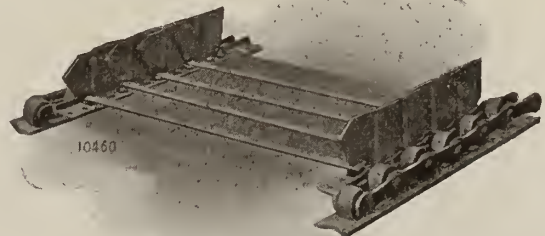
NO. 1 TYPE APRON CONVEYOR

Type No. 1 conveyors are made up with detachable chains and intended for handling packages up to 100 lbs. and for a distance not in excess of 200 ft.



NO. 2 TYPE APRON CONVEYOR

Type No. 2 is made up with roller chains of malleable iron with plain rollers for the lighter loads, and steel thimble roller chains with either plain or flange rollers for heavy work. They are intended for handling packages weighing from 100 to 1600 lbs. for a maximum distance of 200 ft.



NO. 3 TYPE APRON CONVEYOR

Types 3 and 4 handle small loose material. Particularly adapted for use as apron feeders. They consist of two strands of roller chain, either malleable iron as Type 3 or steel thimble roller chain as Type 4, to which are attached double beaded steel flights with steel ends thus forming a continuous trough or apron. Stand-



NO. 4 TYPE APRON CONVEYOR

ard conveyors have a capacity range of from 56 to 1000 tons per hour. Size of material may vary from dust to 24-in. cubes. These standard conveyors may be obtained in any length up to 100 ft.

Catalogue No. 258-A.

THE LAMSON COMPANY

Designers and Builders of Automatic Conveying Machinery

100 Boylston Street
BOSTON, MASS.

WORKS:
LOWELL, MASS.
TORONTO, CANADA

REPRESENTATIVES

ATLANTA, GA., 30 Moore Building
BALTIMORE, MD., Equitable Building
CHICAGO, ILL., 6 North Michigan Avenue
CINCINNATI, OHIO, 119 East 5th Street
CLEVELAND, OHIO, 2063 East 4th Street
DENVER, COLO., 1622 Arapahoe Street
INDIANAPOLIS, IND., Washington and Illinois Streets
KANSAS CITY, MO., 210 New Ridge Building
LOS ANGELES, CAL., 221 San Fernando Building
MINNEAPOLIS, MINN., 320 Tribune Annex

For Texas, Oklahoma, New Mexico and Western Louisiana Business, refer to

THE LAMSON COMPANY OF TEXAS, Dallas Tex.

NEW YORK, N. Y., 9-11 East 37th Street
OMAHA, NEBR., 418 McCague Building
PHILADELPHIA, PA., 210 North Broad Street
PITTSBURGH, PA., 319 Third Avenue
ROCHESTER, N. Y., 194 East Main Street
SAN FRANCISCO, CAL., 617 Mission Street
SEATTLE, WASH., 215 Stewart Street
ST. LOUIS, MO., 709 Pine Street
TORONTO, CANADA, 136 Simcoe Street
VANCOUVER, B. C., 104 Empire Building

Products.

CONVEYING SYSTEMS for Cash, Papers, Merchandise and Products for All Industries.

PNEUMATIC DISPATCH TUBE SYSTEMS.

CONVEYORS: Gravity Roller, Belt and Automatic Selective Power.

SPIRAL CHUTES; SPIRAL CONVEYORS.

SELECTIVE OVERHEAD POWER CONVEYORS.

Light Hand and Electric Power Elevators and Lifts; Electric Cable and Wire Line Cash and Parcel Carriers; Sectional Metallic Receiving and Storage Bins.

Adaptability of Lamson Conveying Systems.

Lamson automatic conveying systems are as varied as industry itself, and are adapted for a wide range of usefulness in nearly every conceivable business.

They carry practically everything that is ordinarily



TRADE-MARK

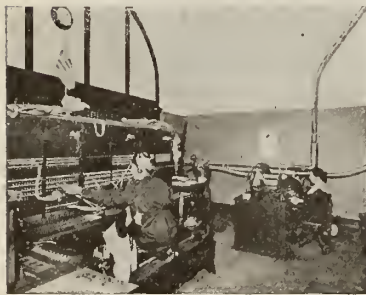
handled—from papers, currency and the most fragile products to boxes, barrels, tools, castings, machine parts, etc.

No matter what the business is, Lamson conveying systems will *save time and expense*, and enable the organization to perform *more work with less effort*.

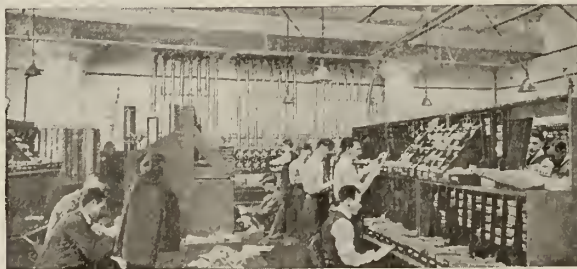
Lamson Service.

Specialists employed by this company are constantly solving all kinds of conveying and carrying problems, and their experience and service are at the disposal of those who desire a satisfactory solution of their conveying needs.

Full information covering any problem to which Lamson conveyors may be adapted will be furnished, without obligation.



Telegrams and messages relayed all over the factory by this Lamson tube station



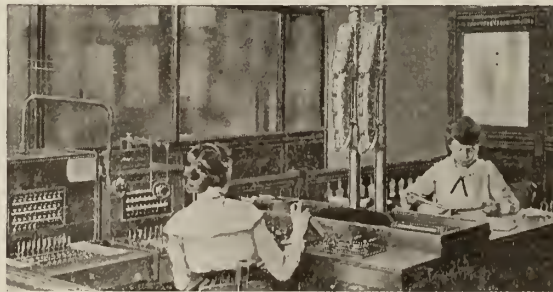
Labor, and the movement of materials, controlled from the central planning department. Lamson pneumatic tubes give practically instantaneous message service to all parts of the plant



This tube service is a quick, mechanical messenger between shop and main office



Papers are kept moving between executives and department heads by Lamson pneumatic tubes



This central desk serves the same purpose as a telephone switchboard. Incoming pneumatic carriers are here relayed by tube to their destinations. The tube system is intercommunicating between all stations



In banks, checks and debit and credit items are kept moving by Lamson pneumatic tubes

LAMSON PNEUMATIC TUBES, THE SWIFT MECHANICAL MESSENGERS OF BUSINESS

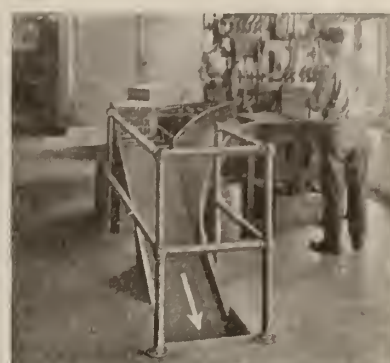
These illustrations show how Lamson pneumatic tubes speed up and systematize the transaction of business by carrying letters, requisitions, orders and other papers quickly and surely in the factory, office, bank and business house



Belt and vertical conveyors carrying bags of flour from sewing machine to outgoing freight cars. They do away with the slowness and confusion of porters with trucks



Packing of all kinds of products systematized by Lamson conveyors. Conveyors bringing empty boxes and bars of soap to packers and carrying packed boxes away to nailing machines



Boxes of soap, shown in illustration to the left are conveyed to these nailing machines. Nailed boxes are conveyed to storage or shipment



In textile mills, Lamson conveyors carry bobbins, laps, raw cotton, finished cloth, etc. Lower belt of this 2-way conveyor brings empty silk quilts to filling machines. Upper belt returns filled quilts



Castings and parts carried between machines in the modern machine-shop. Conveyors keep stock in motion between processes and cut down amount of stock that is necessary. They link a battery of machines into one complete unit



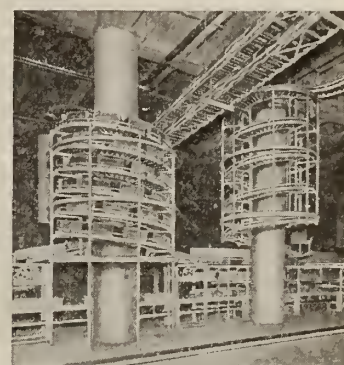
Lumber, boards, shooks and other wood products easily carried on Lamson gravity and power conveyors



Tote boxes of small parts carried by gravity or by this chain conveyor



Lamson spiral chutes carry a steady stream of packages vertically downward, quickly and without attention and without damage



Lamson gravity spiral conveyors carry packages downward to shipment and also serve as "live storage." Hundreds of boxes always "stand in line" ready for shipment



A completely equipped shop. Parts and products from every machine are carried on Lamson conveyors to the two main line conveyors, which in turn carry them to the packing and shipping departments

SAVING LABOR'S USELESS STEPS BY LAMSON GRAVITY AND POWER CONVEYORS

These views show how every phase of industrial work is speeded up when Lamson conveyors are used. These conveyors put the handling and carrying on the same footing as the manufacturing processes—on a quantity production basis

THE LOUDEN MACHINERY CO.

Manufacturers of Overhead Carrying Systems

71 Court Street
FAIRFIELD, IOWA

BRANCH OFFICES

ST. PAUL, MINN., 2288 University Avenue ALBANY, N. Y., 1047 Broadway CHICAGO, ILL., 1051 West 35th Street
KANSAS CITY, MO., HARBISON MFG. CO., Tenth and Mulberry Streets

Products.

OVERHEAD CARRYING SYSTEMS for factories, warehouses, machineshops, garages, etc.; COAL CARRIERS; CHAIN HOISTS; TRAVELING CRANES; SWINGING STEEL CRANES.

Advantages of Louden Overhead Systems.

TIME AND LABOR SAVING—The common method of transferring material from place to place in industrial buildings by trucks, carts and wheelbarrows operating on the floor is, aside from cost and many inefficient features, absolutely wasteful of man power.

By installing Louden systems the work is raised to the highest efficiency. The old way required two men to push a truck loaded with 1000 lbs., while with the air route one man can easily shove 2000 lbs. around corners, over switches, and do it in less time. The overhead system requires practically no rehandling.

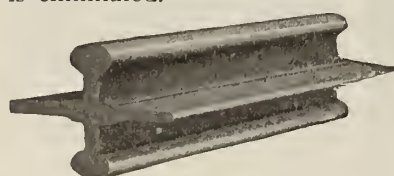
SPACE SAVING—Valuable floor space is saved. There is no congestion of merchandise in aisles as the steady transportation system insures systematic movement of all material.

MONEY SAVING—The cost of transferring goods is actually reduced 50% to 60%.

Wear and tear on the floor caused by heavy trucking is eliminated, reducing the upkeep expense.

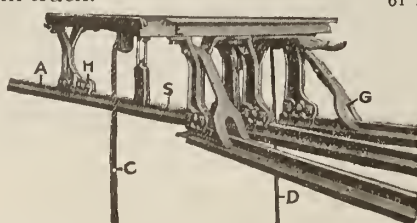
Description of the Louden System.

TRACK AND FITTINGS—The track is of the finest and strongest carbon steel, specially adapted for carrying loads up to 2000 lbs., and can be curved to fit all conditions. The shape is such that all unnecessary friction is eliminated.



TRACK

SWITCHES—When the switch cord is pulled the track is thrown into the desired position, and an automatic safety guard makes it impossible for a car to run off the track. Switch is reversible, right or left, so that several branch tracks can be used on either side of the main track.

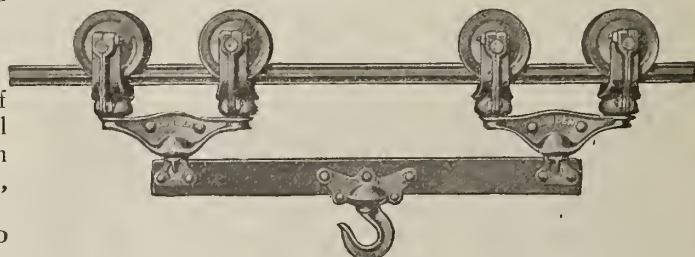


3-WAY SWITCH

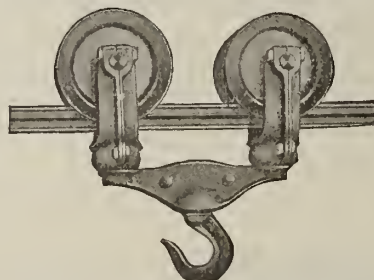


ADJUSTABLE LINK
TRACK HANGER
Odd inch-lengths up to
61 in.

CARRIERS—Fitted with large roller bearing track wheels and heavy swivel truck castings, which make operation easy and insure ample strength.



DOUBLE TRUCK FACTORY CARRIER



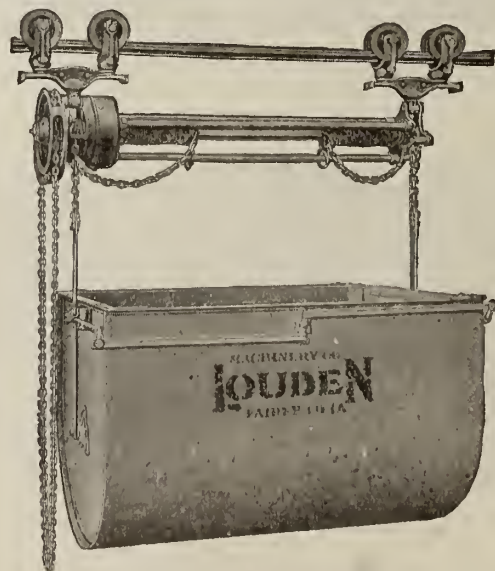
SINGLE TRUCK FACTORY CARRIER

Coal Carrier.

Its roomy tub has the same capacity as 7 large wheelbarrows, and carries its load with absolute safety.

The container will automatically turn upside down, dumping its load at the will of the operator, by simply pushing the trip.

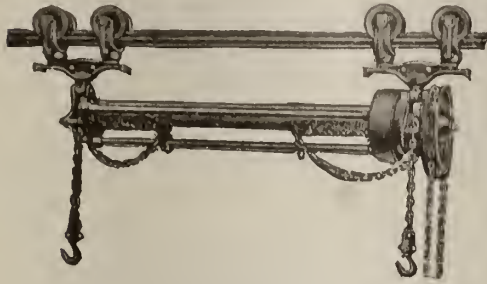
This carrier can be used for carrying ashes, etc. It is equipped with Louden high speed chain hoist and is mechanically right.



LOUDEN COAL CARRIER

High Speed Twin Chain Hoist.

A planetary gear hoist that will raise and lower quickly; is strong, sturdy, and operates easily.



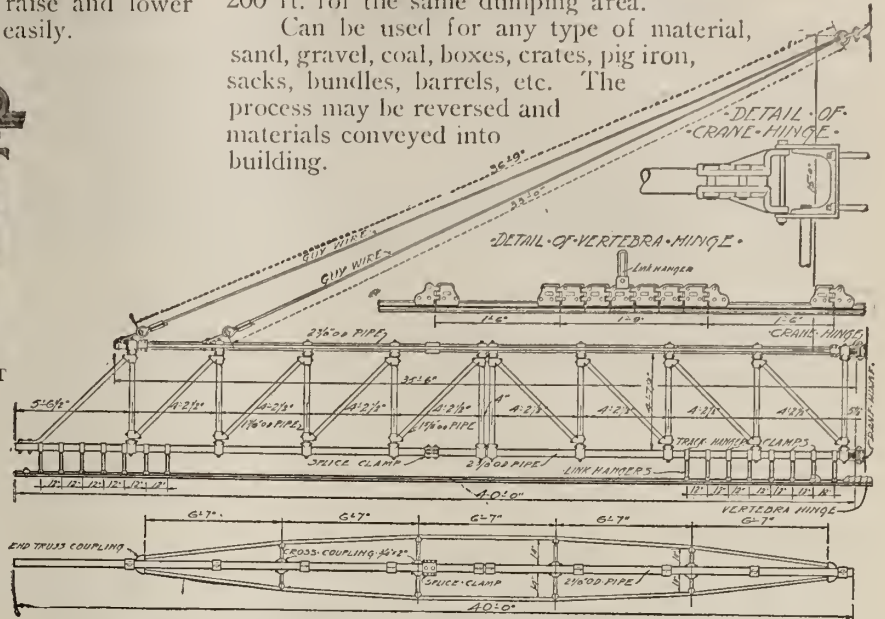
LOUDEN HIGH SPEED TWIN CHAIN HOIST

For lifting and carrying long, cumbersome loads weighing up to 1 ton, this is the ideal hoist to use.

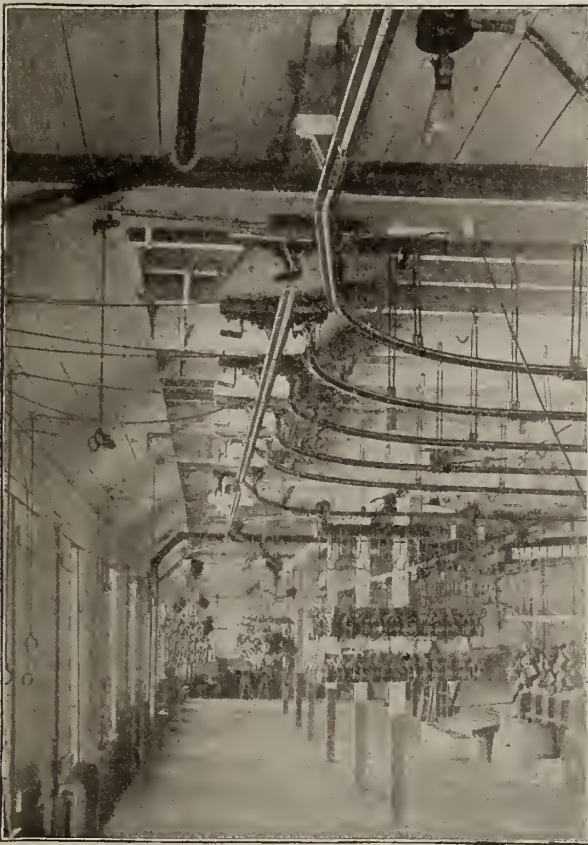
It is also used for carrying long bundles of pipe, timbers, crates, boxes, or in fact, any kind of material or style of load that requires a lift from 2 points.

line out from the building it would have to extend out 200 ft. for the same dumping area.

Can be used for any type of material, sand, gravel, coal, boxes, crates, pig iron, sacks, bundles, barrels, etc. The process may be reversed and materials conveyed into building.



DETAILS OF CONSTRUCTION OF LOUDEN SWINGING STEEL CRANE



OVERHEAD SPACE UTILIZED BY LOUDEN CARRYING SYSTEM AND FLOOR FREE FROM CONGESTION

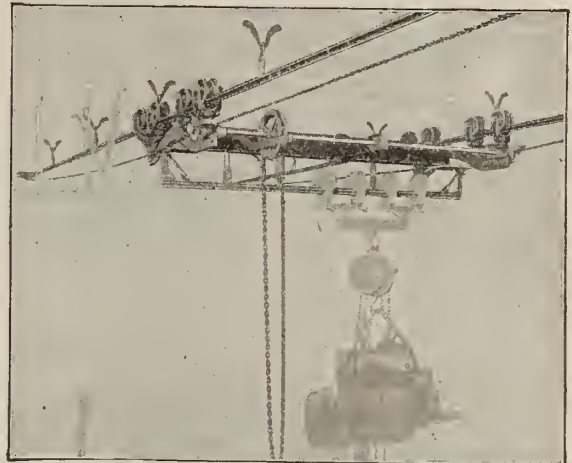
Six 2-way switches connect main line up with 6 branch tracks. Main track forks into 2 parallel tracks at back.

Louden Swinging Steel Cranes.

Hinged to building above door in line with overhead track and extend out over yard from 12 to 40 ft., according to crane length. No posts or supports are necessary in yard. Afford extremely large dumping area. Consider 40-ft. crane for piling up coal swinging in a semicircle with a radius of 40 ft.; the crane covers an area of over 2500 sq. ft. If track were one straight

Traveling Cranes.

Two main tracks parallel with each other, at any desired distance apart, run the entire length of the room. Operating back and forth on these tracks are trolleys which carry a cross track running at right angles to the two main tracks. This cross track crane carries a trolley and a hoist, making it possible to work from one side of the room to the other. Every foot of space in the room is accessible to the hoist. Overhead support may be ordinary 2 by 12-in. timber or an I-beam. Entire outfit strongly constructed and operates over more floor space than any other device.



TYPICAL INSTALLATION LOUDEN TRAVELING CRANE

Co-operative Service.

The engineering department of this company will cheerfully figure on all conveying requirements. These men come in contact with many different classes of installations, where various kinds of work and material are handled and complicated systems of track arrangements are necessary. As a result of their experience, the department is a clearing house for ideas on this line of work. Send for the complete catalogue, which shows scores of installations for almost every class of conveying work imaginable.

MATHEWS GRAVITY CARRIER COMPANY

Elevating and Conveying Apparatus

MAIN OFFICE AND WORKS
ELLWOOD CITY, PA.

BRANCH FACTORIES

LONDON, ENG., BRITISH MATHEWS, LTD.

PORT HOPE, ONT., CANADIAN MATHEWS GRAVITY CARRIER
Co., LTD.

BRANCH OFFICES IN ALL PRINCIPAL AMERICAN CITIES

Products.

MATHEWS GRAVITY ROLLER CONVEYERS.

MATHEWS AUTOMATIC ELEVATORS.

MATHEWS GRAVITY SPIRAL CONVEYERS and
CHUTES.

MATHEWS ROLLER SPECIALTIES.

Standard Conveyers.

SINGLE ROLLER CONVEYER UNITS—Light, medium and heavy construction used for handling light, medium and heavy sizes and weights of merchandise packed in boxes, crates, fiber cartons, barrels, kegs, etc., also miscellaneous articles and commodities having one smooth, reasonably hard surface.

DOUBLE ROLLER CONVEYER UNITS—Light, medium and heavy construction, designed for handling boxes, crates, cartons, etc., running to unusually large sizes and heavy weights.

SPECIAL PATENTED FLANGE ROLLER UNITS—Designed for handling brick, hollow tile, cement blocks, and miscellaneous building materials.

SPECIAL PATENTED DOUBLE AND SINGLE ROLLER CONVEYER UNITS—Designed for handling lumber, lath, flooring, siding, dimension stuff, etc.

SPECIAL PATENTED, BALL BEARING WHEEL CONVEYER UNITS—Designed for handling shingles, green brick, cement blocks, tile, etc., on pallets, also light boxes of canned goods of uniform size.

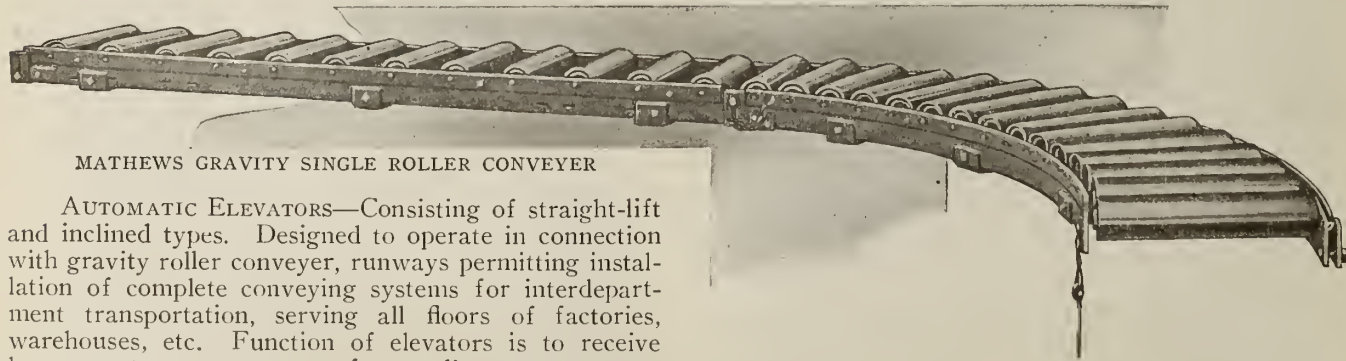
GRAVITY SPIRAL CHUTES—A sheet metal runway built around a metal standpipe or open core, as conditions and requirements may demand. Function is to carry by gravity any kind of package or loose merchandise from upper floors of building to various destinations on lower levels. No positive control of the speed of packages is possible with this type of spiral except such as is exerted by friction produced by contact with bed plates and side guards.

AUXILIARY CONVEYING UNITS AND DEVICES—Consisting of various kinds of switches, counterbalanced hinged sections, deflectors, frogs, stops, etc., all of which are frequently employed in complete factory or warehouse systems to accomplish continuous routing of packages in conformity with an efficient scheme of distribution, or to facilitate the flow of products through a series of processes from one department to another.

ROLLER SPECIALTIES—Consisting of ball bearing steel rollers of various diameters for individual assembly in belt conveyers, and numerous other commercial purposes, lumber dollies, car door rollers, roller trucks, etc.

CURVE UNITS—Standard 90° and 45° curve units are furnished for use in connection with all types of straight roller conveyer units. Curves of any desired angle or radius are also designed to meet special or unusual requirements.

All types of roller conveyers will handle ordinary boxes and other flat, smooth packages, on a grade of 4% or less, depending upon character and weight.

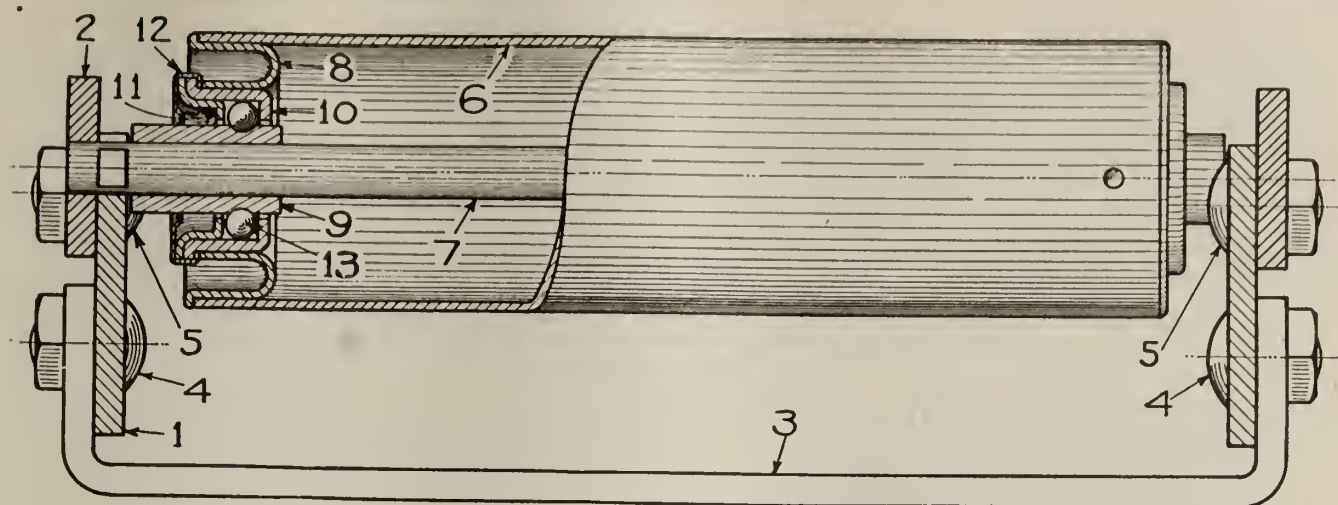


MATHEWS GRAVITY SINGLE ROLLER CONVEYER

AUTOMATIC ELEVATORS—Consisting of straight-lift and inclined types. Designed to operate in connection with gravity roller conveyer, runways permitting installation of complete conveying systems for interdepartment transportation, serving all floors of factories, warehouses, etc. Function of elevators is to receive boxes, crates, cartons, etc., from roller conveyer runways at lower levels and carry same to higher levels, the act of receiving and discharging being accomplished without an attendant.

GRAVITY ROLLER SPIRALS—Practically a continuation of a straight line of gravity roller conveyer units, but so constructed that packages move in a circle of limited diameter while descending from upper to lower levels, the movement being gentle to avoid injury to fragile containers or contents thereof. When desired downward vertical distance has been traveled, the packages are brought out of spiral onto connecting line of portable or permanently placed units of roller conveyer, thence to destination.

ILLUSTRATION—A photographic reproduction of a standard 8-ft. unit of gravity roller conveyer, joined by means of an universal coupling to a standard 90° curve unit. Nearly all types of Mathews roller conveyers are designed for use either portably or installed in permanent locations. Portable units are supplied with universal couplings, making the sections interchangeable. Permanently installed units are supplied with strap couplings, consisting of fish plates and bolts. Curves are reversible, permitting turning of a portable line of carrier in either a right-hand or left-hand direction. Supports of different kinds are furnished, depending upon how the conveyer is to be used.



CROSS-SECTIONAL DIAGRAM OF MATHEWS BALL-BEARING ROLLER

Ball Bearing Roller.

The cross-sectional drawing above clearly indicates the general design and structural details of a Mathews ball bearing roller. Illustration shows the $2\frac{1}{4}$ in. in diameter size. Two larger diameters are made, one $2\frac{1}{2}$ in. and the other $3\frac{1}{4}$ in. These three standard sizes do not differ in general design, but the materials in the two larger sizes are heavier and stronger than those used in the smaller size shown.

The following specifications will indicate the general correlation of the different parts in the complete roller and frame assembly.

General Roller Specifications.

These apply to the $2\frac{1}{4}$ -in., $2\frac{1}{2}$ -in. and $3\frac{1}{4}$ -in. sizes.

No. 1—Frame rail made of bar steel $2\frac{1}{2}$ in. wide by $\frac{1}{4}$ in. thick, slotted on upper edge to receive ends of roller axles.

No. 2—Lock bar made of bar steel $1\frac{1}{2}$ in. wide by $\frac{1}{4}$ in. thick, slotted to fit over ends of axles, holding them in rigid position.

No. 3—"U" brace, made of bar steel $1\frac{1}{2}$ in. wide by $\frac{1}{4}$ in. thick, used to tie frame rails together.

No. 4— $\frac{5}{16}$ in. by $\frac{3}{4}$ in. bolts, used for fastening "U" braces to frame rails.

No. 5— $\frac{5}{16}$ in. by $\frac{3}{4}$ in. bolts, used for fastening lock bar to frame rail.

No. 6—Roller tube, cut from No. 16-gauge cold drawn seamless steel tubing.

No. 7—Roller axle, made of structural steel $\frac{7}{16}$ in. in diameter.

No. 8—Housing made cup-shaped to receive the detachable bearing, of .065-in. dead soft stamping steel.

No. 9—Cone (or sleeve) forming part of ball race, made of cold rolled screw stock, $\frac{3}{4}$ in. in diameter, bored to fit around the axle snugly, but with sufficient play to permit it to revolve slowly when roller rotates under load. Cone is thoroughly case hardened.

No. 10—Flanged steel ring, case hardened, shaped to form inner wall of ball cage, and outer part of ball race; made from .095-in. stamping steel.

No. 11—Retaining washer, case hardened, shaped to form outer wall of ball cage; made from .065-in. stamping steel.

No. 12—Lock ring, designed to bind parts Nos. 10 and 11 together, keeping space in ball cage constantly uniform; made from .035-in. stamping steel.

No. 13—Balls—11 in number, filling the ball race evenly; quality high grade, $\frac{1}{4}$ in. in diameter, made of hardened chrome tool steel.

It will be noted that the assembled detachable bearing is so designed that all parts are positively locked together. When bearing is inserted it is held in position by lock ring (No. 12) coming into contact with housing (No. 8) and by cone (No. 9) fitting against inside surface of frame rail (No. 1). The housing (No. 8) is firmly fastened into ends of roller tube by deep prick punching at three points.



DOUBLE ROLLER CONVEYER STRAIGHT UNIT
Curve units of any desired degree made to fit purchaser's requirements



PATENTED WHEEL CONVEYER STRAIGHT UNIT

Curve units of any desired degree made to fit purchaser's requirements. Construction consists of ball bearing steel wheels, $2\frac{3}{4}$ in. in diameter, $\frac{1}{2}$ in. face, assembled on 3-in. centers, bolted to steel frame rails; standard width, from center to center of wheels, $12\frac{1}{2}$ in. Made any desired width to suit requirements. Suitable for conveying bundles of shingles and boxes of uniform size

Automatic Package Elevators.

The distribution of merchandise packages from lower to upper floors or direct routing of freight from cars to various floors of factory or warehouse is being accomplished efficiently and economically by means of Mathews automatic straight-lift and inclined elevators.

When used in automatic relation to connecting gravity conveyer lines these speedy elevators find their greatest sphere of usefulness and maximum efficiency. Equipped with positive package ejectors, carriage control, safety devices, power discharge stations, etc.

Handle boxes, barrels, crates, cartons, or any character of container having firm, substantial construction. Straight-lifts are made in three standard sizes. Inclined types are simpler in design and generally employed for two-floor service only.



MATHEWS AUTOMATIC ELEVATOR OPERATING BETWEEN FLOORS

Heavy Duty Roller Conveyers.

It frequently happens that the service required of a gravity roller conveyer is of an unusually severe nature. The packages or commodities may run to extreme sizes and weights, or the installation may be surrounded by conditions which cause rapid deterioration, such as the presence of moisture, steam, acids and salts, usually prevailing in dairies, creameries, ice cream factories, meat and fish packing plants, etc.

The company's engineers made a careful investigation of these adverse conditions and conducted a series of chemical and mechanical experiments covering a period of several months. The Mathews heavy duty roller conveyer is, therefore, a product built upon a thorough knowledge of requirements—not mere theories.

The conveyer is also being applied to the handling of pig iron, billets, forgings, castings, shells, bars, angles, etc.



MATHEWS HEAVY DUTY ROLLER CONVEYER

Gravity Spiral Conveyers.

The adoption of the gravity spiral conveyer as a substitute for platform elevators in handling down-coming merchandise has been almost universal in recent years, especially in large wholesale and retail establishments.

Where packages or products are fragile and liable to injury, a Mathews double roller spiral conveyer (patented) may be substituted for the spiral chute. Roller spirals control the movement of packages, eliminating breakage and damage, also permit accumulating and storing of packages without danger of jamming, or buckling.

The Mathews gravity spiral conveyers are the outcome of correct design and scientific construction applied to high grade material. Made in several standard styles or of special design for inside or outside installation.



MATHEWS GRAVITY SPIRAL CONVEYER

Conveying Systems.

In studying the application of gravity conveyance to factory, wholesale and warehouse use, certain limitations were encountered which resulted in the invention of other correlated conveying devices.

This company now has complete systems for accomplishing continuous transportation of packages between all departments connecting all floors, and with extensions to adjacent building.

By means of automatic straight-lift and inclined elevators, gravity roller spirals, gravity spiral chutes, straight chutes, curves, switches, deflectors and power conveyers, operating in automatic relation to gravity conveyer lines, all objective points can be linked together to conform to special or standardized routing plans, and designed to fit into existing structures without expensive alterations.



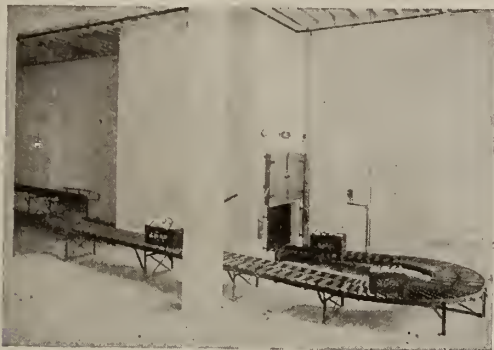
MULTIPLE TREAD SPIRAL CHUTE

Gravity Roller Conveyers.

To secure continuous routing, save rehandling, conserve floor space, eliminate waste of time and labor and to speed production and shipping, are the elements which make for efficiency in the handling of merchandise as well as a wide range of raw materials and finished products.

The principle of gravity conveyance has been scientifically developed by Mathews' engineers during 15 years of continuous contact with conveying problems of every description, and today is being successfully applied to the handling of boxes, crates, cartons, barrels, kegs, trays, cans, drums, etc.

The Mathews specialty is roller conveyers, made of light and heavy construction and in single and double roller types. All parts are of high grade steel. Rollers are of cold drawn seamless tubing, fitted with detachable ball bearings and through axles.



MATHEWS GRAVITY ROLLER CONVEYOR DESCRIBING A SHARP CURVE

Patented Lumber Conveyers.

Construction consists of two parallel rows of steel, ball bearing rollers assembled in 12-ft. steel units having three frame rails. The rollers are so arranged that lumber will not run off, although no guard rails are used.

Units are provided with universal couplings the same as the other styles of portable conveyers; boards of any width or length can be sent over these rollers in any desired direction—around corners or through tight places where teams can not go—using a down-grade of only 4%. Curves of 90° and 45° are also furnished, when needed, for proper routing to desired destination.



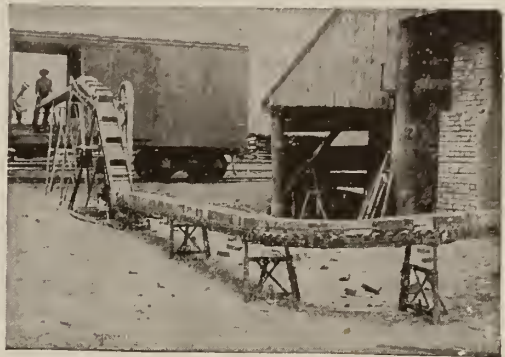
MATHEWS PATENTED LUMBER CONVEYER

Mathews Gravity Brick Conveyor (Patented).

Another labor saver which has won popularity and a prominent place in plants where clay, concrete and

cement products are made. As a substitute for wheelbarrows this conveyer has been approved and adopted by hundreds of brick makers throughout the country. All of the leading steel and iron mills are using thousands of feet for quick handling of fire brick.

Rollers are steel, with ball bearings, and have flanges at each end which act as guard rails, without creating friction. Units are furnished in straight lengths 4 and 8 ft. long, also 90° and 45° curves, all equipped with universal couplings for portable use. Conveyers are made in standard widths of 8, 10, 12, 14 and 16 in.



MATHEWS GRAVITY BRICK CONVEYER

Building Material Conveyers.

The handling of cement, wall plaster, etc., in sacks is being successfully and economically accomplished by means of the Mathews gravity roller conveyer, and is being used today by many retailers, wholesalers and manufacturers, as well as prominent building contractors.

Units are furnished in straight and curve sections in lengths and weights suitable for portable use, and constructed of high grade steel throughout.

Mathews Service.

Sales and engineering offices are maintained in all the leading cities in charge of experts who are available for consultation on short notice. Branch office services are rendered without cost or obligation, and engineers are urged to make full use of the facilities provided.

In cases where correspondence with the home office is preferable, full details concerning conveying problems should be submitted in first letter, accompanied by pencil sketches or blue prints showing the objective points to be connected by conveyer units, distances, elevations, etc.

State minimum and maximum sizes and weights of boxes, crates, cartons or packages to be handled. In the case of milk cans, pails or other round containers, give diameter, height and weight. If barrels, give diameter of head and bilge, height, weight and whether they are to be conveyed filled or empty. Describe fully the size, shape and weight of any odd or unusual form of package or container. Give accurate distance articles are to be conveyed, and if curves are desired give degree of curves; also state any variation in floor levels on which the carrier line will be supported.

These data are absolutely essential to intelligent consideration of any conveying requirements, and strict compliance with these instructions will enable the company to prepare drawings and proposals without unnecessary loss of time.

NATIONAL CONVEYING EQUIPMENT CORPORATION

TELEPHONE:
ALBANY 67

1752-1772 North Kolmar Avenue
CHICAGO, ILL.

Products.

PORTABLE CONVEYORS, Flight, Belt, Pan; ASH ELEVATORS.

Conveying Equipment of every description.

National Quality, Service and Guarantee.

The design and construction is along correct mechanical lines and affords the maximum strength necessary to withstand long, hard and continuous use. Friction has been reduced wherever possible and the cost of upkeep is practically nil. From the selection of materials to the testing and proving of the finished product, exacting supervision at each point of manufacture insures the high standard of National quality, strength and durability. Each machine is thoroughly tested under power before leaving the shop.

Whenever necessary, the company will supervise the installation of conveyors purchased from them, without charge to the customer. They are equipped to render service in all localities and will back up their guarantee that any equipment purchased from them must give the service rightfully expected of it.

Portable Conveyors; Scope of Use.

Adapted for handling materials such as coal, coke,

sand, gravel, crushed stone, cement, brick, clay, earth, ore, steel turnings, borings, scrap, ashes, clinkers, iron sponge, oxide, chemicals, salt, grain, fertilizer, etc.

May be used for piling or loading direct from hopper car or ground storage; for conveying from car to storage bin or overhead hopper; for conveying from ground storage to boiler room; for conveying direct from car or from ground pile to stokers.

Handled on wheels or overhead trolley.

Operating Cost and Results.

Man power is greatly multiplied by use of National conveyors at an operating cost of approximately 5¢ per hour. They speed up the men by doing the hard work, and, wherever installed, the handling charges invariably decrease.

National conveyors provide an efficient, yet inexpensive means for saving time, labor and money.

Special Conveying Equipment.

This company also build stationary conveyors of every description. Fabricating facilities are adequate and special designs not covered by stock equipment will be submitted.

Plans and estimates furnished.



Type A-1 Steel Flight Conveyor

Constructed of steel throughout. Operates with safety at 45°. Can be provided with slide gates for solid piling. Constructed entirely of steel, the depreciation is very small. Stands the strain and rough usage of coal handling better than any rubber or composition belt possibly could.



Type A-2 Dished Belt Conveyor

Consists of 4-ply 20-in. rubber belt provided with 2½-in. steel cleats. Dished idlers running on hollow shafts packed with grease and equipped with grease cups. Operating angle 30°. Every safeguard is provided to insure long life of the belt. Baffle boards are inbuilt to prevent material falling on underside of belt. Receiving end totally enclosed. Ideally adapted for handling all kinds of abrasive materials.

TWO TYPES OF THE NATIONAL PORTABLE CONVEYOR

Made in lengths of 20, 24, 28, 32, 36, and 40 ft. lengths. Adjustable wheeled frame. Delivers at any height up to 30 ft. Capacity over 60 tons per hour. Handles all size materials up to 20 by 20 in. Constructed along correct mechanical lines, great strength is concentrated where strength is most needed. Has extraordinary balance and is strictly portable. Unequaled for truck or car loading. Combines speed capacity and large operating radius.



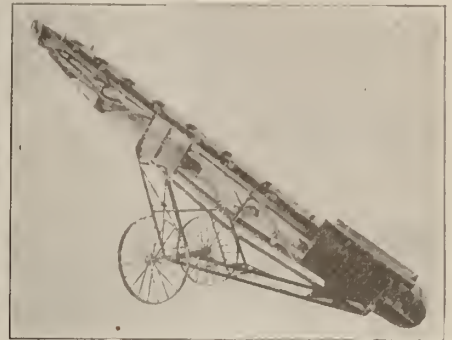
TYPE B NATIONAL COMBINATION CONVEYOR

A general purpose conveyor. Meets all classes of railway equipment. Can be handled on wheels or overhead trolley. Unloads hopper bottom, gondola or box cars with equal facility. Stores direct from car to shed or boiler room. Made in lengths of 16, 20, 24, and 28 ft. All steel construction. Depreciation very small. Operating angle 40°. Electric motor or gaso-line engine drive



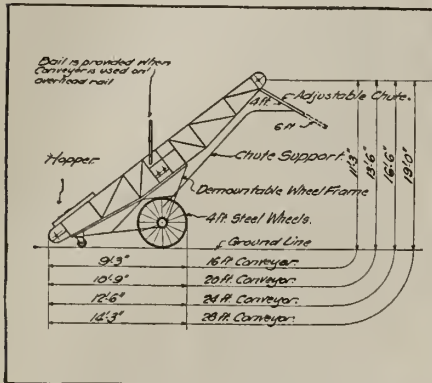
TYPE B CONVEYOR SUSPENDED FROM TROLLEY

Take off the wheels and set into a car, it follows the coal from one end of car to the other. It is always up against the coal. No trimming, wheeling or piling necessary

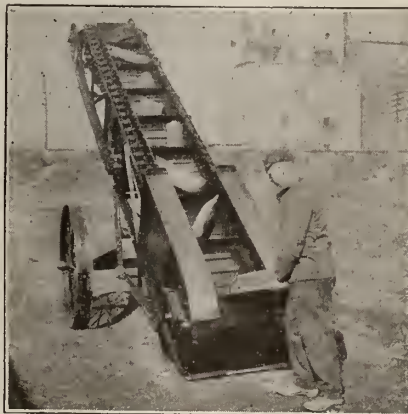


TYPE C NATIONAL DISHED BELT CONVEYOR

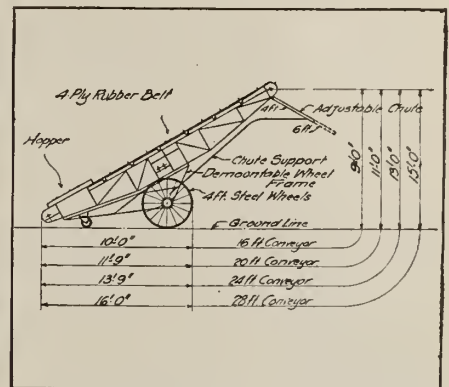
Handled in same manner as Type B. Made in lengths of 16, 20, 24, and 28 ft. Belt 4-ply rubber, 20 in. wide, provided with steel cleats 2½ in. high. Dished idlers run on hollow shafts equipped with grease cups. Frame, angle steel, riveted at all connections. Receiving end totally enclosed prevents material creeping on underside of belt. Baffle boards inbuilt insures maximum belt protection



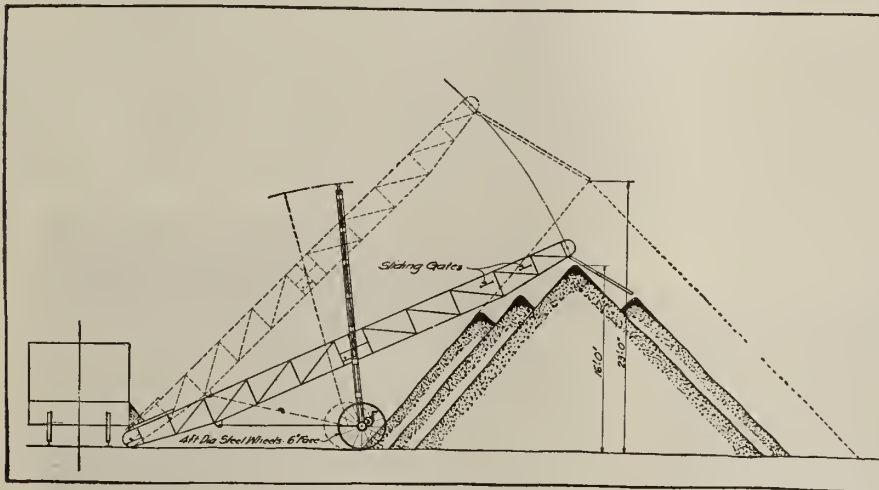
SIDE ELEVATION, FLIGHT CONVEYOR



PIG IRON CONVEYOR

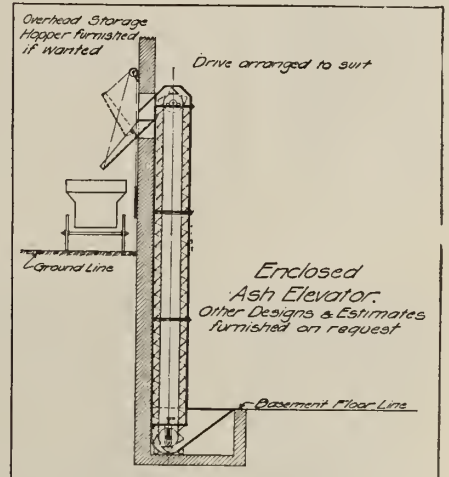


SIDE ELEVATION, BELT CONVEYOR

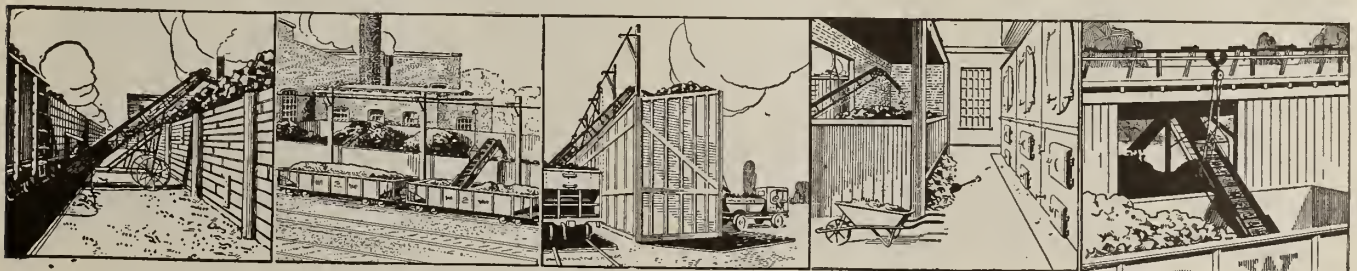


TYPE A-1 NATIONAL PORTABLE CONVEYOR EQUIPPED WITH SLIDE GATES FOR SOLID PILING

Stores 22 tons of coal per lin. ft. Piles 250 tons without moving conveyor



ENCLOSED ASH ELEVATOR



VARIOUS APPLICATIONS OF NATIONAL CONVEYORS

SAMUEL OLSON & CO.

Conveying and Elevating Machinery

TELEPHONE:
ARMITAGE 780, 781

2418-2422 Bloomingdale Avenue
CHICAGO, ILL.

Products.

CONVEYING and ELEVATING MACHINERY for handling materials of every description:

Coal and Ash Handling Elevators and Conveyors, Subveyors, Packing House Conveyors, Ice Handling Machinery, Spiral Chutes, Spiral Fire Escapes, Gravity and Belt Conveyors, Store and Office Service Conveyors, Patented Automatic and Pivoted Tray Elevators, Steel and Wood Apron Conveyors.

Power Transmission Machinery, Flour Blenders and Patented Automatic Proofers for Bakeries.

Conveyors, Spiral Chutes and Elevators.

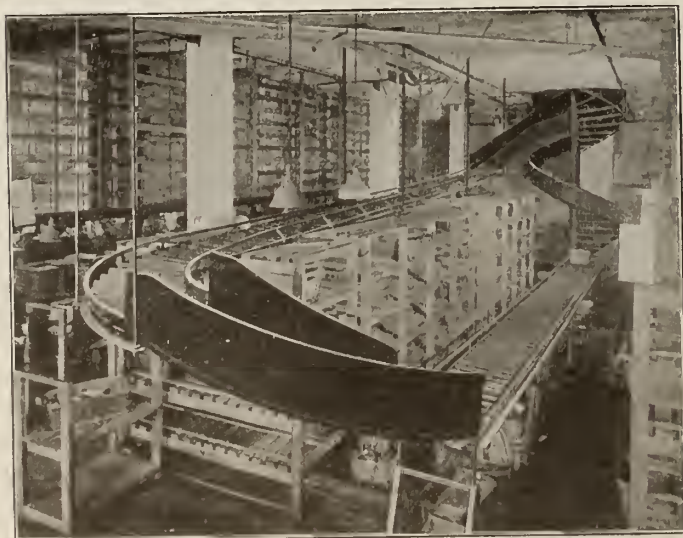
GRAVITY CONVEYORS AND SPIRAL CHUTES—Gravity conveyors afford an economic medium of distribution of commodities within plants irrespective of their characteristics. Working in conjunction with spiral chutes, an ideal system is placed at the disposal of those whose business necessitates the storing of merchandise on various floors previous to final shipping.

BUCKET ELEVATORS—Can to advantage be efficiently employed in elevating bulk commodities such as sand, gravel, cement, coal, grain, flour, etc.

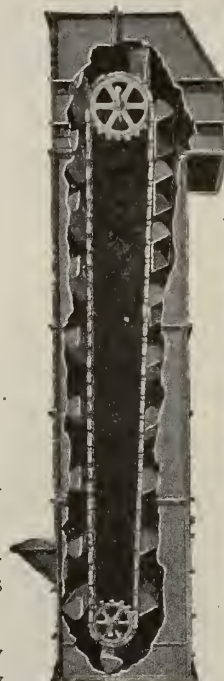
BELT CONVEYORS — Appropriately designed, they are the logical equipment with which to convey any and all commodities, ranging from coal and ore to the very lightest of packages.

Automatic Elevators.

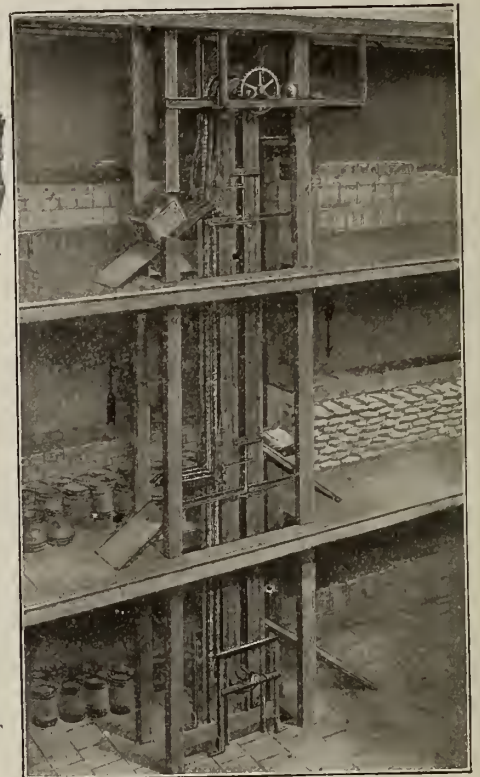
Olson automatic elevators will prove thoroughly efficient in handling packages, boxes, bags, etc., from the basement or lower floors to any desired upper floors; also for lowering packages, etc., from any floor above to any floor below. In other words, goods may be elevated on the upward moving trays unloading automatically on any desired floor, and other goods simultaneously being lowered on the downward moving trays automatically unloading at any desired floor below.



GRAVITY CONVEYORS IN CONJUNCTION WITH SPIRAL CHUTE



SECTION OF BUCKET ELEVATOR



AUTOMATIC ELEVATOR

Co-operative Service.

Engineers should use the vast experience of SAMUEL OLSON & Co. in solving intricate handling problems. Previous to making final decision as to any type of conveying machinery, consult this company. Recommendations particularly adapted for exact conditions will be supplied by experts.



PORTION OF A COMPREHENSIVE CONVEYING AND ELEVATING SYSTEM INSTALLED IN PLANT OF AMERICAN CAN CO., MAYWOOD, ILL.

THE PERRINE STORE SERVICE CO.

Pneumatic Tube Systems and Conveying Apparatus

412 South Sixth Street
MINNEAPOLIS, MINN.

Products.

PNEUMATIC TUBE SYSTEMS, POWER SAVING DEVICES, BELT CONVEYORS.

Light Hand and Electric Lifts; Cash and Parcel Carriers.

Pneumatic Tube Systems.

Types—Vacuum—Independent, twin tube line for each substation. Operated by low pressure, positive blower.

Pressure—Combination pressure incoming lines serving 3 to 4 substations each. Pressure outgoing line to each substation. Operated by low pressure, positive blower.

Vacuum Pressure—Vacuum incoming lines serving 3 to 6 substations each. Pressure outgoing line to each substation. Operated by either 1 or 2 low pressure, positive blowers.

Automatic Pressure—Single tube for service in both directions between various stations. Equipped at each end with terminal, which automatically maintains air flow only while carrier is in transit. Operated on 5 lbs. air pressure from special compressor unit or reduced from high pressure air service.

Especially adapted to light traffic.

Foot Power—Single tube, for service in both directions between stations, with foot power operated compressor at each end.

For light service and distances not exceeding 200 ft.

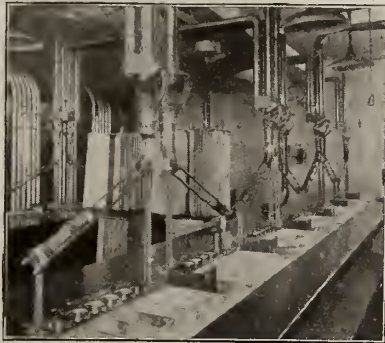
SIZES OF TUBES—2¼-, 3- and 4-in. outside diameter tubing and 3 by 6-in. and 4 by 7-in. oval tubing;

except foot power, which is 2¼- and 3-in. outside diameter tubing only.

Cost—This company can save 15% to 25% on cost of pneumatic tube systems for your requirements. Quotations can be made from the building plans; merely submit plans showing approximate location of stations.

The table below will be of value in approximating the cost of equipment under consideration. (Submit plans for definite quotation.) These costs are based on installations made by THE PERRINE STORE SERVICE CO. at:

Washburn-Crosby Co., Minneapolis, Minn.
U. S. Railroad Consolidated Ticket Office, Minneapolis, Minn.
Powers Mercantile Co., Minneapolis, Minn.
T. S. Martin Co., Sioux City, Iowa
Willys-Overland Co., St. Paul, Minn.
Fairbanks-Morse & Co., St. Paul, Minn.
Swift & Co., South St. Paul, Minn.
Swift & Co., Chicago, Ill.
Cleveland Hotel, Cleveland, Ohio
Morris & Co., Chicago, Ill.
Armour & Co., South St. Paul, Minn.



TYPICAL INSTALLATION PERRINE
VACUUM PRESSURE PNEUMATIC
TUBE SYSTEM



TERMINALS PERRINE AUTO-
MATIC PRESSURE PNEU-
MATIC TUBE SYSTEM

Power Saving Devices.

For automatically cutting off air flow through the tubes when the carriers are not in transit. For both vacuum and pressure systems. They are extremely simple in construction and have no electric wiring or auxiliary air connections to get out of order.

Actuated by the presence of the carrier anywhere in the line, they are the only devices on the market which will always maintain air flow until carrier is delivered.

Covered by patents in United States and Canada.



PERRINE POWER
SAVING DEVICES

Belt Conveyors.

Especially designed for handling merchandise in department stores and wholesale houses.

CONSTRUCTION—Both wood and steel framing; semi-oilless bearings; cut rawhide pinion drive; ceiling or floor supports.

SIZES—Width of belt, 12, 18, 24, 30 or 36 in. Larger sizes special to order.

APPROXIMATE COST OF PNEUMATIC TUBE SYSTEMS, INSTALLED

Type of system	Size of tubing, in.	Tubing material	Number of sub-stations	Size of building, ft.	Number of floors served	Average length of line, central to substation, ft.	Maximum horse power required	Industry served	Cost per sub-station	Total cost of system complete 1
Vacuum pressure "A"....	2¼	Alloy	6	150 x 65	5	90	1½	Wholesale Paper House.....	\$200.00	\$1,200.00
Vacuum pressure "B"....	2¼	Alloy	12	100 x 50	2	110	2½	Retail Hardware.....	158.00	1,900.00
Vacuum pressure "A"....	2¼	Alloy	14	90 x 35	1	55	1	Railroad Ticket Office.....	110.00	1,540.00
Vacuum pressure "F"....	2¼	Alloy	32	150 x 150	7	170	10	Department Store.....	266.00	8,500.00
Vacuum pressure "F"....	2¼	Alloy	82	330 x 155	5	170	20	Department Store.....	180.00	14,800.00
Vacuum pressure "A"....	3	Alloy	5	170 x 100	5	160	2	General Office, Packing Plant....	330.00	1,650.00
Vacuum pressure "F"....	3	Alloy	10	290 x 90	5	150	7½	General Office, Packing Plant....	390.00	3,900.00
Vacuum pressure "C"....	3	Alloy	14	1000 x 600	Plant	640	10	Packing Plant, Orders.....	850.00	12,000.00
Automatic pressure "N"....	2¼	Brass	17 lines	230 x 135	14	175	5	Hotel, Cashier and Floor Service..	341.00	5,800.00
Automatic pressure "N"....	3	Alloy	2 lines	460 x 190	2	340	3	Automobile Assembly Plant.....	600.00	1,200.00

"A," single unit, 1 vacuum incoming line and 1 bank selective pressure outgoing line.

"B," 2 unit, 2 vacuum incoming lines and 2 banks selective pressure outgoing lines.

"C," 3 unit, 3 vacuum incoming lines and 3 banks selective pressure outgoing lines.

"F," combination vacuum incoming lines and independent pressure outgoing lines equipped with power saving devices.

"M," automatic pressure, air compressor unit included.

"N," automatic pressure, air compressor unit not included, but pressure reducing valve only.

PORTABLE MACHINERY CO., INC.

Manufacturers of Scoop Conveyors

PASSAIC, N. J.

Product.

SCOOP CONVEYOR, a Portable Belt Conveyor, Wagon Loader, Car Loader and Unloader.

Description.

The Scoop conveyor is a light weight portable belt conveyor, designed to be handled by one man and to assist the hand shoveller in moving materials, such as coal, coke, ashes, sand, crushed stone, gravel and similar materials. It is also used for conveying manufactured products of various kinds, such as packages, boxes, barrels, bags, etc.

Over 2000 scoop conveyors are now in use by contractors, railroads, coal dealers and by manufacturing plants covering almost every conceivable industry.

The Scoop conveyor saves from 6 to 12 men in storing and reclaiming, loading or unloading cars, trucks or wagons. It keeps equipment moving and saves car demurrage.

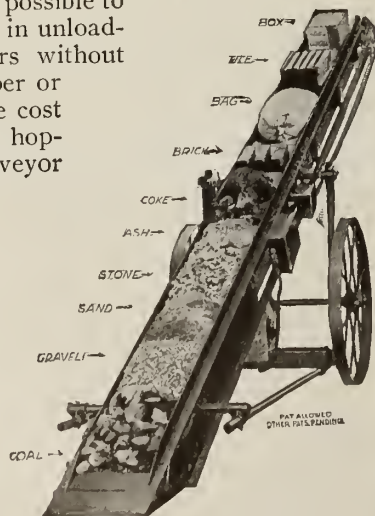


METHOD OF TRANSPORTING THE SCOOP CONVEYOR

Exclusive Features.

One distinctive feature is the scoop on the feeding end, which can be pushed or completely buried into the material to be conveyed. Thus, instead of lifting the material up by shovelfuls into the feeding hoppers fitted to ordinary portable belt conveyors, it is simply scraped onto the carrying belt and saves 50% of labor in feeding. The scoop also makes it possible to use the Scoop conveyor in unloading hopper bottom cars without providing a track hopper or pit. Besides saving the cost of constructing a track hopper, the Scoop conveyor facilitates unloading of hopper bottom cars at any point along the track.

Another distinctive feature is the construction of the sides or skirt plates. These form a trough, giving a 12-in. belt a carrying capacity equal to a 20-in. trough belt.



SCOOP CONVEYOR

The Scoop conveyor has a wide range of adaptability



TRADE-MARK

Specifications.

SIZES—Built in 6 sizes as follows: 12 in. by 14 ft., 16 in. by 14 ft., 12 in. by 20 ft., 16 in. by 20 ft., 12 in. by 24 ft. and 16 in. by 24 ft. Sizes 12 in. by 14 ft. and 16 in. by 14 ft. are suitable for loading or unloading box cars, small industrial cars or for use in limited space. Sizes 12 in. by 20 ft., 16 in. by 20 ft., 12 in. by 24 ft. and 16 in. by 24 ft. are adapted for loading and unloading trucks or cars and for stacking materials. Size most suitable is governed by height and reach required to meet operating conditions.

MOTOR POWER—Furnished either with or without electric motor or gasoline engine as preferred.

CAPACITY—Both the 12- and 16-in. sizes will carry 1 ton per minute of material weighing 50 lbs. per cu. ft., providing trough is kept even full. Belt on 16-in. size travels at slower speed, because it is intended only for handling larger size pieces than can be safely handled on 12-in. size. For handling material containing cubes measuring over 9 in., 16-in. size is recommended.



SCOOP CONVEYOR IN OPERATION

FEEDING—From storage pile, 1 man can feed 1 ton of material that will pass a 1-in. ring in 1½ minutes, providing storage pile is 8 ft. in height or over. If material is large in size or storage pile is low, it will require several men to feed machine to full capacity.

Guarantee.

The company guarantees that the Scoop conveyor repair costs through wear, including conveying belt renewals, will not be over 1½c. per ton of material handled when conveying coal, coke, ashes, sand, crushed stone or similar material.

Information Required When Making Inquiries.

State operating conditions; kind of material to be handled; power available; where material is received and delivered, etc.



SCOOP CONVEYOR OPERATING IN LIMITED SPACE

ROBINS CONVEYING BELT COMPANY

Manufacturers of Robins Conveying Machinery

13-21 Park Row
NEW YORK, N. Y.

BRANCHES AND AGENCIES

CHICAGO, ILL., Old Colony Building
SALT LAKE CITY, UTAH, Newhouse Building
SAN FRANCISCO, CAL., GRIFFIN Co.

PITTSBURGH, PA., Union Arcade Building
BIRMINGHAM, ALA., C. B. DAVIS & Co.
TORONTO, CAN., GUTTA PERCHA & RUBBER, LTD.

Products and Services.

Manufacturers of CONVEYING MACHINERY.

This company furnishes Belt Conveyors, Unloading Towers, Stock and Reclaiming Bridges, Coal Storage and Reclaiming Systems, Coke Cooling Wharfs, Ore Bedding and Reclaiming Systems, Standard and Adjustable Coal or Coke Crushers, and the auxiliary equipment such as Chutes, Feeders, Screens of various types, etc.

The ROBINS CONVEYING BELT COMPANY is prepared to Design and Install Conveying Machinery to meet any requirement.

Scope of Use.

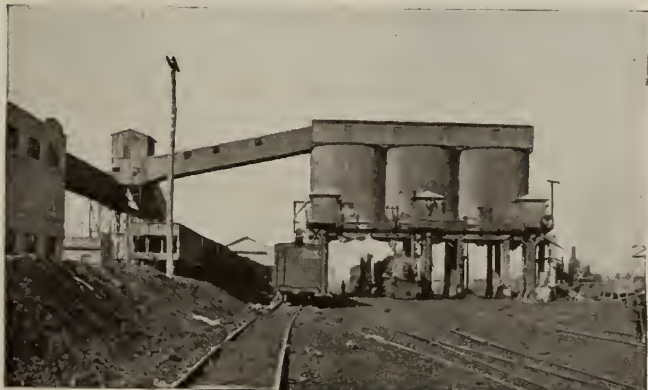
Robins conveying machinery is handling coal, coke, ashes, ore, limestone, clinker, cement in bulk and in bags, wet concrete, sand, crushed stone, dirt, gypsum, phosphate rock, salt, grain, wood chips and pulp, rubbish, packages of all kinds and many other materials.

Lubrication.

Robins machinery parts are fitted for compression grease cup lubrication to protect the bearings from dust and corrosion. Consequently, troubles resulting from these causes are practically eliminated under the most severe operating conditions.



ROBINS UNLOADING, STOCKING, RECLAIMING AND CONVEYING MACHINERY



LOCOMOTIVE COALING STATION OF THE ERIE R. R. AT CROXTON, N. J.

Belts.

Robins conveyor belts are made in a number of different grades, both of the stepped-ply and straight-ply construction, each grade being designed to give the most economical service under certain operating conditions. If this company believes that none of their brands of belts will give satisfactory service because of unusual conditions, they will manufacture a special grade of belt for the work.

Robins stepped-ply belts have thicker rubber cover in the center than at the edges, thus giving more protection where the abrasion is greatest. A belt of this construction is flexible laterally, allowing it to conform to the shape of the troughing idlers, and causing it to run true even when empty.



ROBINS PATENTED STEPPED-PLY BELT

Handbook.

The Robins "Handbook of Conveyor Practice" will prove of value to engineers who are planning for or designing conveyor installations. It contains a group of useful tables concerning capacities, power requirements, speeds of conveyors and similar matter; also dimensions of conveyor parts, together with general data on conveyor practice. A copy will be gladly sent on request.



ROBINS BELT CONVEYOR HANDLING COKE



ROBINS SHAKING FEEDER AND COAL CRUSHER

RICHARDS-WILCOX MANUFACTURING CO.

INCORPORATED

Overhead Carrying Systems and Warehouse Door Hardware

CABLE ADDRESS:
"RICHWILCO"

AURORA, ILL.

CANADIAN FACTORY
LONDON, ONTARIO

BRANCH OFFICES

NEW YORK, N. Y., 85 Walker Street
BOSTON, MASS., 132 Pearl Street
LOS ANGELES, CAL., 503 Equitable Building
ST. LOUIS, MO., 1735 Boatmen's Bank Building

PHILADELPHIA, PA., 507 Arch Street
CHICAGO, ILL., 166-168 West Lake Street
SAN FRANCISCO, CAL., 626 Underwood Building
MINNEAPOLIS, MINN., 321 Plymouth Building

Products.

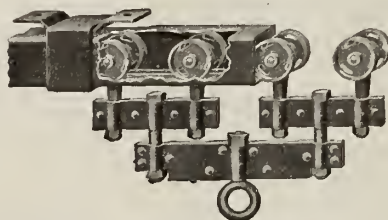
R-W "OVER-WAY" TROLLEY and I-BEAM OVERHEAD CARRYING SYSTEMS, LIFT WAREHOUSE DOOR HARDWARE, FIRE DOOR and FIRE SHUTTER FIXTURES.

Manually Operated Cranes; Jib Cranes; Portable Cranes; Yale Hoists; Store Shelves and Ladders; Angle Iron Door Frames; Warehouse Door Hangers; Door Hangers and Track for Sliding Doors of all kinds and weights; Garage Door Outfits; Elevator Door Hangers; Elevator Door Closer and Check; Sliding Partition Door Hardware; Swing Door Closers and Checks; Hardware Specialities.



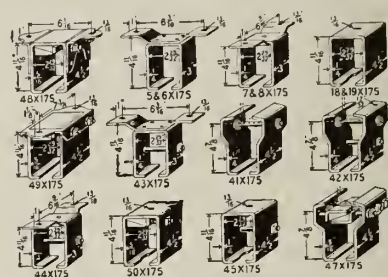
used for storage purposes. Send detail of overhead construction, so proper brackets will be furnished.

Co-OPERATIVE SERVICE—On receipt of requisite information, detailed drawing of equipment to meet requirements will be submitted for approval.



TROLLEY OVERHEAD ROLLER BEARING SWIVEL CARRIER

Nos. 100-11 and 100-13. For curved track. Made for 4 sizes of track and 6 capacities



TROLLEY OVERHEAD CARRYING TRACK BRACKETS

"Over-Way" Trolley and I-Beam Overhead Carrying Systems.

"Over-Way" conveying equipment constitutes the most efficient labor saving devices manufactured for any size factory or machinshop for handling loads up to 4 tons. The tracks are in a position where they are free from obstruction and always ready for instant use. Factory handling costs are reduced to a minimum, and available floor space increased by hundreds of square feet. Equipment includes overhead tracks, brackets, trolleys, carriers, hangers, switches, cross-overs, turntables and Yale hoists.

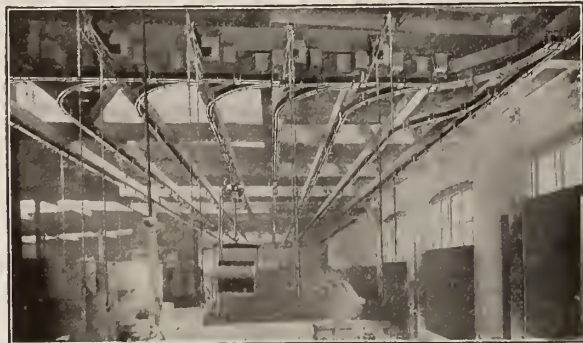
ERECTION—To insure proper erection, blue prints are furnished in detail and all material marked to correspond.

INFORMATION REQUIRED—Always send sketch giving correct dimensions and proposed layout of tracks. State weight and size of maximum load, whether for constant or occasional use, and whether track will be

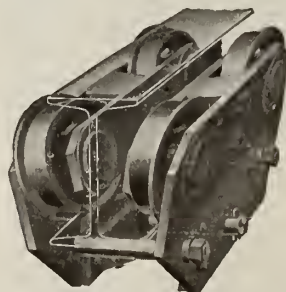
TRACK, SPACING OF BRACKETS, SIZES AND CAPACITIES OF CARRIERS

Size of Carrier							Track		Load on Carrier, lbs.															
No.	No. of wheels	Diam. wheel, in.	Length over all, in.	Bottom of track to bottom of eye, in.	Eye bolt				125	250	500	750	1000	1250	1500	2000	2500	3000						
					Diam. stem, in.	Diam. eye, in.	No.	Ga.	Spacing of brackets according to load															
100-10	16	3	44	13¼	⅞	1⅜	175	13																
							275	12											30"	27"	21"	18"	15"	12"
							375	13											34"	30"	24"	21"	18"	15"
100-11	8	3	21	9¼	¾	1⅞	175	10				27"	21"	17"	15"	12"								
							275	12											32"	24"	20"	17"	15"	
							375	10											48"	32"	24"	21"	18"	
100-12	16	2⅝	31	10	⅝	1¾	75	14	36"															
100-13	8	2⅝	14	6¾	1½	1½	75	14											36"	30"		18"	12"	
100-14	4	2⅝	7	4½	1½	1½	75	14											30"					
100-15	4	3	9	5½	⅝	1¾	175	13																
							275	12											42"	21"	15"			
							375	10											54"	30"	18"			

Spacing of brackets according to load



PARALLEL TRACKS WITH CURVES AND SWITCHES USED BY BARRETT COMPANY, CHICAGO, ILL., FOR HANDLING ROOFING PAPER



OVER-WAY STANDARD I-BEAM TROLLEYS
Axles operate on ball bearings



OVER-WAY UNIVERSAL CLAMP

For attaching supporting brackets to I-beams. Not necessary to drill holes in I-beam. Can be attached at any point

DATA, OVER-WAY STANDARD I-BEAM TROLLEYS

No. and size of I-beam	Capacity, lbs.	Diam. wheels on thread, in.	Smallest radius of curve, in.	Diam. center pin, in.	Distance top of center pin to bottom of beam, in.	Width over all, in.	Length of switch tongue, ft.
925-5"	1000	3 7/8	21	3/4	1 3/4	6 3/4	6
925-6"	2000	4 1/8	21	1 1/8	2 1/8	7 1/8	6
925-7"	3000	5 1/4	34	1 3/8	2 3/8	8 1/8	6
925-8"	4000	6 1/4	36	1 3/4	2 3/4	9 1/4	6
925-9"	6000	7 1/2	42	1 3/4	3	10 1/4	6
925-10"	8000	8 1/4	48	1 3/4	3 1/8	11	6

Always specify by number, stating size and weight of I-beam.

Fire Door and Fire Shutter Fixtures.

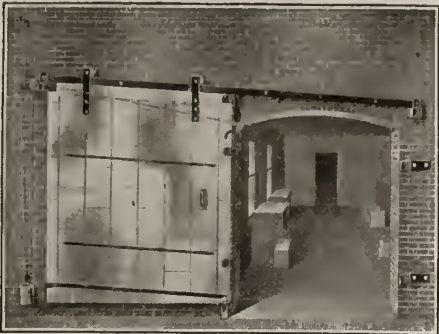
This line of fire door equipment is the most complete in the United States, and includes all types, as follows: inclined and level track, flat or round, vertical and horizontal sliding doors; swinging doors, single and double. Also fire shutters and trap fire door fixtures.

Fixtures marked with * in table are approved by the Underwriters' Laboratories, Inc. Hardware furnished to meet special requirements.

Corrugated sheet metal fire doors lined with asbestos, approved and labeled under the direction of National Board of Fire Underwriters.

Tin clad fire doors, approved and labeled under the direction of National Board of Fire Underwriters.

For more detailed data, ask for fire door hardware catalogue. Blue prints sent on request.



NO. 102 MONARCH FIRE DOOR FIXTURES
Recommended where headroom exceeds 3 ft.
Two fusible links, one in opening and one near ceiling. Door closes by gravity

DATA, FIRE DOOR FIXTURES

Type of door	Fixture number	Round or flat track	Clearance above top of opening, in.	Clearance required at side of opening	
				Where doors slide or swing, in.	Opposite side, in.
Incline track sliding door	102*	Flat	14†	Width of opening + 22	13½
	201*	Flat	14†	Width of opening + 19	13½
	645*	Round	12†	Width of opening + 18	13½
	646*	Round	12†	Width of opening + 15	13½
Level track sliding door	303	Flat	14†	Width of opening + 19	19
	304	Flat	9†	Width of opening + 19	19
Sliding doors in pairs	204*	Flat	14†	Width of opening + 19	
	604*	Round	12†	Width of opening + 15	
Single swing doors	206		9	10	3½
	406*		9	11	3½
	606		none	3½	3½
Swing doors in pairs	306		10	10	10
	506*		10	11	11
	706		3½	3½	3½
Side wall required					
				Doors under 300 lbs.	Doors over 300 lbs.
Vertical sliding doors	203	Flat	Height of opening + 19	15 and 21	21 and 28
	603	Round		16 and 22	22 and 29

Adjustable hanger can be furnished with Nos. 102, 201, 204, 303, 645, 646 and 604 fixtures, and requires 3 in. more headroom above top of opening than rigid hangers.

*Approved and labeled under direction of National Board of Fire Underwriters.

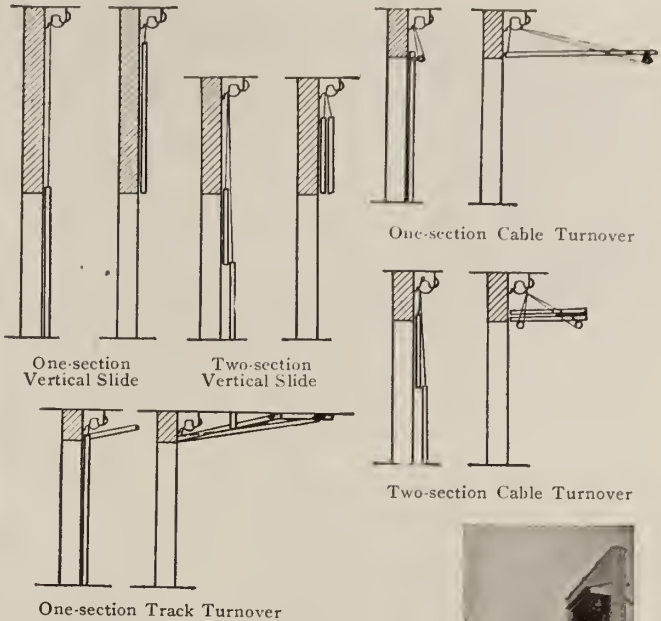
†For arched top openings add ¾ in. for each foot of track back of the center of the opening, to the dimension given. For square top opening add ¾ in. for each foot of track back of edge of opening towards which the door slides in closing, to the dimension given.

Lift Warehouse Door Hardware.

KINDS OF DOORS—One-section turnover door with track supporting top of doors; one-section turnover door, top of door supported by cables, suitable for doors not over 8-ft. high; one-section vertical door; two-section vertical door as illustrated; two-section turnover door.

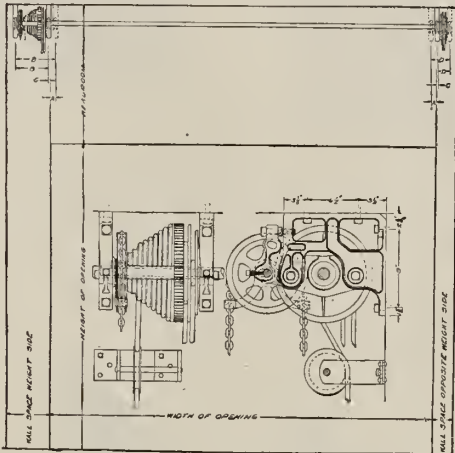
All of these doors are counterbalanced and operated with geared hand chain hoist. Openings should be fitted with steel channel or angle jambs to provide place for attaching hardware.

Used for factories, warehouses, car shops, piers and similar structures having high doorways which require ponderous doors.



VERTICAL SECTIONS OF VARIOUS STYLES OF LIFT WAREHOUSE DOORS

HOW TO ORDER—Furnish width, height, thickness and weight of doors; space between jamb and side walls or nearest obstruction on each side; and space above opening.



TWO-SECTION R.W. LIFT DOOR AT THE UNIVERSAL TRACTOR WORKS, MOLINE, ILL.

DIMENSION DIAGRAM LIFT WAREHOUSE DOOR

Type of door	Catalogue number	Max. height of opening, ft.	Lap of door over opening, in.	Min. side wall space required, in.		Min. space above opening, in.	A in.	B in.	C in.	D in.
				Weight side	Opposite side					
One-section vertical slide	403	16	2	13	4	Height of opening plus 20	0	12¼		
	503 standard	16	2	13	4	Half height of opening plus 20	1	13½		
Two-section vertical slide	503 special	Over 16	2	13	4		0	12¼		3¾
One-section cable turnover door	349	8	2	13	4½	30		9¼	5½	
Two-section cable turnover door	449	16	2	17	8	30		15	1	6¾
One-section track turnover door	249	16	2	13	5½	20		7½	2¾	

SPECIALTY ENGINEERING COMPANY

Manufacturers of Boiler House Equipment and Conveying Machinery

Allegheny and Trenton Avenues
PHILADELPHIA, PA.

Products.

BOILER HOUSE EQUIPMENT for HANDLING COAL and ASH: Skip Hoists, Track Hoppers, Reciprocating Feeders, Coal Crushers, "V" Bucket Conveyors, Flight Conveyors, Bins, Stoker Spouts, and Weighing Larries.

MACHINERY TO CONVEY MATERIALS in Package or in Bulk: Belt Conveyors, Wagon Loaders, Car Unloaders, Barge Unloaders.

COAL POCKETS, ROTARY SCREENS, BAGGING MACHINES and FEEDERS.

Service.

Estimate drawings and specifications are furnished. The experience of Specialty's Engineers is freely given, both in recommending economical methods of handling materials and in selecting the equipment that exactly meets requirements.

Catalogues and bulletins mailed on request.

Shops are equipped to manufacture any work in structural steel or steel plate construction.

Wagon Loaders.

Type No. 15 is shown below. It loads and screens all sizes of anthracite coal. Malleable iron buckets are attached to a double strand of malleable iron and steel chain. Bronze ball and socket bearings prevent lost power. Large steel hopper for screenings. A set of screens furnished with each loader. Motor in dusttight steel casing.

Several types of loaders to suit various conditions are described in Bulletin 4-A.



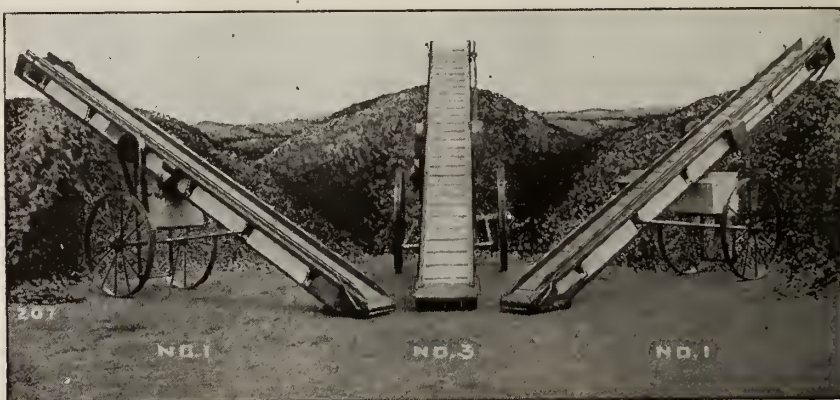
WAGON LOADER IN ACTION

Belt Conveyors.

Movable belt conveyors are used for rapid loading and unloading of soft coal, hard coal, ash, coke, bricks, sand, stone, dirt, etc. They are made in standard sizes.

Type No. 1, the 18-ft. machine with a 12-in. belt, is the one used to load trucks and for piling coal to a height of 8 ft. Type No. 3, the 20-ft. machine with an 18-in. belt, is used for larger quantities and for coarser materials. Type No. 2 measures 24 ft. from center of foot shaft to center of head shaft. It piles coal 12 ft. high. Belt conveyors are also made 30 ft. and 60 ft. long. Height of machine is adjustable. Steel frame offers maximum efficiency and long service.

See Bulletin 1-B.



THREE MOVABLE BELT CONVEYORS

Coal Pockets.

Coal pocket shown is of structural steel and concrete; 1200-ton capacity. Equipped with "V" bucket conveyors and flight conveyors to carry coal from the concrete track hopper to the overhead bins. The driveways are under the pocket. There are steel gates and



STEEL AND CONCRETE COAL POCKET

screening chutes over the driveways. Coal may be brought to the pocket from a barge. Pockets also built of wood.

Write for Catalogue No. 4.

Car Unloaders.

Car unloaders to fill bins, load wagons and "stock out." Coal is dumped from a car into a steel lined concrete track hopper. This hopper feeds the endless chain

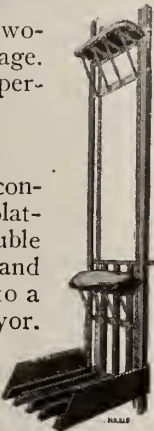


MOTOR DRIVEN CAR UNLOADER

of steel buckets. Coal is conveyed by a two-way chute to wagons or to ground storage. All-steel angle frame. Standard sizes. Operated by motor or gasoline engine.

Package Conveyors.

Illustration shows a section of a bag conveyor. Bags are placed on the loading platform. Arms or brackets attached to a double strand of chain pass through the platform and pick up the bags. The bags are conveyed to a discharging chute at the head of the conveyor. Conveyors made to carry, efficiently and economically, bags, bales, boxes, barrels, etc., from a lower floor to an upper floor. Electrically operated. These conveyors are used in factories and warehouses.

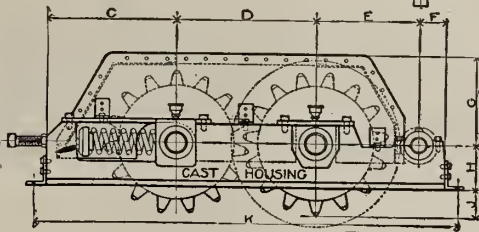
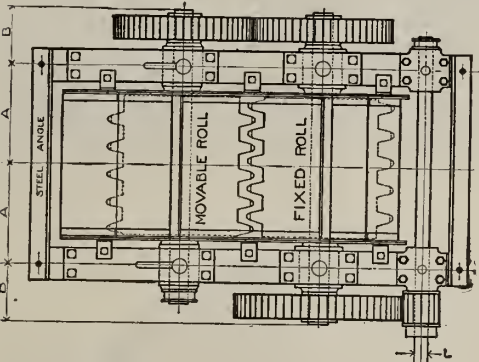


BAG CONVEYOR

Coal Crushers.

Used to reduce bituminous coal to stoker size. Illustrations show the standard sizes usually installed with a reciprocating feeder. The crusher is fitted with compression springs—a safety guard. Heavy bronze bushed bearings.

Coal crushers are described in Bulletin 6.

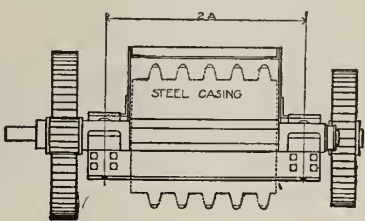


DIMENSION DRAWINGS OF COAL CRUSHER

CRUSHER DIMENSIONS (INCHES) AND CAPACITIES

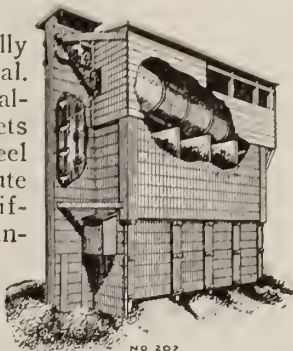
Nominal size of rolls	Size of angle	A	B	C	D	E	F	G	H	J	K	L
20 x 24	5 x 3	16	10	19	20	15	5	14	7	3	64	2 7/8
28 x 24	6 x 4	17 1/4	12	26	28	21	5	18	9	6	85	2 13/16
28 x 30	6 x 4	20	12	26	28	21	5	18	9	6	85	2 13/16
28 x 36	6 x 4	22 3/4	12	26	28	21	5	18	9	6	85	2 13/16

	Tons per hour	H. p.
20 x 24... @ rate...	25	5 to 7 1/2
28 x 24... " "	50	7 1/2 to 10
28 x 30... " "	60	12
28 x 36... " "	70	15



Screening Outfits.

Screening outfits electrically operated to screen and store coal. An enclosed conveyor with malleable iron chain and buckets carries coal from a concrete steel lined hopper to a steel chute which feeds the screen. The different sized meshes of the inclined rotating screen assort the coal to standard sizes into separate bins. SPECIALTY ENGINEERING COMPANY makes rotary screens 30 in. in diameter and 8 ft. long mounted on angle frame for screening coal, coke, sand, gravel, etc.



SCREENING OUTFIT

Larries.

For automatically weighing coal and keeping an accurate record of the amount of fuel consumed by each boiler. Made in capacities from 1000 to 10,000 lbs. Hand or electric power. A close spacing of gates may be had and little dead coal left in the bunker. The weighing larry is one part of the complete outfits installed in boiler houses by SPECIALTY ENGINEERING COMPANY. Equipments consist of track hoppers, reciprocating feeders, coal crushers, conveyors, bins, and larries.



WEIGHING LARRY

Skip Hoists.

A cheap method of conveying coal, ash, and other bulk material. A steel bucket is automatically hoisted on vertical tracks by means of a steel cable attached to a winding machine. The bucket dumps into a chute which directs material to a bin.



SKIP HOIST INSTALLATION

THE WELLMAN-SEEVER-MORGAN CO.

Apparatus for Handling and Transporting Raw Materials and Finished Products,
Steel Works Equipment, Coke Oven Machinery, Rubber Machinery

CLEVELAND, OHIO

BRANCH OFFICES

NEW YORK, N. Y. PHILADELPHIA, PA. DENVER, COLO. ATLANTA, GA. SAN FRANCISCO, CAL.
WORKS: CLEVELAND AND AKRON, OHIO

Products.

APPARATUS for HAULING and TRANSPORTING which includes:

Coal and Ore Handling Machinery: Unloaders; Traveling Bridges with Grab Buckets; Car Dumpers; Car Haulages; Transfer Cars; Boat Loaders; Bucket Handling Cranes; Revolving Derricks; Excavating Buckets; Weighing Larries.

Special Cranes: Pontoon, Dock Shipbuilding, for Concrete Handling and Steel Plant Service, Special Purpose.

Hoisting and Mining Machinery: Electric or Steam Hoisting Plants; Cages and Skips; Revolving Car Tipples; Akron Chilian Mills; Safety Detaching Hooks.

Hydraulic Turbines: Horizontal or Vertical with spiral or steel plate cylindrical casings, or for open flume settings.

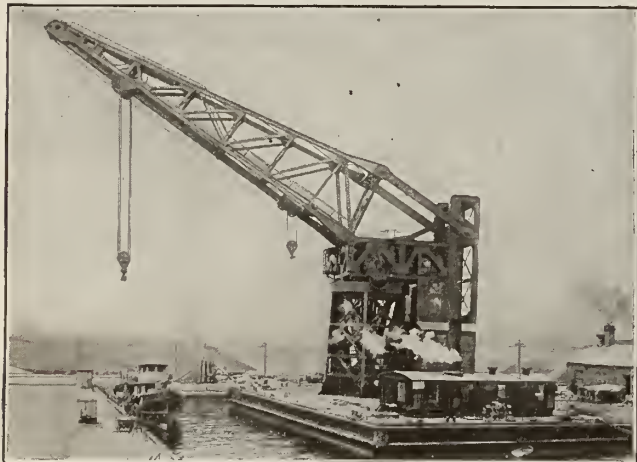
Steel Works Equipment: Hughes Mechanical Gas Producers and Valves; Open Hearth Furnaces and Metal Mixers; Continuous Heating Furnaces; Charging Machines; Charging Boxes; Manipulators; Forter

Valves; Gantry Cranes; Special Cranes for Heavy Work.

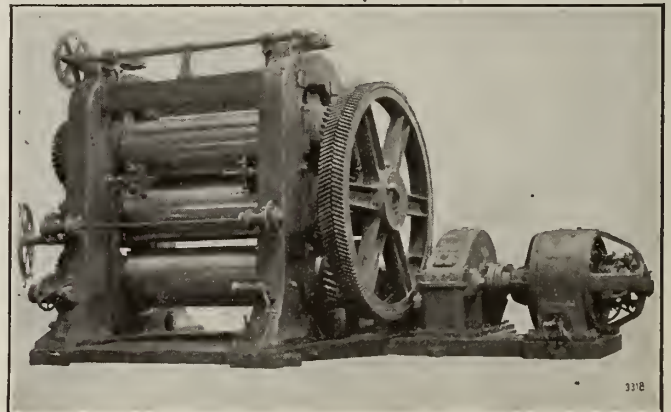
Coke Oven Machinery: Coal Levelers; Door Extractors; Coke Quenchers, Pushers, Loaders.

Rubber Machinery: Tire Applying Presses; Rubber Calenders; Mixing and Grinding Mills; Tubing Machines; Vulcanizing Presses; Moulds and Cores; Iron and Steel Castings; Jobbing Work of all kinds.

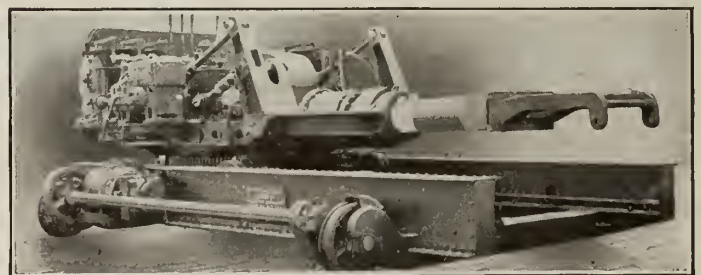
Port and Terminal Equipment: Machinery for Loading and Unloading Ships; Handling Freight in Sheds, and Fueling Ships.



150-TON ELECTRICALLY OPERATED REVOLVING-TURRET PONTON CRANE, NAVY YARD, NORFOLK, VA.
A duplicate is at the U. S. Navy Yard, Mare Island, Cal.



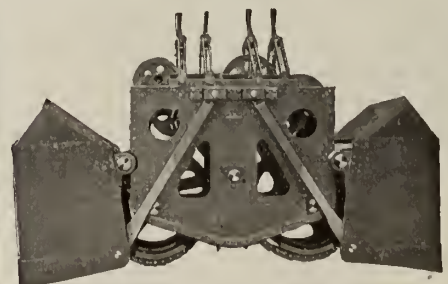
FRONT VIEW, W-S-M 3-ROLL STANDARD RUBBER CALENDER, BUILT FOR STAR RUBBER CO., AKRON, OHIO



TRAVELING WHEEL BLANK MANIPULATOR, WITH REVOLVING TROLLEY
Capacities from 1000 to 6000 lbs.



ORE BRIDGE PENNSYLVANIA R. R. DOCKS, CLEVELAND, OHIO
Serves dock space 612 ft. deep and carries a 15-ton bucket.
Transfers ore, weighing while handling.
Capacity, 800 tons per hour



W-S-M EXCAVATING BUCKET
Handles iron ore, coal, crushed stone, cinders, sand, gravel, clay, etc.
Capacity, 20 to 360 cu. ft.

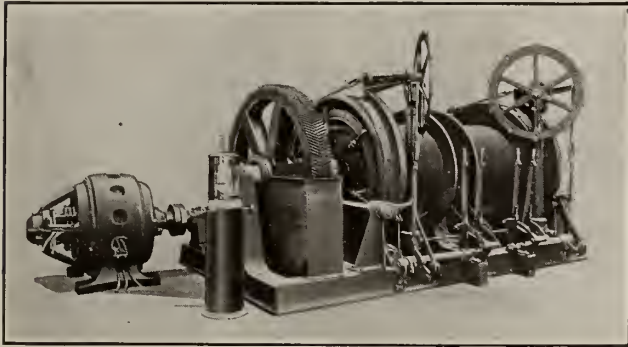


McDERMOTT CONTINUOUS TWIN SCOOP LOADER



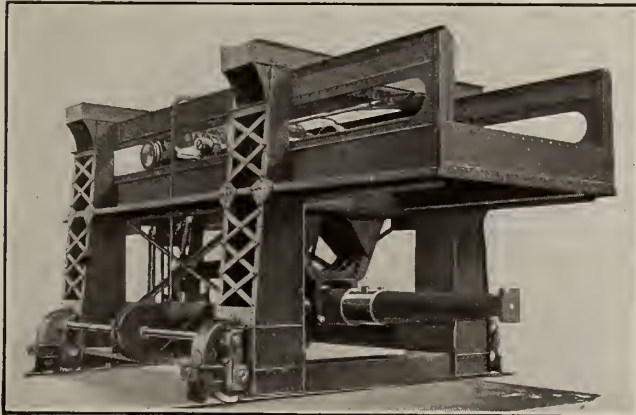
W-S-M UNLOADER ON DOCKS OF UNITED STATES STEEL CORPORATION, CONNEAUT, OHIO

The fastest single ore handling machine in the world with a maximum unloading capacity of 850 tons per hour. 7 machines in use on this dock



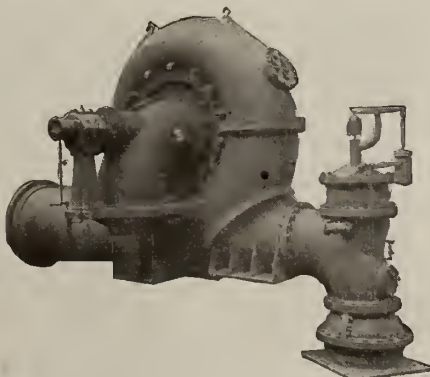
DOUBLE DRUM HOIST, HIGH TYPE

Driven through one reduction of herringbone gears. Fitted with hand operated clutches and post brakes



OPEN HEARTH CHARGING EQUIPMENT, HIGH TYPE

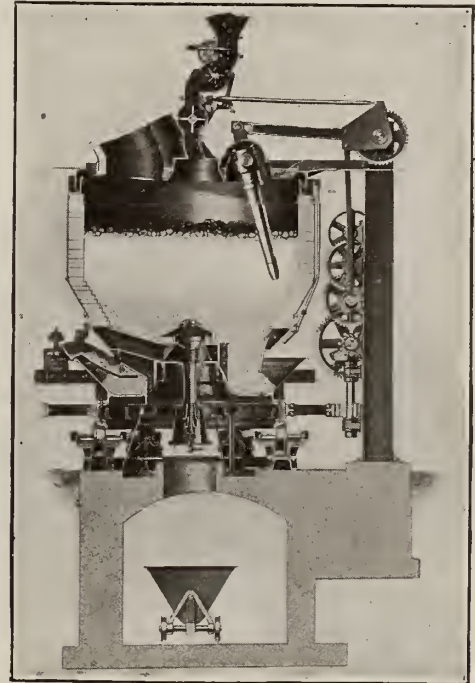
Built to handle loads from 5000 to 12000 lbs.; furnished with any standard type of motor and control equipment



HORIZONTAL, SINGLE DISCHARGE, REACTION TURBINE FOR HIGH HEADS, MOUNT HOOD RAILWAY AND POWER CO., PORTLAND, ORE.

Speed, 514 r.p.m. under head of 320 ft.; develops 6400 h.p. Bronze runner

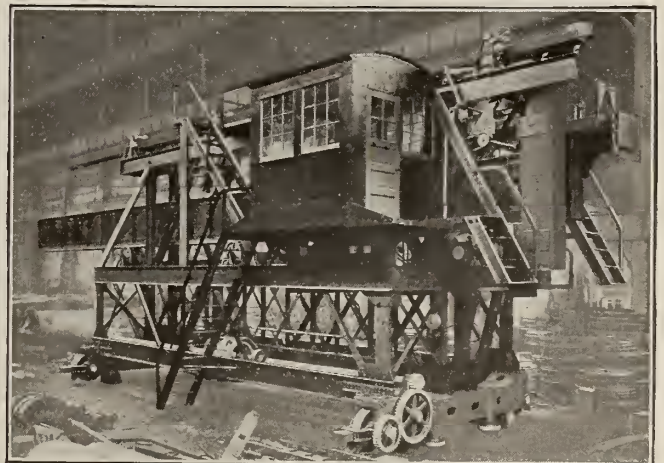
SWEET'S CATALOGUE



SECTION, HUGHES MECHANICAL GAS PRODUCER

The only machine with the combination of a revolving fuel chamber and ash bed with a reciprocating, water cooled poker.

Will gasify 3000 lbs. of standard bituminous gas coal per hour, gas containing an average of 168 B.t.u. per cu. ft. and with an ash loss of less than 1%



W-S-M COMBINED COKE PUSHER AND COAL LEVELER FOR SEMET-SOLVAY OVENS

Bulletins.

Separate bulletins, each with full information on its particular subject, have been issued and, on request, will be sent to those interested.

STANDARD CONVEYOR COMPANY

FORMERLY MINNESOTA MANUFACTURERS' ASSOCIATION

MAIN OFFICE AND FACTORY
NORTH ST. PAUL, MINN.

Products.

GRAVITY ROLLER CONVEYORS; GRAVITY SPIRAL CHUTES; POWER CONVEYORS; ELEVATORS.

Co-operative Service.

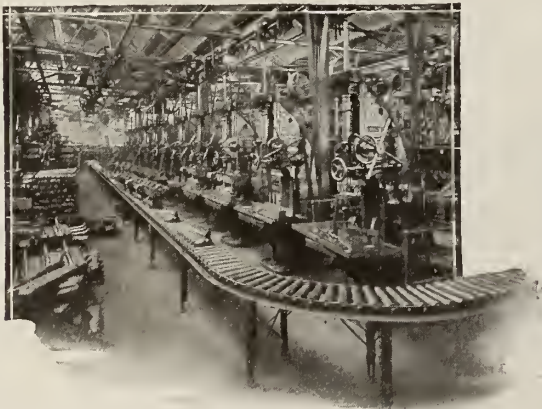
An office with a competent "Gravity Efficiency" force is in every important city and engineers and contractors are invited to make use of this service.

Gravity Roller Conveyors.

Used for the conveying of boxed and cased goods, brick, lumber, pig iron, shells, tubing, and cylindrical shaped objects, and all merchandise having one hard smooth surface.



STANDARD GRAVITY ROLLER CONVEYOR CONVEYING BOXED AND CASED GOODS



STANDARD GRAVITY ROLLER CONVEYOR IN OPERATION IN LARGE AUTOMOBILE PLANT

Large castings and parts of machine products are moved on sections of gravity conveyor to and from various machines for specific operation. Trucking and operator's time waiting for materials entirely eliminated.

Power Conveyors and Elevators.

Consisting of slat conveyors, belt conveyors, and special conveying machinery, including inclined elevators and straight lift automatic elevators.

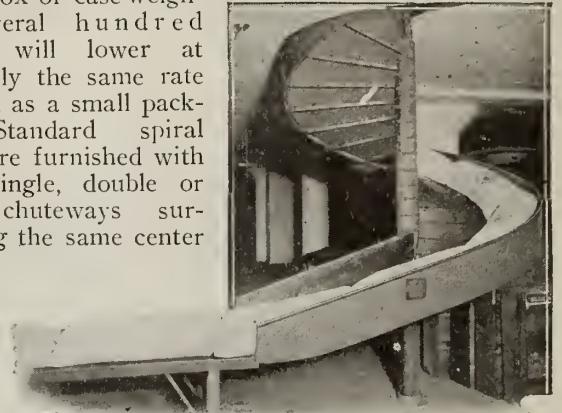
Spiral Chutes.

For the lowering of general merchandise for de-

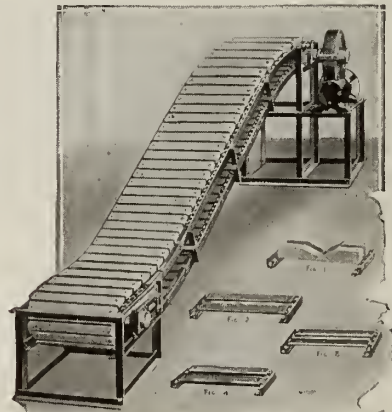
partment stores, wholesale grocery houses, wholesale drug houses, and all establishments of two stories or higher.

Standard spiral chutes are constructed on a scientific basis, absolutely controlling the movement of the material being lowered.

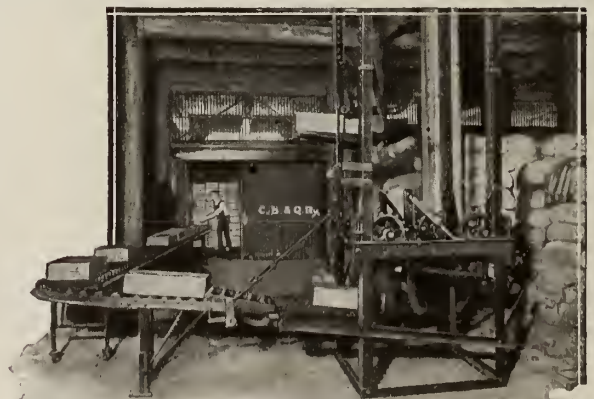
A box or case weighing several hundred pounds will lower at practically the same rate of speed as a small package. Standard spiral chutes are furnished with either single, double or triple chuteways surrounding the same center post.



SPIRAL CHUTE LOWERING BAGS OF SEEDS



POWER SLAT INCLINED ELEVATOR



STRAIGHT LIFT AUTOMATIC ELEVATOR

CHAS. K. ERNST SPECIALTY CO.

Manufacturers of Ash Hoisting Specialties

998 East Ferry Street
BUFFALO, N. Y.

Products.

ERNST TELESCOPIC ASH HOISTS; ERNST AUTOMATIC SAFETY-GUARDED SIDEWALK DOORS; COMBINATION TELESCOPIC ASH HOIST and SAFETY-GUARDED SIDEWALK DOOR with DOOR OPERATING MECHANISM; ERNST PERFECTION CELLAR WINDOW ASH ELEVATOR; ERNST SELF-RAISING SIDEWALK ELEVATOR; ELECTRIC MOTOR DRIVEN ELEVATOR.

Also, Ernst Type "A" Light Sidewalk Elevator.

Ernst Combination Telescopic Ash Hoist and Sidewalk Door with Door Operating Mechanism.

The opening, closing and locking of the sidewalk door is automatically taken care of, when the hoist extension arm is moved in a single operation by operator at cellar floor level.

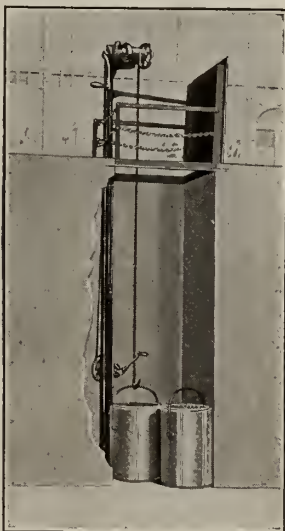
The automatic guard rail completely encloses the open hatchway to avoid danger of the open door when hoist is being used.

The sidewalk door opens towards the building and is made of a one-piece 3 by 2-in. angle iron frame and checkered steel plate, flush with sidewalk. Furnished in 3 ft. square and 4 ft. square sizes.

Makes one of the best appearing doors made.

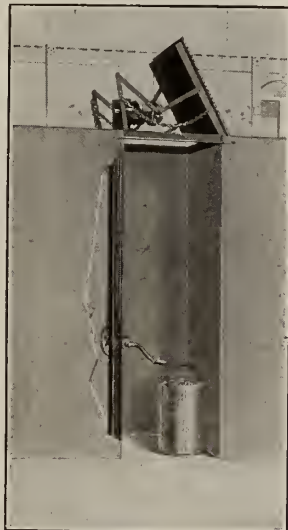
TELESCOPIC ASH HOIST—Operated entirely by one man from sidewalk level. The opening, closing and locking of sidewalk door is done by same operator from cellar floor level. The hoist is equipped with an automatic gear shifting device and brake to lower empty cans to cellar by brake, ball bearings on main shaft supporting loads, machined cut gears, and steel safety ratchet, automatic clutch pin, steady pin, $\frac{3}{8}$ -in. steel cable, cable grooved drum.

Hoist operates at a speed of 30 ft. per minute. From 4 to 5 ash cans can be hoisted to grade, before operator has to leave the sidewalk. Capacity, 500 lbs.



Door Opening Completely Safety-guarded on 4 Sides

From 4 to 5 ash cans can be hooked on, hoisted, swung and deposited on sidewalk before operator has to leave the sidewalk



Partly Opened

Shows how door is automatically opened or closed in a single operation by operator turning the telescopic crank from cellar floor level

COMBINATION TELESCOPIC ASH HOIST AND SIDEWALK DOOR

Ernst Perfection Cellar Window Ash Elevator.

This handy and compact elevator makes use of any cellar window 28 in. square or larger, to hoist and swing ash cans, etc., directly to the sidewalk, and can be used in any new or old building to advantage. No changes in window frame are necessary.

Six anchor bolts install elevator rigidly in place to cellar floor and concrete, plastered or wood ceiling. Upright installed but 8 in. from wall.

Elevator is constructed entirely of metal, having a 3-in. iron pipe upright; 21-in. diameter iron platform, powerful cranking mechanism directly attached to upright. Hoisting speed 15 to 25 ft. per minute. Platform lowered on cellar floor, requiring no pit.



CELLAR WINDOW ASH ELEVATOR

Elevator with loaded platform hoisted and swung out of cellar window by operator in cellar. Provides a means of access to grade where no outside areaway has been provided

Ernst Self-raising Sidewalk Elevator.

This lift can be used alongside a cellar window as well as through a sidewalk areaway to handle ashes and materials to and from basements. The platform is counterbalanced, eliminating at least one-half of the time and labor ordinarily required to crank elevator.

Lowers loads from 300 to 1000 lbs. by gravity controlled by hand brake and when platform is empty the platform rises automatically to sidewalk level.

Cranking mechanism is directly attached to uprights, taking up no extra room and is of the endless chain type, eliminating replacements of cable and makes elevators always operate the same.



SELF-RAISING SIDEWALK ELEVATOR

Elevator installed at 3-ft. cellar window with 4 ash cans hoisted to grade ready to be removed. Eliminates an outside areaway and requires but one man to operate. Elevator inclined but 2 ft. 5 in. Can be used with or without pit

Electric Motor Driven Elevator.

Operates elevator at speed of 20 ft. per minute while automatic switch and brake automatically stops platform at both floor levels, requiring but one operator. One of the finest, least expensive motor driven elevators made.

GRAVES ELEVATOR CO., INC.

426 Exchange Street
ROCHESTER, N. Y.

NEW YORK OFFICE, 113-117 Cedar Street

Products.

Manufacturers of PASSENGER and FREIGHT ELEVATORS; ELECTRIC TRACTION ELEVATOR MACHINES, for overhead or basement installation.

Graves Electric Traction Elevators.

CONSTRUCTION—In the construction of Graves traction elevators, passenger and freight, the tractive force is exerted directly on the car cables by passing same over a driving sheave, without any attachment thereto. Cables, anchored in car, pass over sheave, then down over an idler, thence down to counterweight where fastening is made.

ADAPTABILITY—Height of car travel bears no relation to size of drive sheave; therefore, the Graves elevators, freight and passenger, are adapted for efficient use in all kinds of buildings, high or low (Fig. 2).

Graves Traction Type Elevator Machines.

CONSTRUCTION—Simple and durable; built compact, to occupy small space; all working parts are accessible for adjustment and oiling; driving sheave shaft is short and bearings are large, giving strength, great rigidity and long life; a phosphor bronze gear is used, with a steel worm cut integral with worm shaft; worm thrust is taken care of on one end of worm shaft, permitting entire thrust bearings to be removed without disturbing balance of machine. Thrusts are S.K.F. Special (Fig. 1). Machines are built in two types and different sizes to suit requirements and service—straight worm geared for passenger and high speed freight service, and compound geared for slow speed freight service.

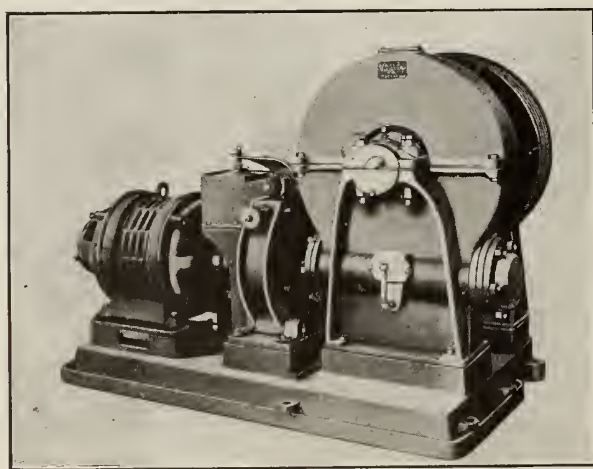
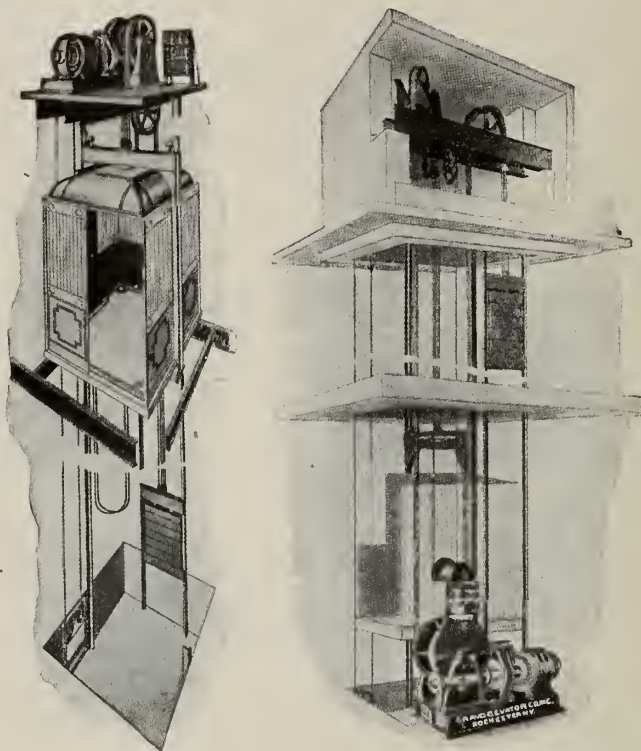


FIG. 1. DIRECT CONNECTED ELECTRIC WORM GEARED V-GROOVE TRACTION ELEVATOR MACHINE

Equipped with electric brake. For either overhead or basement installation. Mechanically and electrically correct

OPERATION—These machines provide for operation of the elevator quietly on direct or alternating current, either with push button, car switch or hand rope control. Elevator can not travel into overhead work, being prevented by reason of the special design of the traction feature. The service is efficient, with economical operation.

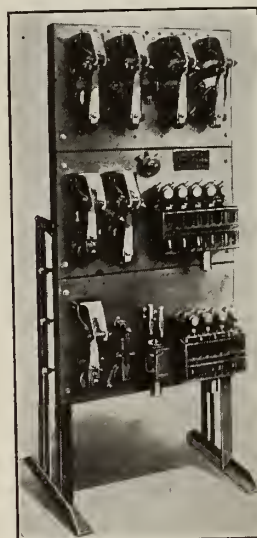
SPECIFICATION DATA FOR ARCHITECTS—Depth of pit and



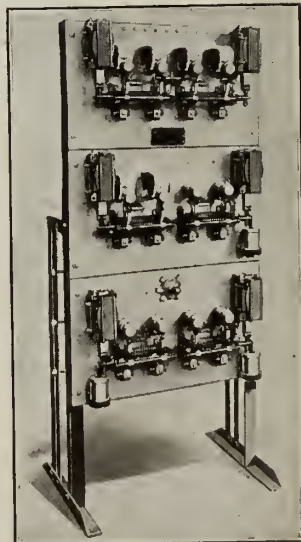
Passenger Type, Overhead

Freight Type, Basement

FIG. 2. GRAVES TRACTION ELEVATORS



Two-speed, Full Magnet Dynamic Brake, Direct Current



Full Magnet Controller, Alternating Current

FIG. 3. THE GRAVES MAGNET CONTROLLERS

overhead clearance is governed by car speed, and is specified in State requirements. Size of hatch for wood guides is approximately 18 in. wider post-wise and 2 in. wider front to back than car size. Size of hatch for steel guide is approximately 15 in. wider post-wise and 2 in. wider front to back than car size.

Co-operative Service.

Estimates and specifications for complete traction elevators which prospective purchasers propose to install will be furnished on application.

KAESTNER & HECHT COMPANY

Electric Elevator Builders

OFFICES AND WORKS

Harrison, Throop and Congress Streets

CHICAGO, ILL.

BRANCH OFFICES IN LEADING CITIES

Products.

Manufacturers of K & H ELECTRIC ELEVATORS for PASSENGER, FREIGHT or PACKAGE SERVICE, including those types controlled by Operators and also by Automatic Push Buttons.

Electrically Controlled Hydraulic Lifts, Electric Dumbwaiters.

Service.

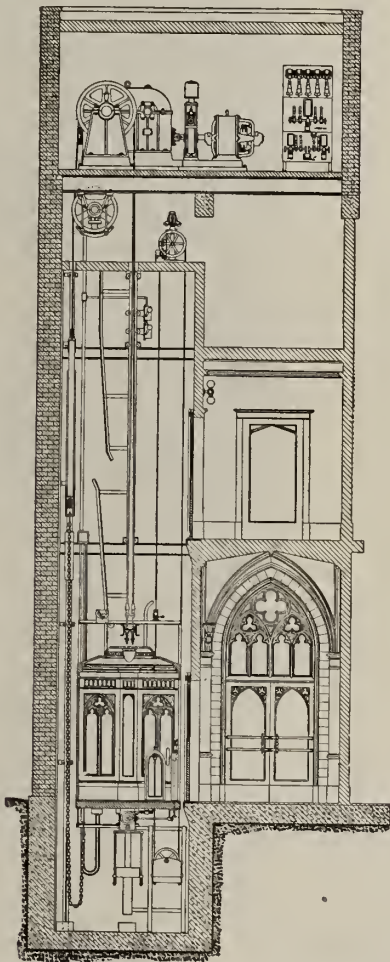
Each elevator installation is a separate problem in itself. Each K & H product is carefully engineered to

meet the specific requirements of the individual job.

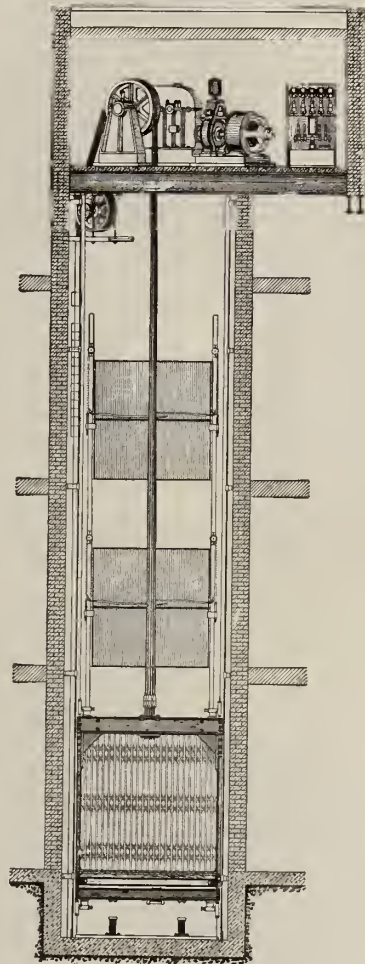
The broadest possible co-operation is offered to engineers, architects and owners in connection with *all vertical lifting problems.*

Reliability.

Aside from the splendid manufacturing facilities, which insure a quality product, the responsibility of this firm is of great importance to those who have to select and maintain elevator equipment.



A RECOMMENDATION FOR PASSENGER SERVICE



A RECOMMENDATION FOR INDUSTRIAL SERVICE

F. S. PAYNE CO.

Elevator Manufacturers

GENERAL OFFICE AND WORKS
Richdale Avenue
CAMBRIDGE, MASS.

BOSTON, MASS.

BRANCH OFFICES
LOWELL, MASS.

NEW HAVEN, CONN.

Products.

ELECTRIC and HYDRAULIC PASSENGER and FREIGHT ELEVATORS; ELEVATOR CONTROLLERS for operation by hand rope, lever car switch, push button and dual control, adapted for any make of machine; Patented HYDRAULIC ASH HOISTS. Also Dumbwaiters.

Electric Elevator Machines.

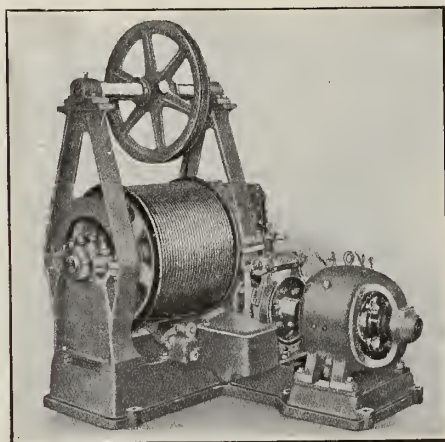
These machines are adaptable for use on any electric current and have a wide range of duty as regards capacity and speed.

All safety devices of the latest type are a part of the equipment and have met with the approval of representative architects, engineers and insurance companies.

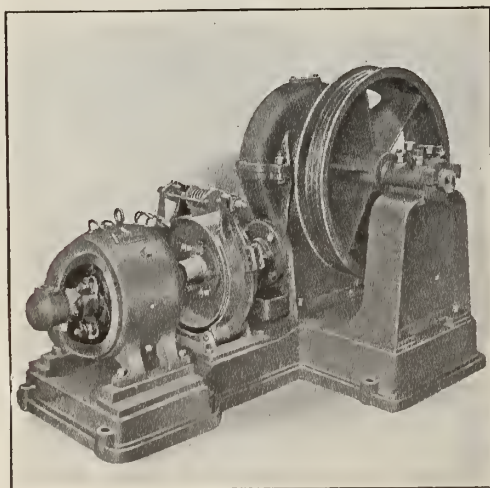
State and city requirements are complied with in all installations.

Conservative engineering principles have been adhered to in the design of all Payne products which have resulted in most efficient and satisfactory installations.

Prompt deliveries and a refined product are assured by our policy of standardizing the design of all our machines.



PAYNE DIRECT CURRENT DIRECT CONNECTED ELECTRIC WORM GEAR DRUM MACHINE



PAYNE DIRECT CONNECTED ELECTRIC WORM GEAR TRACTION MACHINE



TRADE-MARK

Hydraulic Elevator Machines.

Hydraulic plunger elevators which can be adapted to meet any requirements are manufactured by this company.

Information Desired for Estimates on Elevator Machines.

The opportunity to co-operate with architects, engineers and owners will be appreciated either in furnishing preliminary plans and specifications or comparative costs of electric and hydraulic equipments.

To avoid delay and to insure intelligent response to inquiries the following information should be furnished:

Travel of car: Distance between bottom and top landings.
Maximum load to be carried. If a freight elevator, materials to be carried. Approximate speed desired.

Size of car required or size of hoistway provided.

Construction of hoistway: Brick, concrete, steel or wood.

Number and size of openings at each floor, and side or sides of hoistway where openings are located.

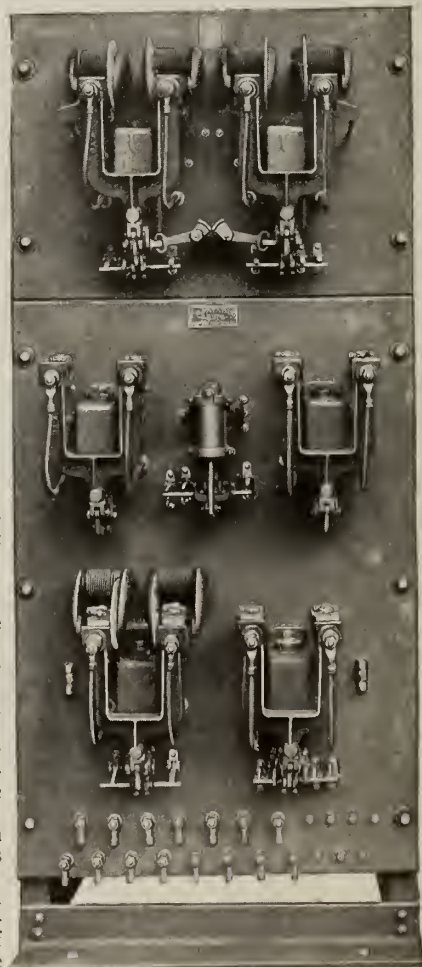
If electric elevator, state location of space provided for machine: in pent house over hoistway or adjacent to hoistway at lowest landing.

If hydraulic plunger elevator, advise nature of soil: gravel, sand, salt marsh or rock. Give water pressure.

For electric elevators give current available, whether D. C. or A. C. If D. C. state voltage. If A. C. state voltage, phase and cycles.

As there is considerable difference in cost between wood and steel guides, a preference should be designated or a request made for price of each.

Where wooden freight elevator gates are required, state number and type: full automatic or semi-automatic; also if gates are to be single or double bar or slatted.



PAYNE ELECTRIC ELEVATOR CONTROLLER

Payne Patented Hydraulic Ash Hoists.

Designed for use wherever differences in grade necessitate the use of a hoist for the removal of ashes.

REVOLVATOR CO.

334 Garfield Avenue
JERSEY CITY, N. J.

SALES AGENT FOR N. Y. REVOLVING PORTABLE ELEV. CO.

Products.

PORTABLE ELEVATORS (Tiering Machines), Revolvable and Non-revolvable Types, Hand or Electric Power or Combination.

Barrel Racks to meet any situation.

Revolvator.

The Revolvator is a portable elevator for stacking or tiering bales, boxes, barrels, or any other heavy, bulky, or fragile articles.

Advantages.

A Revolvator will increase the storage capacity of a warehouse from 20% to 50%. Materials can be stacked clear to the ceiling, leaving no waste space and making wide aisles unnecessary.

It reduces the labor bill for handling material. Usually two men and a Revolvator can do the work of from four to eight men without one, and can do it more speedily.

Types.

The Revolvator is made in nine models, operated by hand, motor, and combination hand and motor. All are built in both revolvable and non-revolvable types.

HAND OPERATED—An economical machine which will materially reduce the cost of labor wherever lifting, piling, and stacking is being done.

MOTOR OPERATED—For very high piling, for extra heavy loads or especially fast work, the electric motor driven Revolvator is recommended. This machine has all the advantages of the other types, except that it can not be operated by hand or plugged into an ordinary lighting circuit.

These machines are standard up to 1800 lbs. capacity, and can be built to order for greater weights or to meet special conditions.

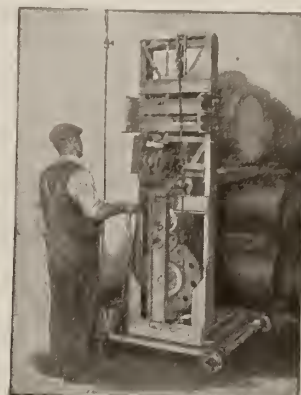
COMBINATION HAND AND MOTOR OPERATED—Giving a combination machine which may be run by hand or by electricity. The $\frac{1}{2}$ h. p. motor will raise a load of 1800 lbs. at more than three times the speed of the average man operating by hand.

The electric motor attachment used on this machine can be furnished for and installed on any hand operated Revolvator, or any make of tiering machine.

REVOLVABLE TYPE—The exclusive feature of this



Operated by Hand



Operated by Motor

COMBINATION REVOLVATOR

machine is the revolvable base. The whole upper structure including the loading platform may be swung around in any direction, like a turntable, without changing the position of the lower base.

NON-REVOLVABLE TYPE—Some types of piling may be done effectively with a machine of this kind, which is similar in construction to the revolvable type, but is made without the revolvable base feature.



REVOLVABLE TYPE



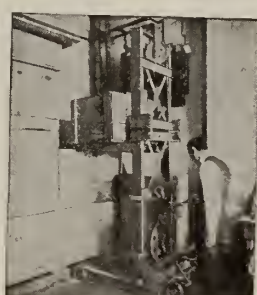
NON-REVOLVABLE TYPE

Literature and Information.

Literature giving full information on any of these machines will be sent on request.



PILING ROLLS OF PAPER



PILING CASES



PILING BALES



LOADING TRUCKS

SMITH ELEVATOR CO., INC.

OFFICE AND WORKS
BUFFALO, N. Y.

Products.

Builders and designers of **ELECTRIC ELEVATOR EQUIPMENT** for Passenger and Freight Service.

Service.

Architects have at their command, through the **SMITH ELEVATOR CO., INC.**, an organization of experts with extensive experience in the planning of passenger, freight and sidewalk elevators.

Various Types of Elevators.

Both passenger and freight elevators of this company's manufacture are of standard types and there is every facility here for perfectly meeting every condition.

Careful study is made of their application and the installations are planned and carried out to exactly meet particular conditions and to perfectly accomplish desired results.

Specialists in Freight Elevators.

This company specializes in freight elevators and has developed an elevator machine for very heavy and severe service which is shown in an illustration on this page.



TRADE-MARK

Typical Installations.

There are 35 elevators of this company's design and installation in the Larkin buildings, including the equipment for the largest terminal warehouse in the world.

The Pierce-Arrow Motor Car plant is equipped with Smith elevators, as is the home of Shredded Wheat and hundreds of other well-known industries including the following:

Armour & Co., Westfield, N. Y.
American Agricultural & Chemical Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Jacob Dold Packing Co., Buffalo, N. Y.
Detroit Valve & Fitting Co., Detroit, Mich.
Empire Auto Sales Co., Glens Falls, N. Y.
Ferro Machine & Foundry Co., Cleveland, Ohio
H. H. Franklin Mfg. Co., Syracuse, N. Y.
General Electric Co., Schenectady, N. Y.
Wire Wheel Corporation of America, Buffalo, N. Y.
International Salt Co., Ithaca, N. Y.
New Process Gear Corporation, Syracuse, N. Y.
Niagara Electro Chemical Co., Niagara Falls, N. Y.
Pratt & Lambert, Buffalo, N. Y.
Syracuse Buick Co., Syracuse, N. Y.
U. S. Light & Heating Co., Niagara Falls, N. Y.
Union Carbide Co., Welland, Ontario
Wells Fargo & Co., Express, Buffalo, N. Y.
White Co., Cleveland, Ohio
Rudolph Wurlitzer Mfg. Co., North Tonawanda, N. Y.



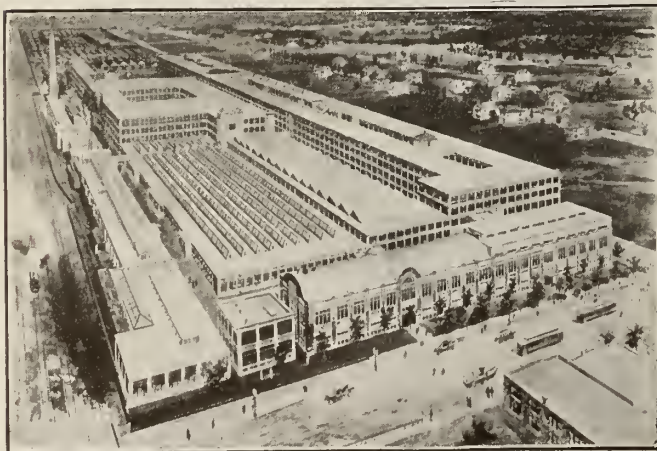
LARKIN & COMPANY'S TERMINAL BUILDING

The various Larkin buildings are equipped with 35 Smith elevators, including the world's largest terminal building



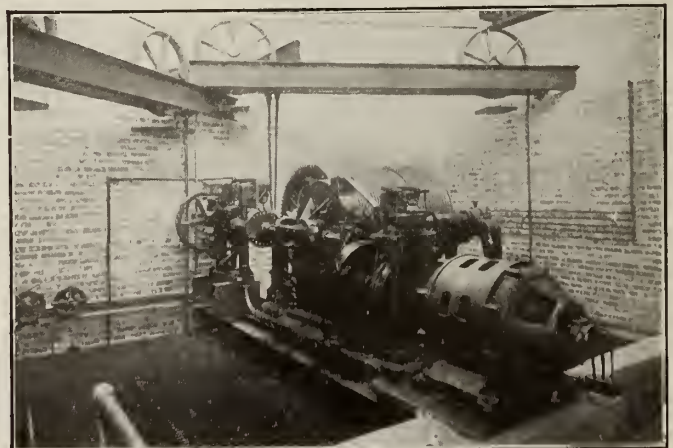
THE HOME OF SHREDDED WHEAT

Equipped with Smith passenger and freight elevators



PLANT OF THE PIERCE-ARROW MOTOR CAR CO.

LOCKWOOD, GREEN & Co., Architects
Equipped with 10 Smith elevators



SMITH ELEVATOR MACHINE FOR HEAVY DUTY AND SEVERE SERVICE

ESTABLISHED 1866

GILLIS & GEOGHEGAN

Manufacturers of G&G Telescopic Hoists

TELEPHONE:
SPRING 6140

542 West Broadway
NEW YORK, N. Y.

PARTIAL LIST OF AGENCIES IN THE UNITED STATES

ATLANTA, GA., HILL R. HUFFMAN, INC., Healey Building
BALTIMORE, MD., EASTERN SALES Co., 15 East Fayette Street
BOSTON, MASS., see New Haven, Conn.
BIRMINGHAM, ALA., JOHN D. TURNER Co., Jefferson Bank Building
BUFFALO, N. Y., BUFFALO BUILDERS SUPPLY Co., 1336 Genesee Street
CHICAGO, ILL., S. I. KAUFMAN, Peoples Gas Building
CHARLOTTE, N. C., GENERAL MILL SUPPLY Co., Latta Arcade Building
CLEVELAND, OHIO, R. L. QUEISSER Co., Schofield Building
COLUMBUS, OHIO, R. L. Watson, 51 Columbia Building
DALLAS, TEX., SOUTHERN IRON & WIRE Co.
DENVER, COLO., HOWARD H. FIELDING, 815 Boston Building
DES MOINES, IOWA, DES MOINES BUILDING MATERIAL Co., 906 Walnut Street
DETROIT, MICH., KENNEDY & DAWSON, 816 Penobscot Building

INDIANAPOLIS, IND., VONNEGUT HARDWARE Co.
KANSAS CITY, MO., ROBERT ORMSBY SMITH, Railway Exchange Building
MILWAUKEE, WIS., PHILIP GROSS HARDWARE Co., 218-22 3d Street
MINNEAPOLIS, MINN., MORGAN-GERRISH Co., 501 South 6th Street
NEW HAVEN, CONN., WARNER-MILLER Co., Railroad Avenue and St. John Street—Represents all New England
OMAHA, NEBR., F. H. TURNEY & Co., Farnum Building
PHILADELPHIA, PA., W. G. CULBERT, 1503 Sansom Street
PITTSBURGH, PA., JAMES R. PITCAIRN, 345 Fourth Avenue
RICHMOND, VA., J. S. ARCHER, Real Estate Exchange Building
SEATTLE, WASH., S. W. R. DALLY, Globe Building
ST. LOUIS, MO., CONCRETE STEEL FIREPROOFING COMPANY, Syndicate Trust Building

Products.

Manufacturers of the G&G MODEL D TELESCOPIC CRANE HOIST, ELECTRICALLY OPERATED.

Also, Model A Hand Power Hoist, with Automatic Gear Shifting Brake Device and Silencer; Model B Overhead Crane Hand Power Hoist, with Automatic Gear Shifting Brake Device and Silencer; Model E Hoist operated by Electric Motor mounted on pipe standard; Model C Hoist, electrically operated.

For use with G&G Hoists, this company also manufactures the G&G Automatic Sidewalk Door Opening and Closing Device with Spring Guard Gate and Sidewalk Doors, and G&G Swing Bail Hoisting Cans, G&G Side Handle Cans, G&G Ash Can Trucks, G&G Iron Ladders.

Model D, Overhead Telescopic Crane Hoist.

This hoist is operated by electric power and should be installed where the daily removal of ashes involves a considerable number of cans and where the grade level approaches are constructed so as to permit ash wagons to drive close to hoistway leading to boiler room. Distance between hoistway and wagon can be as great as 36 in. The overhead crane attachment makes it possible to raise a load from the level of the boiler room, to a point over the top of the ash wagon and the ashes dumped directly into the wagon without re-handling the cans at grade level.

Motor.

Hoist has a 1½ h. p. series wound, totally enclosed motor with mechanical load brake, automatic upper and lower limit, and a single speed controller giving one hoisting and one lowering speed. Cast iron base is provided for motor. Equipment includes a non-rotating cable.

The apparatus is dustproof and moistureproof, lubrication being effected throughout by means of grease forced through compression cups.

Speed.

Model D will raise a load of 300 lbs. at an actual speed of 60 ft. per minute. (Maximum load, see "Factor of Safety.") When the can reaches its full height the power is shut off by the automatic upper limit.



Telescopic Feature.

No part of the hoisting apparatus shows above pavement, when not in use.

Factor of Safety.

No part has a factor of safety less than 8, based on the ultimate strength of the material when a load of 300 lbs. is raised.

Gearing has a very high factor of safety of about 30, and all running parts have a factor of safety far beyond what is ordinarily considered necessary. When adjustable wrought iron guy rods from top of hoist to building wall are provided, the factor of safety is 8 when maximum load of 500 lbs. is raised.

Installation.

All necessary clamps and bolts are furnished with each hoist, together with detailed blue print showing how to erect, and set of instructions covering operation. Each hoist is constructed especially for some particular installation.

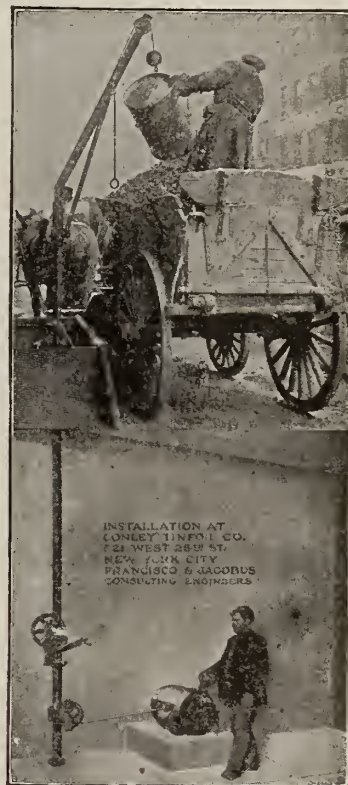
Size of Opening.

It is strongly recommended that opening at grade level be made 4 by 4 ft. in size.

How to Specify.

Furnish and install where indicated on plans, one G&G Telescopic Overhead Crane Hoist with electric motor, Model D.

G&G Swing Bail Cans should also be specified.



MODEL D, G&G TELESCOPIC HOIST IN OPERATION

MERRICK SCALE MFG. CO.

Designers of Weighing and Conveying Installations

CABLE ADDRESS:
"WEIGHTOM, PASSAIC, N. J."

178 Autumn Street
PASSAIC, N. J.

CODES:
A. B. C., Western Union

Product.

The MERRICK WEIGHTOMETER.

Description.

The Weightometer consists of a pair of weighing levers, L, and a steelyard or beam, B, similar to that of the platform scale, but of special design, so that a short section of the conveyor can be suspended from the weighing levers. The load on this suspended portion, however distributed, is always automatically counterbalanced by the buoyancy of a cylindrical iron float immersed in a mercury bath and suspended from the long end of the weighing beam. This float allows the beam to move from its position, when the conveyor is empty, in exact proportion to the weight of material on the suspended portion of the conveyor at any moment. A mechanical integrator totalizes the movement of the beam, with a factor obtained from the travel of the conveyor by means of suitable gearing from the bend pulley or sprocket wheel. The result obtained from the product of two quantities, one proportional to the weight of the material suspended and the other to the travel, therefore represents accurately the total weight of material moved. This is plainly indicated, by a register, in units and decimals of either a short ton, long ton, metric ton or other desired units.

Applications.

In the past 11 years 400 Weightometers have been installed and are now operating. Materials weighed in domestic and foreign service include coal, coke, hog fuel, stone, gravel, sand, limestone, and iron, silver, zinc, lead, copper, gold, telluride ores and metallic ore concentrates, ammonium sulphate, caliche, copra, cement rock, clinker and finished cement, phosphate rock or pebbles, wood chips, sulphite pulp lumps, fish or fish products, slaughter house tankage, sugar beet cossettes and asbestos rock.

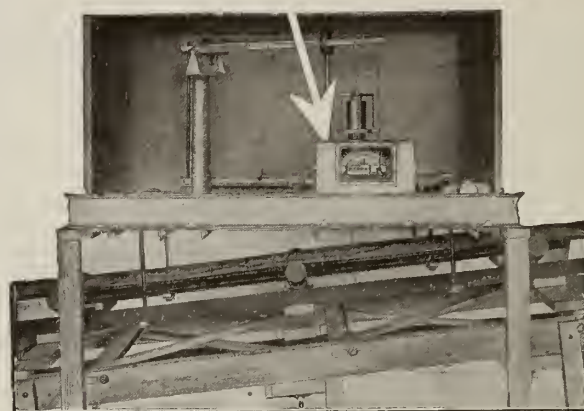
Accuracy.

This company guarantees, when this machine is erected and operated in accordance with instructions, that the accuracy shall be within 1% of the actual weight of material carried over the conveyor at a rate of not less than one-half of the maximum capacity for which the Weightometer is designed. This is not limited to a uniform continuous load, as portions of the conveyor may be loaded to full capacity of the Weightometer with empty portions intervening.

In testing, at least sufficient material must pass over the conveyor to register 5 or more unit figures on the counter.

Guarantee.

This company guarantees to replace by new ones, free of charge, f. o. b. factory, Passaic, N. J., any parts breaking or wearing out from ordinary use within one year's time, providing the defective part or parts be returned with transportation prepaid within a reasonable time after receipt of new part.



VIEW OF WEIGHTOMETER ON BELT CONVEYOR
Front sheet of casing removed

Registration.

Weight to be registered by 5-figure counter in tons of 2000 lbs. and decimals thereof, unless otherwise requested. Registration can be made in other units, as long tons, metric tons, barrels of a certain number of pounds, etc.

Material Furnished.

The Weightometer includes all weighing levers, beam, mercury balance and integrator enclosed in a sheet iron removable casing.

For belt conveyors, all parts for suspending the idlers and driving the integrator with snub pulley from return conveyor belt, are furnished.

For pan conveyors, suspension rods and brackets for suspending the track, and sprocket chain with sprocket to attach to one of the conveyor sprocket shafts, are furnished.

Material Not Furnished.

Uprights and cross members on which the Weightometer is placed.

Magnetic Counters.

One or more magnetic counters, for duplicating the readings of the register on the scale at distant points, can be supplied.

Durability.

Many of these machines have been in practical service for ten years, without appreciable expense for replacements and still maintain their original accuracy.

Essential Features.

The important advantages of the Merrick Weightometer are:

Easy installation; automatic operation; no expense for attendance; durability; simplicity; sheet iron enclosure for all working parts, thereby eliminating exposure to dust and interference by tampering; weighing without interruption of conveyor service, and a high degree of accuracy, whether the load be intermittent or uniform.

RICHARDSON SCALE COMPANY

Manufacturers of Automatic Scales

MAIN OFFICES AND FACTORIES

PASSAIC, N. J.

BRANCH OFFICES

NEW YORK, N. Y.	BOSTON, MASS.	BUFFALO, N. Y.	WICHITA, KANS.	SPOKANE, WASH.
CHICAGO, ILL.	ATLANTA, GA.	OMAHA, NEBR.	MEMPHIS, TENN.	MINNEAPOLIS, MINN.
PHILADELPHIA, PA.				

Products.

RICHARDSON AUTOMATIC COAL SCALES.

Description.

The scale is built on the equal beam or weight for weight principle. On either end of an even armed beam, balanced exactly in the center, is suspended a receptacle, one containing standard government test weights, the other coal to be weighed.

When the weigh hopper has received coal equivalent to the weights, a toggle mechanism causes the feed gate to close, and the hopper door to open and the coal discharges through gravity. Each weighing is registered and totaled on a mechanical counter.

An ingenious device known as the Richardson patent gate interlocking gear makes it impossible for the feed gate and discharge door to be open at the same time and coal to pass through unweighed.

This part of the scale is made of bronze, as are all the pins upon which the levers of the scale work. The weigh hopper is lined with or partially made of sheet Tobin bronze. Thus the vital parts of the scale are protected against the moisture content of the coal.

Purposes.

Richardson automatic coal scales serve two important purposes:

(1) Weighing the coal as received and protecting the user from short weights; (2) keeping a record of the coal burned, which, when compared with the weight

of water used, gives a continuous record of evaporative efficiency. Thus preventable losses, due to scale, poor draft, dirty flues, etc., are promptly indicated, and once recognized, can be remedied.

Scope of Use.

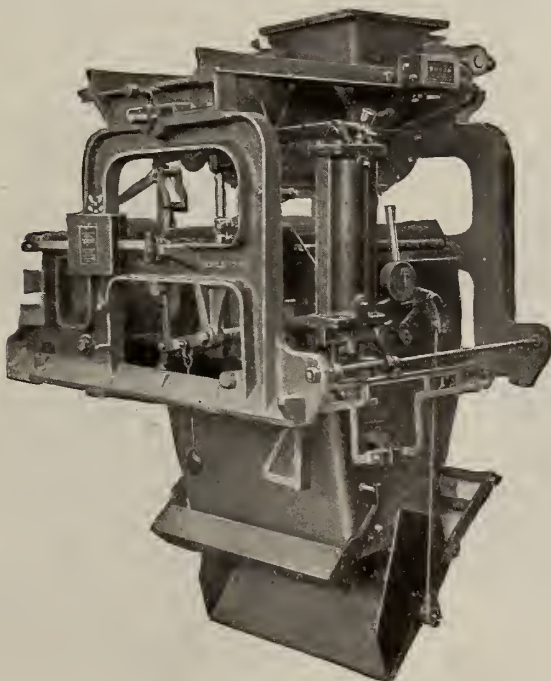
Used for weighing coal; also for dust, ores, rock, cement, grain, flour, feeds, sugar, lumpy materials, granular and powdered products of every description; water, oils and other liquids.

Capacity.

100 to 3000 lbs. per discharge or 1 to 150 tons hourly.

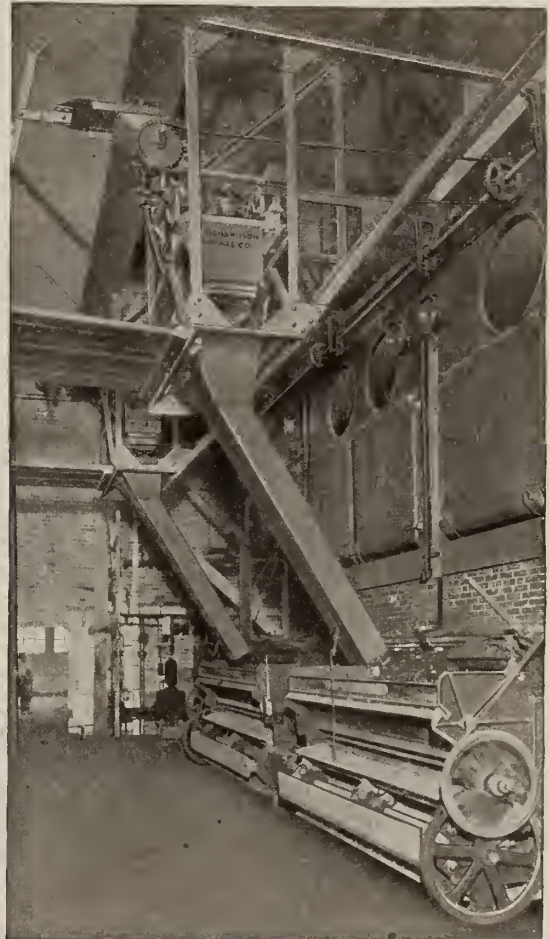
Accuracy.

Guaranteed to weigh within $\frac{1}{2}$ of 1% of the true weight.



RICHARDSON AUTOMATIC RECEIVING SCALE FOR CRUSHED COAL

SWEET'S CATALOGUE



INSTALLATION OF TWO STATIONARY, 100-LB. RICHARDSON AUTOMATIC COAL SCALES

Coal is taken directly from bunkers and charged into a spout leading directly to stokers. Agitators driven by line shaft

THE STANDARD SCALE & SUPPLY CO.

Manufacturers of Scales

1631 Liberty Avenue
PITTSBURGH, PA.

STORES AND WAREHOUSES

CHICAGO, ILL., 169 North May Street
PHILADELPHIA, PA., 523 Arch Street

NEW YORK, N. Y., 145 Chambers Street
CLEVELAND, OHIO, 1547 Columbus Road
DALLAS, TEX., 3027 Elm Street

Products.

SCALES.

Also, Gasoline and Oil Engines, Contractor's Hoists, Pumps, Hand and Trailer Trucks, Dump Wagons, Cars, Scrapers, etc.

For Concrete Mixers, see page 100.

General.

"The Standard" line of scales includes practically all types for every purpose, in sizes from the smaller counter graduated so fine as $\frac{1}{16}$ oz. up through the general run of express packages, portable platform, dormant, mine, wagon, motor truck, etc., to railroad track scales of the heaviest capacity and longest platform. This company specializes particularly on the heavier type of scales for steel mills, mines, grain elevators, etc.

Experience.

Over 25 years' experience in manufacturing scales, and the company's location in the geographical center of the industrial field places it in a position to furnish manufacturers with the right scales for every requirement and at prices in line with the grade of scales required.



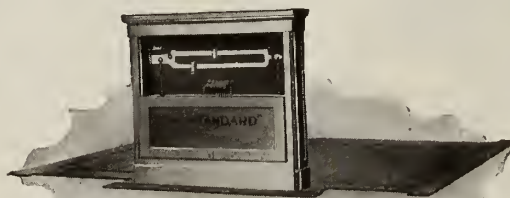
"THE STANDARD" MOTOR TRUCK SCALE

Scientifically designed and constructed to withstand the heavy strain imposed upon it by the concentration of from 70% to 90% of the motor truck load on its rear axle



AUTOMATIC DIAL SCALE

Constructed entirely of metal and ready to place on foundation upon arrival. Gives instant readings without use of weights. Usually equipped with a tare beam for balancing weight of truck. For use in receiving and shipping rooms and warehouses of industrial and transportation companies



WAGON SCALE



MONITOR ROLLING MILL SCALE

Equipped with short iron pillar and raised platform. Permits weighing of heavy castings, large plates, etc., handled by cranes



MINE OR TIPPLE SCALE



TANK OR HOPPER SCALE

"The Standard" Modern Railroad Track Scale.

These scales are of massive and scientific design assuring durability, accuracy, economical maintenance, avoidance of breakdowns and the consequent delays, and the elimination of losses and possible disputes. Scales are readily accessible for inspection and attention.

Manufactured in capacities up to 300 tons and



RAILROAD TRACK SCALE

lengths of platforms running from 6 ft. up. This company is prepared to furnish a specially heavy type where the scale is called upon to perform particularly heavy duty, or where it is necessary for a locomotive to pass over it. With the lighter pattern, a dead rail is usually provided. A single full capacity beam, graduated from 20 lbs. up to the capacity of the scale, either with or without recording attachment, is usually furnished. Double, triple or special beams are frequently used and the company is prepared to meet all demands.

Catalogue No. 89 will be sent on request. Please specify the type of scale in which interested so that full information can be furnished.

THE BONNOT COMPANY

Pulverized Coal Systems

CANTON, OHIO

Products.

HOLBECK PULVERIZED COAL SYSTEMS.

Bonnot Pulverizers, Rotary Kilns, Dryers and Coolers, and Bonnot Clay Working Machinery.

Holbeck Pulverized Coal Systems.

THE BONNOT COMPANY has passed into the fifth year of the successful manufacture and installation of the Holbeck system. The company can speak with experience and confidence of the good results that can be obtained, but the fact that many of the best known and most successful corporations have adopted the Holbeck system expresses more eloquently the reception accorded it.

The fundamental advantages of the use of pulverized coal are due to the coal particles being so finely divided that they readily mix with oxygen for combustion, thus requiring only the minimum amount of air.

Pulverized coal, when mixed with the proper amount of air, burns without smoke, not unlike gas; either reducing or oxidizing flames being obtainable. The fire is started with a swab of oiled waste; combustion readily taking place in a cold furnace. It can be turned on or off, up or down, to meet the temperature and conditions required.

The Holbeck system saves the labor required for unloading, wheeling and stoking the coal, also about 90% of the labor required for removing the ashes, clinkers and unburned coal. It requires no labor outside of the operators who stop and start the equipment, keep the bearings adjusted and lubricated.

The pulverized coal is delivered automatically as required to the different furnaces. After the coal is pulverized and delivered to the pulverized coal storage bins, the only equipment used is a screw conveyor to feed the coal from the bin, a blower to propel the air, an air indicator to indicate the quantity of air required, and an automatic regulator that works in conjunction with the air indicator to control the speed of the feeder that feeds the pulverized coal into the system.

Holbeck systems have been installed in almost every field of furnace heating, embracing the operation of steam boilers, open hearth, continuous billet heating, ingot heating, forging, malleable iron and cast steel annealing, busheling, fagoting, drop forging, nut, bolt and rivet making, rivet and plate heating, bull-dozer, sheet and pair and tinning, core drying, copper and lead reverberatory furnaces, roasters, rotary kilns, dryers and many other types of furnaces.

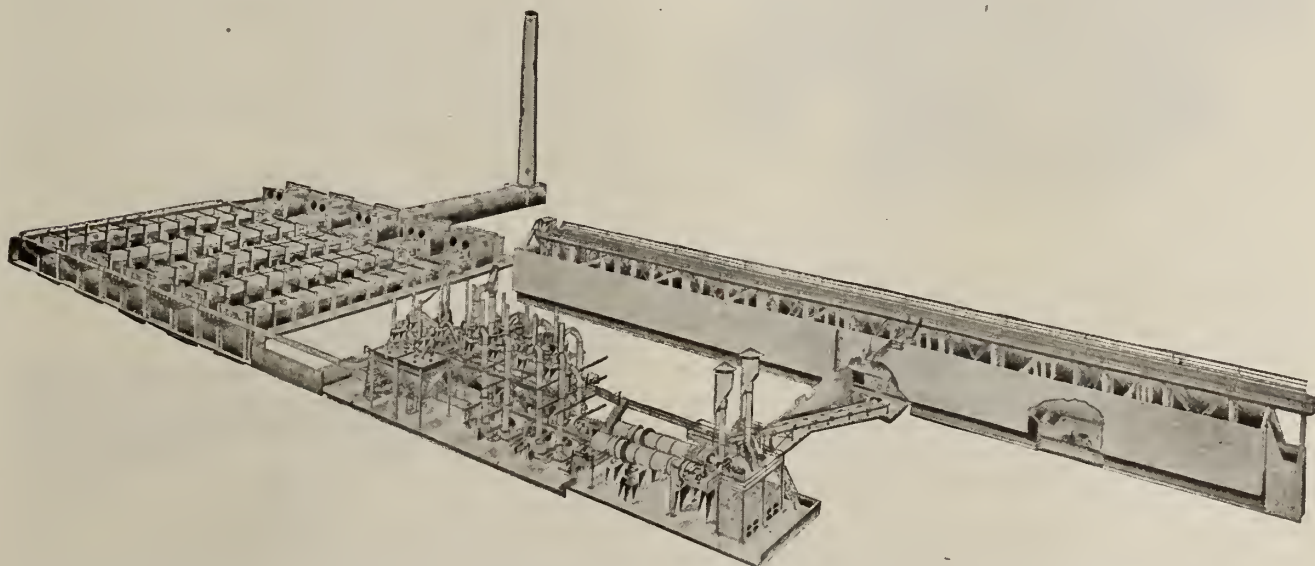
In every case, saving has been effected over the fuel previously used.

The perspective illustrated shows the Holbeck system as installed in a large copper smelter where it has been operating for more than two years.

More complete information will be sent to interested parties and the engineers of this company will make estimates on the possible economy of using pulverized coal.

Bonnot Pulverizers, Rotary Kilns, Bonnot Clay Working Machinery, etc.

Complete information and catalogue will be sent on request.



PERSPECTIVE OF HOLBECK PULVERIZED COAL SYSTEM INSTALLED IN LARGE COPPER SMELTER

KEK MANUFACTURING CO.

Manufacturers of Universal Grinding Mills

1372 Clinton Street
BUFFALO, N. Y.

Product.

KEK UNIVERSAL GRINDING MILLS.

Scope of Work.

The Kek Mill will handle any material which is dry and of a nature that will grind or pulverize. It will grind chemicals, colors, paints, minerals, metals, cereals, drugs and fibrous materials, or any other materials of a like nature not included in these general classifications.

A complete laboratory is maintained by this company, where samples of products will be ground and returned with full data as to fineness, capacity, power consumed, etc.

Kek Mill.

The Kek Universal Grinding Mill embodies a new application of the idea of using centrifugal force to aid in grinding and pulverizing materials. As shown below, the Kek is a cylindrically shaped mill, small and compact, the larger size, being 32 in. high by 32 in. in diameter.

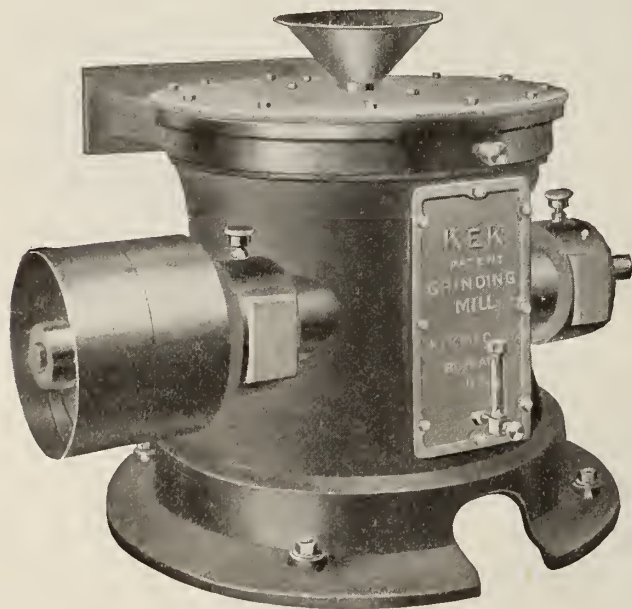


FIG. 1. 26-INCH KEK MILL, COMPLETE

The grinding or pulverizing medium consists of two taper dished steel plates, containing short steel pins set in circular rows in the plates (Fig. 2). The top plate with pins facing downward is stationary and bolted to body of the machine; the bottom plate set on a vertical shaft revolves, and pins in each plate run in circular grooves in the opposite plate. Bottom plate is revolved at high speed by a worm and gear arrangement (Fig. 3). The gear ratio between horizontal shaft and vertical shaft is 4 to 1.

In operation the Kek works as follows: material is fed in through the center opening in the top of the mill (Fig. 1), drops onto the bottom disk which is revolving

at a high rate of speed, about 3000 r.p.m., and is whirled by centrifugal force towards the outside of the disk; in passing through the revolving pins it is pulverized to fine powder and is then thrown out through a rectangular mouthpiece at the back of the mill.

By regulating the speed of the drive shaft and also by using pin plates containing different numbers of pins, any degree of fineness up to 300-mesh screening may be obtained. Four sets of pin plates are manufactured for the large 26-in. size Kek, containing 174 pins, 369 pins, 598 pins and 961 pins respectively.

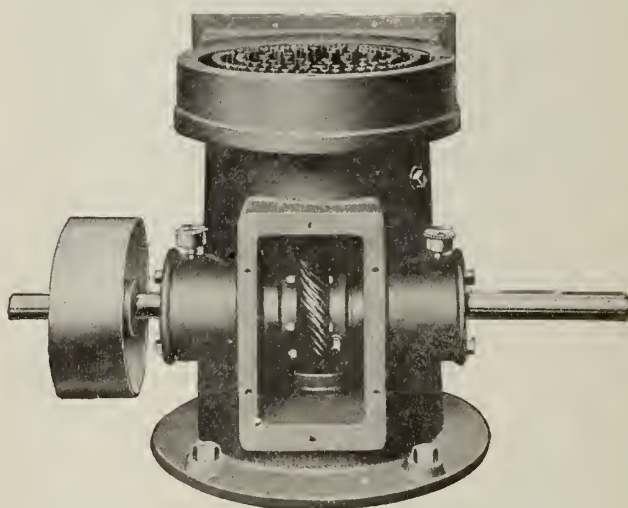


FIG. 2. 13-INCH KEK MILL, SHOWING INTERIOR
Top grinding disk removed

For the small size 13-in. Kek, 2 sets of pin plates are manufactured, containing 273 pins and 369 pins respectively. For fine grinding the larger number of pins are used.

The 26-in. Kek will handle up to two tons an hour and will consume 15 to 25 h.p., depending on the material ground. It weighs 2000 lbs.

The 13-in. Kek will handle up to 1000 lbs. per hour and consume 7 to 10 h.p., depending on the material handled. It weighs 800 lbs.

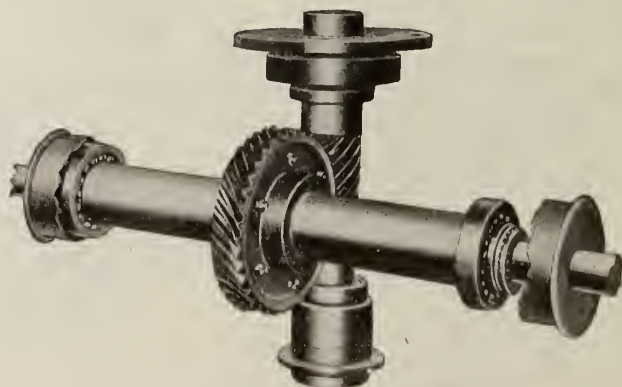


FIG. 3. DRIVE SHAFTS AND WORM GEAR ARRANGEMENT OF KEK MILL

RAYMOND BROS. IMPACT PULVERIZER CO.

Manufacturers of Grinding, Pulverizing and Air Separating Machinery

OFFICE AND WORKS
1316 North Branch Street
CHICAGO, ILL.

Products.

ROLLER MILLS, AUTOMATIC PULVERIZERS, VACUUM AIR SEPARATORS, for the fine grinding of all dry materials to a powder.

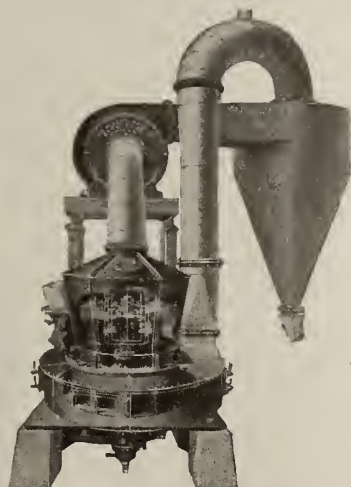
Special Exhaust Fans and Dust Collectors.

Roller Mills.

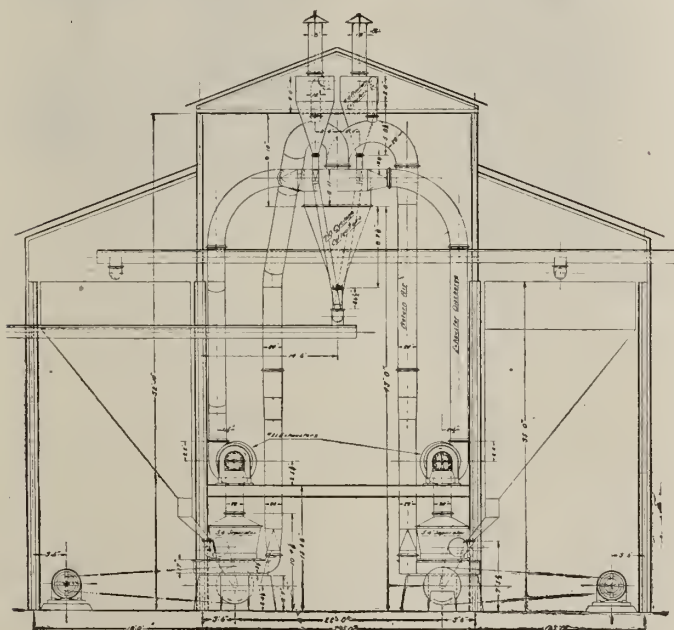
These are built for capacities of from 1 to 10 tons per hour and for fine or coarse grinding.

They are of the suspended roller type, crushing and pulverizing the material by centrifugal force. The fine material is carried away from the grinding chamber by our air separation principle as fast as it is made, eliminating the clogging effect produced by screen separation. In this way the rolls are always working on coarse material.

Raymond roller mills have been adopted as standard equipment by many large industrial corporations for grinding materials such as coal, coke, gypsum, limestone, phosphate rock, etc., to 100-mesh; and talc, graphite, barytes, caustic lime, lithopone, etc., to 200-mesh and finer.



RAYMOND ROLLER MILL



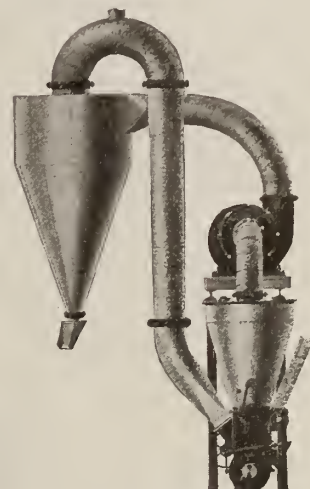
TYPICAL ROLLER MILL INSTALLATION FOR GRINDING COAL

Automatic Pulverizers.

These, like the roller mills, are equipped with air separation for the production of uniform fine products, but they are of the high speed type and therefore used for softer materials like clay, dry colors, hydrated lime, litharge, etc.

They are built in several sizes and will grind to any fineness by a simple adjustment in the air separator.

They can also be equipped with our special automatic throw-out attachment for separating impurities from such materials as hydrated lime, litharge, etc.



RAYMOND AUTOMATIC PULVERIZER

Special Features and Advantages.

The installation shown is typical of the Raymond system, as in all cases the piping can be arranged to allow placing the collector at almost any point where the material is to be discharged.

This discharge can be made into any convenient storage bin or conveyor and requires no extra power for operation.

In some of these installations the collector is set as high as 100 ft., and at a distance from the mill, eliminating at least one elevator and sometimes a conveyor.

NO SCREENS OR BOLTERS—The mills shown require no screens or bolters to produce the required fineness, as this is obtained automatically by the use of our patented air separators.

These separators after once being adjusted require no attention and produce absolutely uniform fine products containing no lumps or oversizes. They will give any fineness desired by a simple adjustment.

How to Specify.

To properly quote prices and guarantees on the right machinery, it is necessary to have all the information that can be supplied in regard to the proposition.

Always include the material to be ground and the capacity and fineness required. In this connection we would like to have some small mail samples, showing the crude material intended for the mill and the finished product to be duplicated.

If there is no sample of the finished product, kindly advise, in the terms of the Tyler standard screen scale, the fineness required.

E. H. STROUD & COMPANY

ESTABLISHED 1896

Engineers and Manufacturers of Crushing, Pulverizing and Stoking Machinery

928, 930, 932 and 934 Fullerton Avenue
CHICAGO, ILL.

Products.

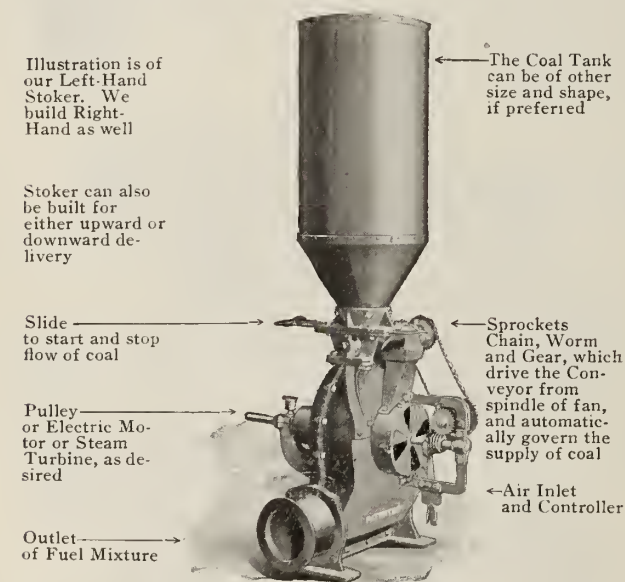
Machinery for the reduction of all sorts of DRY GRINDABLE MATERIALS, ANIMAL, CHEMICAL, MINERAL and VEGETABLE and some that carry 6% to 8% of MOISTURE. Also POWDERED COAL BURNING EQUIPMENT.

Pioneers.

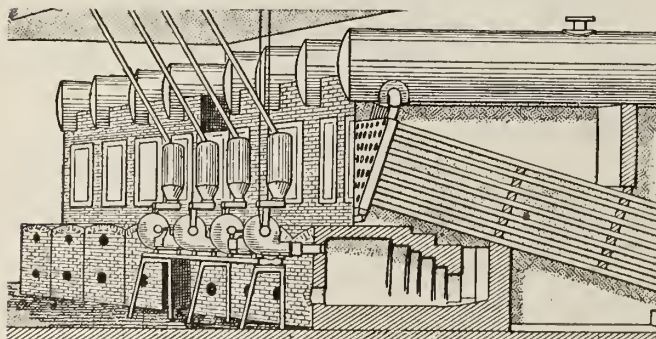
Pioneers in the art of pulverizing, stoking and burning powdered coal under boilers and some other heating units.

Stroud Powdered Coal Stoker and Burner.

This device receives the powdered coal, draws its own supply of air from the atmosphere, measures the coal and the air as used, mixes them thoroughly, delivers the mixture to the furnace (where it ignites at once) and enables the operator to have complete control of furnace temperatures and to make records from which to duplicate his results at will.



STROUD POWDERED COAL STOKER AND BURNER



ROUGH SKETCH OF A TYPICAL STROUD POWDERED COAL INSTALLATION

We have purposely made an incorrect drawing of the furnace and some other details because we do not



TRADE-MARK

wish to advertise or give away gratis information which has cost us considerable time and money and effort.

Our installation is as simple as that shown, and gives entire satisfaction.

All persons are warned that the ideas embodied in the "Stroud Powdered Coal Stoker and Burner" are well covered by fundamental patents.

SIZES AND CAPACITIES—Sizes and capacities from 15 lbs. to 5000 lbs. of coal per hour per stoker with all the air needed for combustion.

Write for Bulletins No. 103-B and No. 107.

Stroud Air Separation Pulverizers.

The illustration shows a product collector attached to the pulverizer. We build air vent chambers too.

These mills give a finished product direct which, without subsequent sieving, is so uniformly fine that 95% or 98% or all of it, as wanted, will, if tested when dry, pass through a horizontal brass wire cloth testing sieve of the desired mesh, which can be any mesh from say 40x40 down to the most impalpable powders, far finer than a 200x200 mesh.

They are without exception the most efficient pulverizers made.

Dustless in operation.

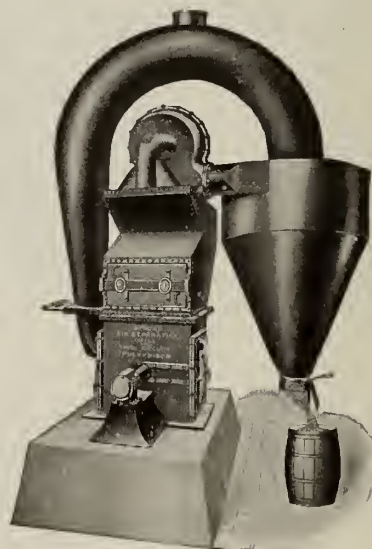
Difficult to clog.
Easy to clean.

A cool pulverizer for chemicals.

So automatic in feeding and operation that one man can attend to at least half a dozen mills.

Cost of milling is very low.

Ask for Bulletin No. 101-A.



STROUD AIR SEPARATION PULVERIZER

Throw-out-Box-End-Door.

For cleansing materials from imperfect and foreign matter during process of pulverization.

Ask for Bulletin No. 101-B.

Stroud Screen Separation Crushing and Grinding and Shredding Mills.

Ask for Bulletin No. 102-B.

Crushing and Granulating Roller Mills.

With either pointed or chisel shaped cutters, or fluted rollers, one pair, two pairs or three pairs of rolls high, per mill.

Ask for Bulletin No. 200.

STURTEVANT MILL COMPANY

Crushing, Grinding, Screening and Elevating Machinery

CABLE ADDRESS:
"EMERYSTONE, BOSTON"

Harrison Square
BOSTON, MASS.

CODES USED:
Lieber, Western Union
and Private

NEW YORK, Singer Building
ATLANTA, Healey Building

CHICAGO, Peoples Gas Building
DENVER, Colorado Building

PITTSBURGH, First National Bank Building
LONDON, ENG., Queen Victoria Street

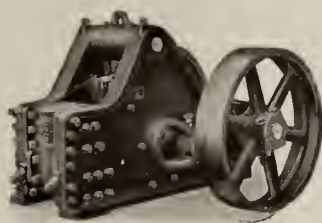
Products.

CRUSHING, PULVERIZING, GRINDING, SCREENING, SAMPLING, ELEVATING, CONVEYING, MIXING and WEIGHING MACHINERY.

Crushers.

JAW TYPE—For coarse, intermediate and fine crushing. Plate steel, cast steel or cast iron construction. Blake, Dodge and roll jaw actions. Cam and roll designs.

Catalogue No. 62.



JAW TYPE CRUSHER

DATA, STURTEVANT JAW TYPE CRUSHERS

Jaw opening.....	2x6	4x8	5x10	6x15	8x10	10x15	6x20	12x26
*Capacity, tons per hour:								
Jaws set to 1/8 in.	250 to 350 lbs.	1/2 to 1	1 to 1 1/2	2 to 3	1/2 to 3	8 to 10	5 to 7	12 to 15
**Jaws set to 1/4 in.	360 to 600 lbs.	1 to 1 1/2	2 to 3	3 to 4	6 to 10	12 to 18	16 to 20	20 to 30
Approx. h. p.....	2 to 3	3 to 4	8 to 10	8 to 10	15	20	25	
R.p.m.....	350	250	170	160	160	155	160	140
Pulley, in.....	18x3 1/2	30x4	30x6 1/2	36x8	30x6	48x10	48x10	60x10
Length over all, in.	33 1/2	46	58	72	61	90	68	117
Width over all, in.	22	38 1/2	36	55	39	60	63	84
Height over all, in.	22	35	40	45	40	52	41	74
Net weight, lbs.....	900	2200	3600	7600	3500	11000	8750	22500
Shipping weight, lbs.	1000	3000	4000	8400	4000	12000	9500	25000
Finest setting, in....	1/8	1/4	1/2	1/2	1/2	1	1 1/2	1 1/2
Coarsest setting, in.	3/4	1	2	2	2	3	4	5

*Capacities vary according to conditions.

**Also set to 1/2", 3/4", 1" and 2" in the larger sizes.

ROTARY TYPE (NOT GYRATORY)—For the fine reduction of soft and moderately hard materials, such as lime, gypsum, talc, soapstone, clay, coal, caustic soda, salt, etc. Open door, accessible construction and hand wheel adjustment.

Constantly adjustable while in operation. Inexpensive to buy, belt, erect and run. One of the most popular machines built by this company.

Catalogue No. 63.



ROTARY TYPE CRUSHER

DATA, STURTEVANT ROTARY TYPE CRUSHERS

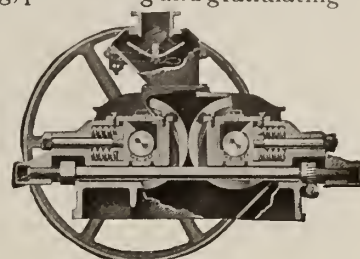
No.....	00	0	1	1 1/2	2
*Hopper opening, in.....	6x18	9x18	6x19	10x28	19x30
*Capacity, tons per hour.....	1 to 1 1/2	1 to 2	2 to 4	5 to 7	8 to 10
Approx. h. p.....	1 to 2	3 to 4	6 to 10	15	15 to 20
R. p. m.....	300	250	300	200	250
Pulley diam. and face, in.....	12x4	18x6	24x8	30x10	30x12
Length, in.....	45	56	76	87	104
Width, in.....	29	32	42	42	46
Height, in.....	41	43	60	72	85
Finest setting, in.....	1/4	1/4	1/4	1/4	1/4
Coarsest setting, in.....	1 1/2	1 1/2	1	1	1
Net weight, lbs.....	900	1300	4000	6000	9000
Shipping weight, lbs.....	1050	1600	4700	7000	10500

*These approximate dimensions do not mean size of rock machine can grip.

**Capacities based on 1/4 in. setting and will necessarily vary according to conditions.

ROLLS—For crushing, pulverizing and granulating—coarse or fine work. Balanced construction. Springs back of all 4 bearings give instant relief under breaking pressures; crushing shocks are quartered; automatic adjustments.

Catalogue No. 65.



ROLL TYPE CRUSHER

DATA, STURTEVANT BALANCED CRUSHING ROLLS

Size, in.....	16x10	36x16	20x14	22x14	24x15	30x16
Pulley, in.....	48x4	72x10	48x6	48x6	60x8 1/2	66x10
Approx. h.p.....	3 to 4	14 to 18	7 to 10	7 to 10	8 to 12	12 to 15
*R.p.m.....	200 to 270	60 to 85	150 to 215	150 to 215	115 to 160	80 to 100
Approx. length, in.....	69	116	84	84	94	102
Approx. width, in.....	64	108	80	80	87 1/2	102
Approx. height with flywheel, in.....	54	78	60	60	66 1/2	74
Net weight, lbs.....	6000	34000	10000	10600	13350	20000
Shipping weight, lbs.....	7000	37500	11200	11800	14750	21500

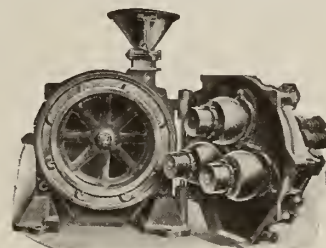
Size, in.....	32x16	36x20	38x20	36x16	38x16	8x5	12x12
Pulley, in.....	66x10	72x12 1/2	72x12 1/2	66x10	66x10	18x4	36x6
Approx. h.p.....	12 to 15	16 to 20	16 to 20	14 to 18	14 to 18	1	3 to 4
*R.p.m.....	80 to 100	60 to 85	60 to 85	60 to 85	60 to 85	150	150
Approx. length, in.....	102	125	125	102	102	33	48
Approx. width, in.....	102	122 1/2	122 1/2	96	96	29	56
Approx. height with flywheel, in.....	74	72	72	77	77	22	38
Net weight, lbs.....	20750	32400	33700	22000	22700	650	3000
Shipping weight, lbs.....	22250	35000	36300	23500	24200	700	3500

*The speed of rolls varies according to size and kind of material.

Pulverizers.

RING-ROLL MILLS—For grinding hard, medium or soft material from 2-in. size to from 10-mesh to 100-mesh. Used largely for grinding cement clinker, limestone, ores, granite, trap, phosphate, clay, shale, iron borings, feldspar, etc. Slow speed; durable and accessible. Wearing parts are a ring and 3 rolls, easily and quickly replaced. No clogging, no internal screens, no shields nor scrapers. Large capacity per horsepower and low upkeep.

Catalogue No. 79.



RING-ROLL MILL

DATA, STURTEVANT "OPEN DOOR" RING-ROLL MILLS

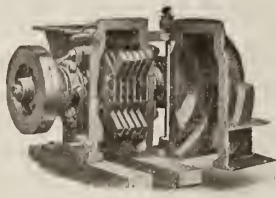
No.....	0	1	2	1 Duplex	2 Duplex
Ring, diam. and face, in.....	24x7	33x7	44x12	33x7	44x12
Rolls, diam. and face, in.....	14x7	14x7	18x10	14x7	18x10
Pulley, diam. and face, in.....	36x10	30x8	36x12	30x12	42x20
Pulley, r. p. m.....	125	320	300	375	325
Ring, r. p. m.....	125	80	63	80	64
Approx. h. p.....	8 to 15	18 to 25	40 to 45	35 to 50	80 to 90
Approx. width, in.....	48	63 1/2	83	72	92
Approx. length, in.....	121 1/2	132	161	154	252
Approx. height, in.....	54	71	88	74	90
Approx. net weight, lbs.....	7000	13000	27000	21000	45000
Approx. shipping weight, lbs.....	8000	14000	29000	24000	50000

Capacities vary so that it is impossible to give them here. Write for capacities, stating material and fineness desired.

HINGED HAMMER PULVERIZERS—For reducing salt, clay, shells, fertilizers, chemicals and other soft or fibrous materials to a fineness of from ¼ in. to 20-mesh. A high speed, inexpensive mill having large output with small horsepower.

On sticky materials the gates are often omitted entirely or in part, thus giving the mill a free discharge to prevent clogging; and if separation is required, an outside screen is used, the oversize being returned to the mill for regrinding.

Catalogue No. 84.



“OPEN DOOR” HINGED HAMMER PULVERIZER

DATA, STURTEVANT “OPEN DOOR” HINGED HAMMER PULVERIZER

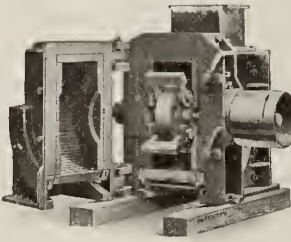
No.	0
Length over all, door closed, in.	42
Length over all, door open, in.	52
Width over all, in.	30
Height over all, in.	30
Inside diam., in.	24
Inside width, in.	9
*Feed opening, in.	12½x12
Driving pulley, in.	12 x10½
Pulley, r.p.m.	1000 to 1200
Approx. h.p.	5 to 15
Approx. net weight, lbs.	1700
Approx. shipping weight, lbs.	2000

*Does not mean size of material machine will take.

SWING SLEDGE MILL—For reducing limestone, lime, coal, shale, clay, etc. to a fineness of from ½ in. to 20-mesh. “Open door” accessibility is shown in illustration and is of great importance, in pulverizers of this class where adjustments and repairs are frequent. It is a great labor saver. Self-aligning ball bearings are another feature allowing the machine to run at very high speeds.

Many kinds of hammers and sledges are used for various purposes.

Catalogue No. 84.



“OPEN DOOR” SWING SLEDGE MILL

DATA, STURTEVANT “OPEN DOOR” SWING SLEDGE MILL

No.	0	1	2
Length over all, in.	48½	61	72½
Width over all, in.	49	65½	84
Height, over all, in.	42	44½	53
Inside diam., in.	24	30	36
Inside width, in.	10	20	30
*Feed opening, in.	12½x11	17x20½	14¾x30½
Driving pulley, in.	12 x10½	15x12½	20 x16½
Pulley, r.p.m.	1000 to 1200	1200 to 1500	1000 to 1200
Approx. h.p.	12	40	80
Approx. capacity per hour, 10-mesh, tons.	1 to 2	3 to 7	8 to 15
Approx. net weight, lbs.	3350	6300	1200
Approx. shipping weight, lbs.	3700	7000	1400

*Does not mean size of material machine will take.

EMERY MILLS—Made in vertical and horizontal types for grinding soft and moderately hard materials such as clay, shale, chalk, falc, salt, coal, facings, colors, lime, manganese, barytes, etc., to a fine powder.

These mills are economical in power and upkeep and are instantly accessible.

Size of feed, ¼ in. and finer; range of output, 20- to 200-mesh.

On ordinary material, they will grind to 100-mesh without screens or separators. Finer than this, bolts, reels, screens or air separators are desirable. Run without vibration on any good floor. Furnished right-

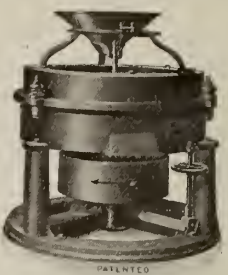
or left-hand discharge with automatic feeder.

Catalogue No. 64.



Vertical

ROCK-EMERY MILLS



Horizontal

DATA, STURTEVANT VERTICAL ROCK-EMERY MILLS

Size, in.	24	30	36	42
Length with track, in.	123	138	174	210
Length without track, in.	68	88	117	132
Width, in.	38	41	48	60
Height, in.	48	54	61	72
Pulley, in.	20x6	20x8	30x12	36x16
R.p.m.	700	650	550	350 to 450
Approx. h.p.	12 to 15	18 to 20	30 to 35	45 to 80
*Capacity per hour, tons.	½ to 2	1 to 4	2 to 7	5 to 15
Approx. net weight, lbs.	2000	3500	6000	1200
Approx. shipping weight, lbs.	2300	4300	7000	1300

*Capacity is approximate and varies according to material and fineness.

DATA, STURTEVANT HORIZONTAL ROCK-EMERY MILLS

Size, in.	42
Length, in.	60
Width, in.	60
Height, in.	60
Pulley, in.	30x10
R.p.m.	300
Approx. h.p.	18
*Capacity per hour, tons.	1 to 3
Approx. net weight, lbs.	5200
Approx. shipping weight, lbs.	5500

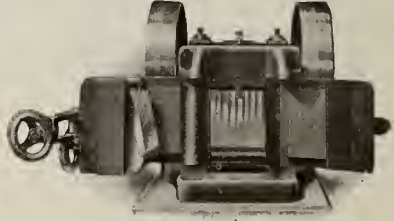
*Capacity is approximate and varies according to material and fineness.

Sampling and Laboratory Machinery.

This line embraces sample crushers, rolls, pulverizers, screens and automatic coal crushers.

LABORATORY ROLL JAW FINE CRUSHER—The most rugged machine built for sampling and used extensively in laboratories, assayer's offices, mining schools, steel mills, etc. “Open door” construction provides for quick and thorough cleaning.

Catalogue No. 67.



ROLL JAW FINE CRUSHER

DATA, STURTEVANT LABORATORY ROLL JAW FINE CRUSHERS

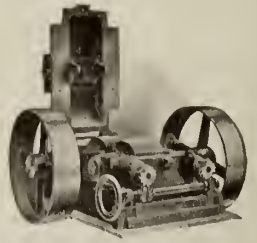
Jaw opening, in.	2x6
Approx. capacity per hour, lbs.:	
With jaws set to ½ in.	250 to 350
With jaws set to ¼ in.	350 to 600
Approx. h.p.	1
R.p.m.	350
Pulley, in.	18x3½
Length over all, in.	33½
Width over all, in.	34
Height over all, in.	34
Approx. net weight, lbs.	900
Approx. shipping weight, lbs.	1000

LABORATORY CRUSHING ROLLS—For crushing hard or soft rock and ores.

Usually installed to reduce crusher outputs to finer sizes.

Immediately accessible for cleaning. Automatic adjustments.

Catalogue No. 67.



LABORATORY CRUSHING ROLLS

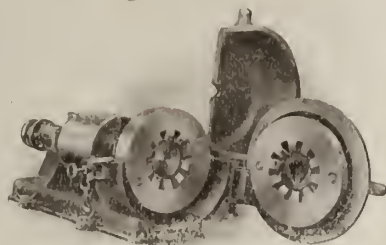
DATA, STURTEVANT LABORATORY CRUSHING ROLLS

Size, in.	Pulley, in.	R.p.m.	Approx. h.p.	Approx. length, in.	Approx. width, in.	Approx. height, in.	Approx. net weight, lbs.	Approx. shipping weight, lbs.
8x5 12x1	18x4 36x6	150 150	1 3 to 4	33 48	29 56	22 38	650 3000	700 3500

SAMPLE GRINDERS—For the fine grinding of rock and ore samples.

Open door construction for accessibility and thorough cleaning.

Catalogue No. 67.



"OPEN DOOR" SAMPLE GRINDER

DATA, STURTEVANT LABORATORY SAMPLE GRINDER

No.	Diam. grinding plate, in.	Approx. length, in.	Approx. width, in.	Approx. height, in.	Approx. h.p.	Pulley, in.	R.p.m.	Approx. net weight, lbs.
2 0	10 6	32 30	16 12	14½ 11¾	3 2	7x3 6x2¾	750 1200	175 150

AUTOMATIC COAL CRUSHER AND SAMPLER—For crushing and automatically sampling coal preparatory to analysis. Takes coal 3 in. in size or finer, crushes it to ¼ in. and finer and at the same time automatically extracts a sample of 5%, 10% or 15% of the amount passing through the machine. This sample is an accurate representation of the whole.

Used by many plants purchasing fuel on a B. t. u. basis.

Catalogue No. 85.



AUTOMATIC COAL CRUSHER AND SAMPLER

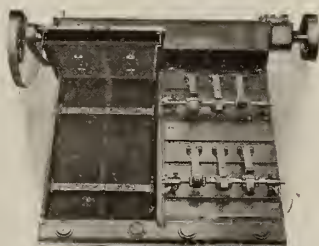
DATA, STURTEVANT AUTOMATIC COAL CRUSHER AND SAMPLER

No.	Hopper opening, in.	Approx. length, in.	Approx. width, in.	Approx. height, in.	Approx. h.p.	Pulley, in.	R.p.m.	Approx. net weight, lbs.
WITH PULLEY								
00	6x18	45	28½	41	1 to 2	12x4	300	900
WITH MOTOR								
00	6x18	69½	28½	41	1 to 2	12x4	300	1300

Screens.

NEWAYGO SUPERSCREENS—For screening everything screenable from ½ in. to 180-mesh. The Newaygo screening principle embodies: inclined screen surface, adjustable angle to regulate flow, wire stretched taut and automatically held taut to prevent sagging, elastic bridges tapped by hammers which keep screen in constant rapid vibration, thus insuring open meshes and large accurate output. On account of screen inclination, heavy gage wire and large meshes produce fine output, thus wear is reduced to a minimum and clogging is rare. Unit construction. Made in many styles and sizes to suit practically every condition.

Catalogue No. 77.



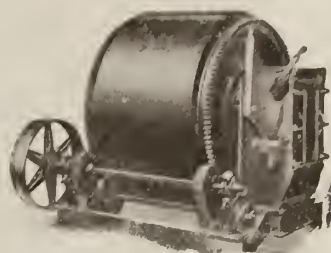
"OPEN DOOR" TWO UNIT SCREEN

Dry Mixers.

For mixing fertilizer and other dry ingredients in batches from ¼ to 1 ton. Capacities from 4 to 30 tons per hour.

A simple and durable machine that accomplishes a thorough and rapid mixing.

Catalogue No. 80.



"OPEN DOOR" DRY MIXER

DATA, STURTEVANT DRY MIXERS

Size	Drum mixing capacity, cu. ft.	Height with hopper, in.	Length with hopper, in.	Height without hopper, in.	Length without hopper, in.
1 3	12 50	96 144	90 144	60 85	64¾ 99

DATA—Continued

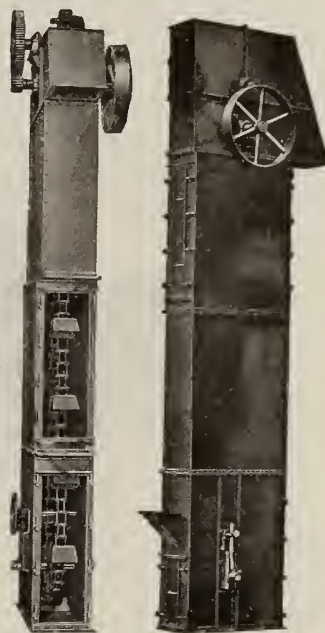
Size	Width, in.	Pulley, in.	R.p.m.	Approx. capacity per hour, tons	Weight with hopper, lbs.	Weight without hopper, lbs.
1 3	60¾ 91¼	24x4 36x8	120 75	4 to 5 20 to 30	2900 7840	2660 7300

Elevating and Conveying Machinery.

"Open door" elevators for use with crushing, grinding and screening machinery or for many other purposes. "Open door" construction insures instant accessibility for cleaning, adjustment and repair. Dustless and fireproof, of strong, rugged design and of ample proportions to withstand hard and constant use. Removable sections, split head, automatic take-ups, etc.

This company's engineers will co-operate with you in designing that portion of your plant in which this machine is to be installed, and will submit figures on the complete equipment.

Catalogue No. 61.



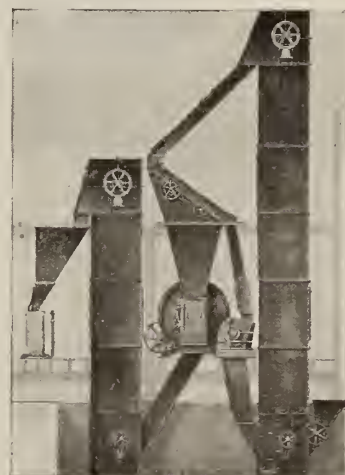
"OPEN DOOR" ELEVATORS

Fertilizer Mixing Units.

Consist of elevators, mixer, pulverizer, screen, scales, chutes, feeders—complete, ready to set up. All-steel construction, practically dustless and fireproof.

All parts are designed to allow instant accessibility for cleaning. Special units embodying your present machines will be built to improve present conditions.

Catalogue No. 86.



FERTILIZER MIXING UNIT

WILMOT ENGINEERING CO.

Manufacturers of Coal Handling Appliances

HAZLETON, PA.

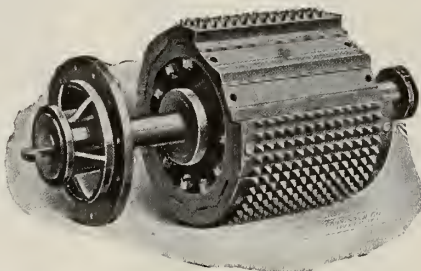
Products.

LLOYD COAL BREAKING ROLLS, solid and hollow ground teeth; PARRISH FLEXIBLE ARM SHAKER; KEYSTONE RIVETLESS CONVEYOR and ELEVATOR CHAIN; SIMPLEX JIGS.

Lloyd Coal Breaking Rolls.

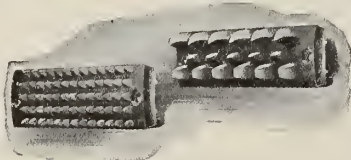
The compound gearing of Lloyd's coal breaking rolls is an exclusive feature. The company's long experience warrants the use of slow peripheral speed as "hammer blows" are positively eliminated, thereby creating less pulverization.

The outer surface of the roll bodies of Lloyd's crusher have their surface planed to receive the toothed segments and the roll body takes all the load resulting from the crushing of the coal. The only strain on the bolts is that required to hold the segments on the roll against the peripheral speed. This construction makes the replacing or changing of segments a very easy matter. The arrangement of teeth is such that it is impossible for a lump of coal to get between any two teeth without meeting a cutting or splitting edge. These rolls are also made with Johnson hollow ground teeth; which give a very much greater percentage of prepared sizes. Get the largest possible percentage of domestic sizes by specifying hollow ground teeth on the rolls.



COAL BREAKING ROLL BODY

Size, in.	Tons per hour	Speed, r. p. m.	Horsepower
24 x 28	40 to 60	210	25
36 x 34	120 to 150	135	35
36 x 46	160 to 200	135	40



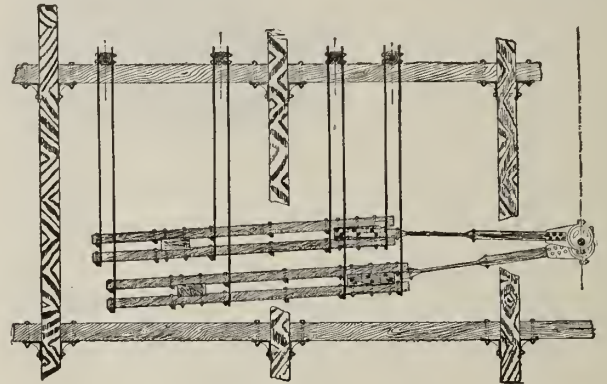
SEGMENT OF COAL BREAKING ROLL

Parrish Flexible Arm Shaker.

Experience has fully demonstrated the superiority of shakers over revolving screens for sizing coals. An investigation will demonstrate the superiority of Parrish flexible arm shakers over all other shakers.

In all shakers other than the Parrish the shaker arm is attached to the frame by some sort of pin or bearing. In the Parrish the two are bolted rigidly together, the flexibility of the shaker arm itself allowing sufficient vertical movement for the throw of the eccentric. In comparison, Parrish flexible arm shakers are cheaper to install, lighter, more durable, require less power to operate and give greater capacity for any given size. Parrish shakers subject a breaker to no greater strain than revolving screens and can be safely installed in old

breakers where it would be dangerous to place other types of shakers because of their great weight and the vibration resulting from their use.



FLEXIBLE ARM SHAKER

Keystone Rivetless Steel Conveyor and Elevator Chain.

This chain contains only three parts; the center link, the side links which are alike and interchangeable, and the connecting pin. No bolts or rivets are used and no tools are required for assembling or taking apart. All bending strains have been avoided, the links being in tension and the pins in double shear. The strength of the chain in position is therefore exactly the same as the ultimate strength of the cross-sectional area of the metal. Curves and arches have been avoided in the design so it is impossible for any change to develop in the pitch. Every part of the chain is drop forged from steel having a tensile strength of 85,000 to 95,000 lbs. per sq. in.

Buying new chain for renewals involves an additional expense in the time and labor required to place it in position; a chain, therefore, which can not stretch and which by reason of its enormous strength will not easily break, offers two-fold economy.



Side Link

Center Link

Pin



RIVETLESS CONVEYOR CHAIN

Pitch, in.	Diameter of pin, in.	Malleable iron No.	40 h. c. s. Drop forged No.	Weight per ft., lbs.	Approximate breaking strain, lbs.
3	5/8	358	....	5	16,000
4	3/4	468	....	5.75	20,000
6	1 1/8	698	....	10.1	42,000
9	1 1/2	998	....	8.24	42,000
4	3/4	....	468	7.12	43,000
6	7/8	....	678	5.92	60,350
6	1 1/8	....	698	10.72	100,000
9	1 1/8	....	998	8.46	100,000
9	1 3/8	....	9118	15.7	200,000

Prices quoted on application.

Simplex Jig.

Wilmot Simplex coal jig has no equal in the preparation of anthracite coal. It has been installed in a majority of the anthracite breakers with very gratifying results—cleaning the coal to pass the most rigid inspection. Why have coal condemned when it can be made fit for market at an expense less than the cost of handling the condemned product? Install Simplex jigs and save money.

SMOKELESS FUEL CO.

Blacksmithing Coal

CABLE ADDRESS:
"MILTRENA, NEW YORK"

Kanawha Banking and Trust Building
CHARLESTON, W. VA.

BRANCH OFFICES
NEW YORK, N. Y. CHICAGO, ILL. NORFOLK, VA. LONDON, ENG.
TIDEWATER PIERS
NEWPORT NEWS, VA. LAMBERTS POINT, VA. SEWALLS POINT, VA.

Products.

MILTRENA BLACKSMITHING COAL.

Pocahontas, New River and Kanawha Gas and Splint Coals.

Physical Characteristics and Peculiar Properties.

Miltrena blacksmithing coal is a superior product of mines of rare deposits controlled by this company. Only in a very few localities on the globe has nature deposited coal that possesses the vital, heat generating qualities that perfect smithing demands. Coal seams designated by geologists as containing such deposits are often lacking in the essential "fusing" quality, making perfect welds impossible.

Miltrena blacksmithing coal contains the lowest percentage of moisture and ash and the highest percentage of fixed carbon and volatile matter which combine to make it the most efficient and therefore most economical coal for smithing. Due to the high fusing or melting temperature of the ash—approximately 3000° Fahr.—and the low percentage of sulphur, this coal is free from clinker or any other heat resisting bodies. Perfect fusing which depends for success chiefly upon a sustained, high temperature is thus assured. By actual test, Miltrena blacksmithing coal contains from 15,000 to 15,500 B.t.u.

Uses.

Its free burning, intense heat generating qualities would suggest many and varied uses for this coal. For all kinds of welding, brazing, heating, lead burning, paint burning and similar classes of work where an intense, sustained, concentrated heat is essential, Miltrena blacksmithing coal is admirably adapted.

Output.

The annual output of coal from mines controlled by this company is 2,000,000 tons. Many thousands of carloads of Miltrena blacksmithing coal distributed to satisfied users from Jacksonville, Fla., to Alaska, many of whom are the largest concerns in their line in the world, establishes beyond doubt the superior quality of this coal.

Tests.

A mineral or chemical product stands or falls according to the results of official tests to which it is subjected.

Two analyses are presented here, made by the United

States Navy, of Miltrena blacksmithing coal taken from cars for cargoes.

NAVY YARD, NORFOLK, VA.
Dec. 5, 1918.

Sample No. 614

	As Received	Dry Coal
Moisture	2.1	.....
Volatile matter	.....	17.7
Fixed carbon	.....	79.7
Ash	.....	2.6
Total	.....	100.00
Sulphur	.....	.49
British thermal units	15,015	15,351

F. A. WALKER,
by direction, Pay Corps, U. S. Navy
Supply Officer

NAVY YARD, NORFOLK, VA.
Nov. 18, 1918.

Sample No. 540

	As Received	Dry Coal
Moisture	1.1	.....
Volatile matter	.....	20.3
Fixed carbon	.....	76.5
Ash	.....	3.2
Total	.....	100.00
Sulphur	.....	.46
British thermal units	15,158	15,326

F. A. WALKER,
by direction, Pay Corps, U. S. Navy
Supply Officer

Partial List of Users.

Big-Four Railway Co., Cincinnati, Ohio
American Car & Foundry Co., New York, N. Y.
American Bridge Co., Pittsburgh, Pa.
International Harvester Co., Chicago, Ill.
Jeffrey Manufacturing Co., Columbus, Ohio
Pennsylvania Lines West of Pittsburgh, Pittsburgh, Pa.
Studebaker Corporation, South Bend, Ind.
Bickett Coal & Coke Co., Chicago, Ill.
Fairbanks Steam Shovel Co., Marion, Ohio
Canadian Pacific Railway Co., Montreal, Can.
Simmons Mfg. Co., Kenosha, Wis.
Bucyrus Company, Evansville, Ind.
Anaconda Copper Mining Co., New York, N. Y.
Baer Fuel Company, San Francisco, Cal.
Wheland Co., Chattanooga, Tenn.
Lehigh Portland Cement Co., Allentown, Pa.
Southern Coal Co., Asheville, N. C.
F. W. Kennedy, Jackson, Miss.
Dakota Iron Store Co., Sioux Falls, S. D.
Vulcan Fuel Co., Savannah, Ga.
White Hickory Wagon Co., Atlanta, Ga.
Consolidated Mining & Smelting Co., Trail, B. C.
Evans, Coleman & Evans, Ltd., Vancouver, B. C.

FLINN & DREFFEIN COMPANY

Gas and Fuel Engineers

431 South Dearborn Street
CHICAGO, ILL.

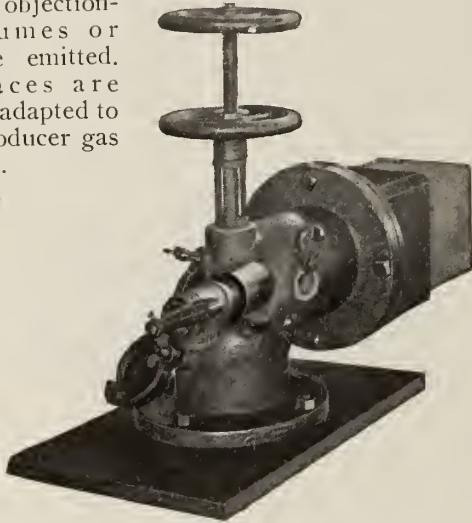
Products.

DESIGNERS and BUILDERS of INDUSTRIAL FUEL EQUIPMENT, which includes:

Anthracite Producer Gas Plants.
Bituminous Producer Gas Plants (Raw).
Bituminous Producer Gas Plants (Clean).
Mechanical Gas Producers.
Gas Washing Apparatus.
Tar Extractors.
Raw Producer Gas Burners.
Special Gas Apparatus for making:
Nitrogen, Carbon Monoxide, Carbon Dioxide.

Raw Producer Gas Burner.

These burners can be applied to furnaces using fuel oil, coal or coke with virtually no material alterations. Combustion is complete within the furnaces and there are no objectionable fumes or smoke emitted. Furnaces are readily adapted to raw producer gas burners.

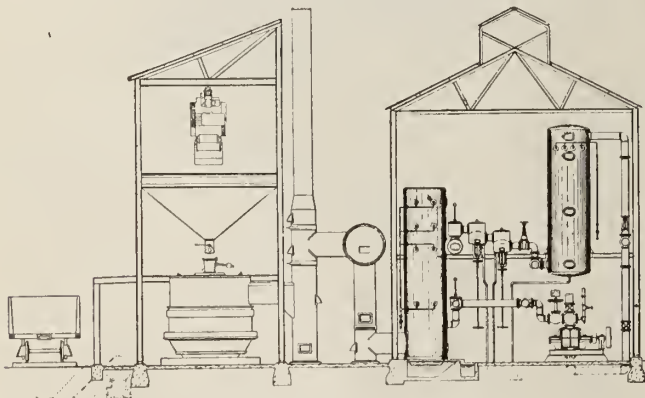


FLINN & DREFFEIN RAW PRODUCER GAS BURNER

For displacing oil, natural gas, coal and coke in a wide range of industrial heating operations

Clean Producer Gas from Bituminous Coal.

The FLINN & DREFFEIN COMPANY is prepared to



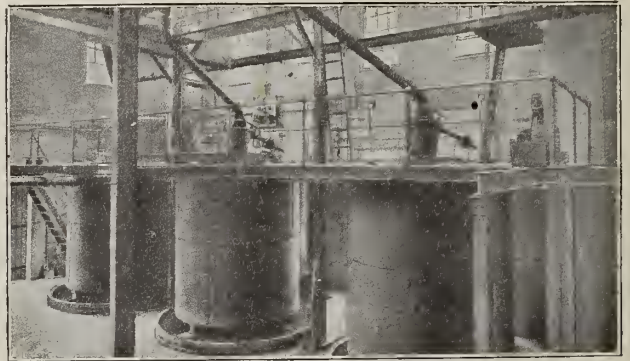
FLINN & DREFFEIN BITUMINOUS PRODUCER GAS CLEANING PLANT

For delivering a tar-free cold gas suitable for transmission through standard steel pipe to operations where this fuel can be advantageously applied. Any standard gas producer may be used in connection with FLINN & DREFFEIN gas cleaning equipment

build bituminous producer gas cleaning plants in capacities ranging from 50 lbs. of coal per hour up to the maximum that may be required.

Anthracite Producer Plant.

This type of apparatus is built for soldering tin cans, canning, etc. Also for hardening, tempering, annealing and heat treating of steel.



ANTHRACITE PRODUCER PLANT

Furnishing gas for bright annealing cold rolled steel, sherardizing, japanning and various operations formerly using city gas

Raw Bituminous Producer Gas Plant.

This apparatus is especially suitable for heating reducing kettles, ovens, etc., as well as in all moderate temperature, direct fired furnaces, such as hardening, tempering, annealing and heat treating of steel.



RAW BITUMINOUS PRODUCER GAS PLANT

In combination with a complete burner system for heating asphalt stills

Services.

For more than ten years, the FLINN & DREFFEIN COMPANY has designed and built fuel equipments for industrial and manufacturing purposes, covering the entire range of heating and burner operations, and is in a position to offer only that equipment which is most suitable to the manufacturer's needs. Fuel systems of its design can be seen in successful operation in many leading factories throughout the country.

Information Required.

In the nature of things, nearly every proposition must be specially considered before definite recommendations can be made regarding the apparatus involved. In writing, please describe as fully as possible the requirements, giving kind and quantity of fuel used and nature of heating operations to be performed.

INTERNATIONAL OXYGEN COMPANY

NEWARK, N. J.

Products.

GENERATORS for OXYGEN and HYDROGEN.

Pressure, Regulating and Reducing Valves for high pressure gases; Gas Testing Apparatus and Cylinders; Distilling Apparatus and Hydraulic Testing Apparatus; Oxygen and Hydrogen Gases in cylinders; Welding and Cutting Equipment.

Scope.

The organization takes in the requirements of the entire field of oxygen and hydrogen users. It manufactures unit oxygen and hydrogen generators for any quantity of gas needed.

I. O. C. Type 4—1000 Oxy-hydrogen Generators.

These generators of the unit or single cell type have set a new standard of economy in gas production.

Each generator is complete in itself, making pure oxygen and pure hydrogen at a rate determined by the amperage of the electric current supplied.

Each unit requires floor space of 4 by 40 in., or about the equivalent of a square foot and with necessary pipe connections needs headroom of about 6 ft. This generator per unit of floor space produces normally 3 times the gases made by any other apparatus.

Practically no organic material enters into the construction of the Type 4—1000 generator. There are no parts on the interior of the cell constructed of glass, por-

celain, rubber or paraffin which are readily destructible. I. O. C. cells are indestructible and timeproof.

ELECTRICAL EFFICIENCY—At normal current of 600 amp., each cell, with an electrolyte of caustic soda solution, requires 2.2 volts and has a guaranteed capacity of 4.8 cu. ft. of oxygen and 9.6 cu. ft. of hydrogen per clock hour. The kilowatt hour efficiency is 3.65 cu. ft. of oxygen and 7.3 cu. ft. of hydrogen.

A normal current of 600 amp. is stated, because, at the common current rates, the cell operated at this amperage shows the most economical adjustment between installation cost and operating cost.

Below 600 amp., a slightly higher electrical efficiency is obtained, but the gas output per cell diminishes. Above 600 amp., the electrical efficiency diminishes slightly, while the output per cell increases.

When the demand falls below normal, current can be saved by running the plant on a lower amperage, thus securing the smaller gas output needed at a higher electrical efficiency. As gas requirements increase, a higher amperage can be used and a larger output secured.

It is practical to operate, at a range, from less than 200 amp. to upwards of 1000 amp.—or at a ratio of more than 1 to 5.

PURITY OF GASES—I. O. C. Type 4—1000 generators are guaranteed to produce gases of a minimum purity of 99% for oxygen and 99.5% for hydrogen. Experience, however, shows oxygen averaging 99.7% pure and hydrogen 99.9% pure.

CAPACITIES, I. O. C. TYPE 4—1000 UNIT GENERATOR

No. of cells	Capacity in cu. ft. per 24 hours			
	At 600 amp.		At 1000 amp.	
	Oxygen	Hydrogen	Oxygen	Hydrogen
25	2880	5760	4800	9600
50	5760	11520	9600	19200
75	8640	17280	14400	28800
100	11520	23040	19200	38400
150	17280	34560	28800	57600



BANK OF 15 I.O.C. TYPE 4—1000 OXY-HYDROGEN GENERATORS

I. O. C. Engineering Service.

The company designs, installs, and puts into operation oxy-hydrogen plants complete in every detail—not alone I. O. C. generating apparatus, but also such purchased accessories as motor generators, switchboards and control apparatus, compressors, gas holders, piping systems, and apparatus for utilizing the gases.

Or the company will, in connection with the purchase of its own apparatus, prepare plans for the complete installation and furnish specifications covering all accessories—with a view to safeguarding the purchaser's interests at every point.

MILWAUKEE RELIANCE BOILER WORKS

Manufacturers of Gas Producers

32nd and Hadley Streets
MILWAUKEE, WIS.

Products.

"SHARP-BASSETT" GAS PRODUCERS.

Also, "Reliance" Steel Tanks, Feed Water Heaters, Vertical Boilers.

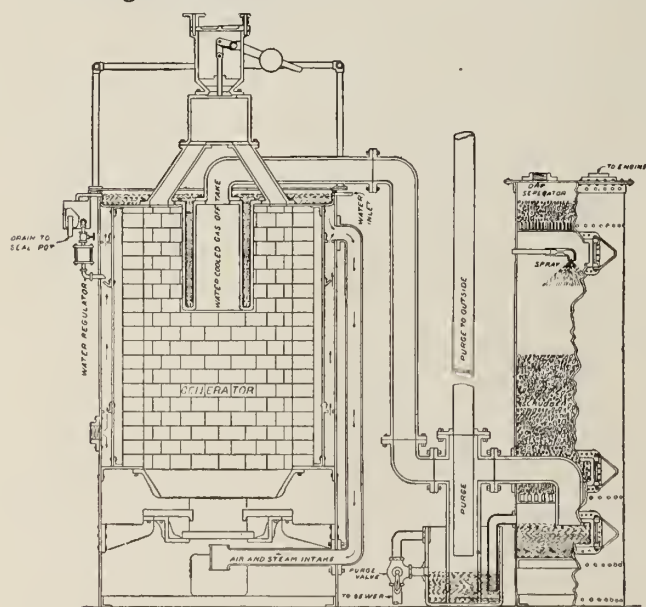
"Sharp-Bassett" Gas Producer.

The "Sharp-Bassett" improved gas producer, was designed by A. J. Bassett who has had many years of experience in operating, testing and experimenting with different makes of gas producers and gas engines, under actual working conditions; thereby being in position to know the proper design and construction necessary to produce the most economical, reliable and serviceable gas producer.

In designing this gas producer, it was the designer's aim to place a gas producer on the market that would be simple, economical, convenient to operate and absolutely reliable under all working conditions.

The great number of installations which are now in successful operation, throughout the United States and foreign countries, prove beyond a doubt, that this gas producer furnishes fuel for modern gas engines and refined heating operations cheaper than any other method known.

Exhaustive tests, run on a great number of "Sharp-Bassett" improved gas producers in service show that they will deliver 80% of the total heating value of the fuel as fired, in a clean, cool gas, for use in gas engines and heating furnaces.



CROSS SECTION OF "SHARP-BASSETT" IMPROVED STANDARD GAS PRODUCER

Showing method of firing, cleaning and cooling the gas; double shell arrangement; method by which brick lining and grates are installed

"Sharp-Bassett" Combined Steam and Gas Generator.

Designed to meet the demands of power and fuel users who require a quantity of steam and hot water for heating purposes during the winter months, also other heating applications in the manufacturing process of products.

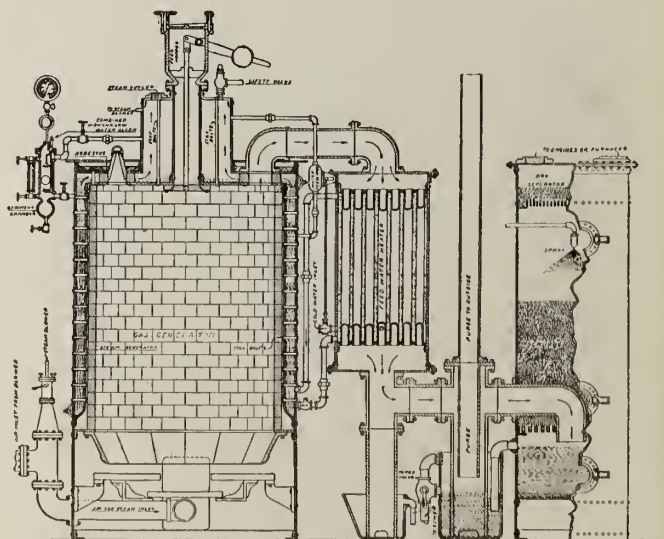
With regular equipment the gas generating efficiency of the "Sharp-Bassett" combined steam and gas generator is the same as the efficiency of the "Sharp-Bassett" improved gas producer.

The steam generating part of the equipment is entirely a recovery process, as through the process of distilling the fuel a certain percentage of the heating value of the fuel is thrown off through radiation, and this is the heat which is used to generate steam, therefore the steam is generated at no cost to the user.

Should the user's steam requirements be larger than the steam thus recovered the volume of steam generated can be increased by simply reducing the thickness of the brick lining, or eliminating the brick lining entirely to obtain the volume of steam required.

The construction of this combined steam and gas generator is of the same general construction as the improved gas producer.

With the improved gas producer the double shell is used as an economizer, vaporizer, and saturator, but with the combined steam and gas generator the double shell is staybolted and in addition has a crown sheet, steam dome, and feed water heater.

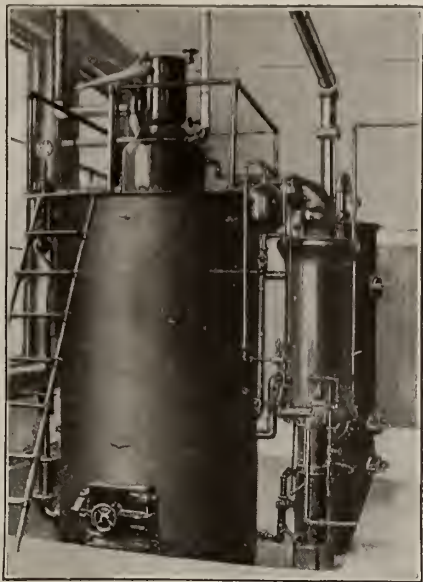


CROSS SECTION OF "SHARP-BASSETT" COMBINED STEAM AND GAS PRODUCER

Gas generated by this generator supplies the fuel to a modern gas engine, which in turn supplies the power for this factory, and the steam generated is used throughout the factory for heating purposes

The feed water heater is placed in the gas offtake between the gas generator and the scrubber and recovers the heat which would otherwise enter the scrubber and be carried off by the scrubber water to the sewer.

A scientific test-run made on the "Sharp-Bassett" combined steam and gas generator operating in actual service, showed an over all efficiency of 96%. This being the highest efficiency thus far obtained through any other type of power generating apparatus.



"SHARP-BASSETT" COMBINED STEAM AND GAS GENERATOR

Producer Gas for Power.

Producer gas when used for power is cooled and thoroughly cleaned before being delivered to the engine. The U. S. Government made tests at their plant in St. Louis to determine the commercial value of various fuels and the most perfect system of conversion into power and heat. The producer gas tests made at this time by the government experts proved that power can be developed by the producer gas plant with 1/5 to 1/3 the amount of coal used in modern steam plants. The results of these tests will be found in publication, which can be obtained by application to Bureau of Mines, Washington, D. C.

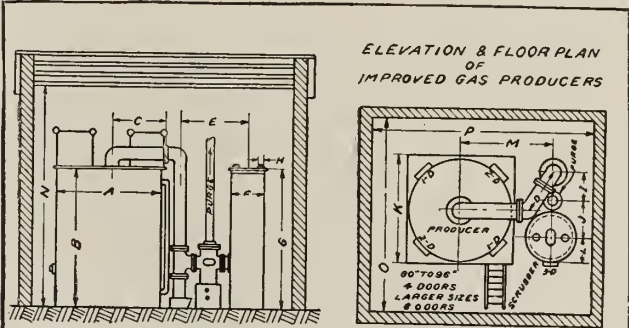
It is now universally acknowledged that producer gas is the coming power, displacing all other methods, because of its greater economy, and its great saving in labor, repairs and increased longevity of plants; its safety and reduction of fire risk; its cleanliness and elim-

ination of smoke nuisance, which is important, especially in cities. Power can be developed for three-tenths of a cent per horsepower hour, fuel cost, using buckwheat size anthracite coal at \$6.00 per ton. Electricity can be developed for one half cent per kw. hour. Producer gas can be used for power or fuel at less cost than city gas at 20¢ per 1000 cu. ft. or natural gas at 35¢ per 1000 cu. ft.

Producer Gas for Fuel.

Producer gas is used for supplying a fuel gas to replace other fuels with a great many advantages, as well as being very much more economical. The heat or calorific energy of the fuel can be applied in the most direct and economical way. It prevents waste of material and prolongs the life of furnaces. It shortens time of operation, thus increasing production. It produces more uniform and better products. It can readily be applied to almost every form of industry where heat is required. In large plants, centralization of gas producer results in a reduction of labor and increases efficiency over separately fired furnaces. When firing furnaces with producer gas they are under perfect control of the operator and almost any heat can be obtained.

The labor required for firing a gas producer for power or fuel is very small compared to a steam boiler. One man can take care of a large plant and have plenty of time for other duties. He can charge our producer, stoke, inspect and regulate fire, and remove the ash without facing uncomfortable heat. His work is clean. No carelessness or accident can cause an explosion and there is no smoke.

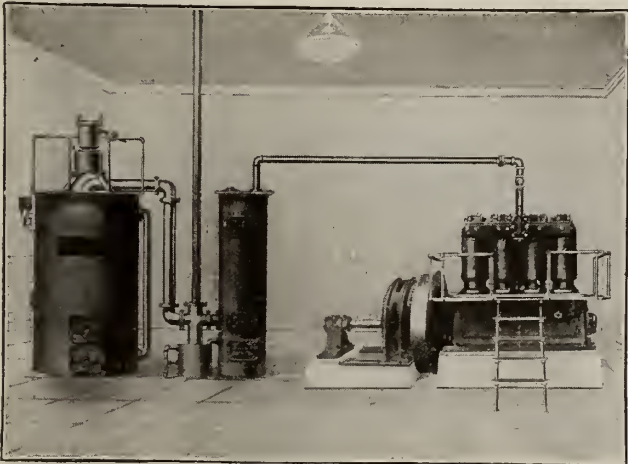


OUTLINE DIMENSIONS

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	HP
60	10'	23 1/2"	34"	47 1/2"	30"	10'	4"	17"	30 1/2"	66"	18"	56"	20"	11'	12'	35
66	10'	39"	34"	47 1/2"	30"	10'	4"	17"	30 1/2"	72"	18"	56"	20"	12'	13'	50
72	10'	42"	34"	47 1/2"	30"	10'	5"	17"	30 1/2"	78"	18"	56"	20"	12'	13'	75
78	10'	45"	40"	56"	36"	10'	6"	20"	36"	84"	21"	69"	20"	13'	14'	100
84	10'	48"	40"	56"	36"	10'	6"	20"	36"	90"	21"	69"	20"	13'	14'	125
90	10'	51"	40"	56"	36"	10'	6"	20"	36"	90"	21"	69"	20"	14'	15'	150
96	10'	54"	40"	56"	36"	10'	8"	20"	36"	102"	21"	69"	20"	14'	16'	175
102	10'	57"	45"	62"	42"	10'	8"	23"	39"	108"	24"	99"	20"	15'	17'	200
108	10'	60"	45"	62"	42"	10'	10"	23"	39"	114"	24"	99"	20"	16'	18'	250
120	10'	66"	45"	62"	42"	10'	10"	23"	39"	126"	24"	99"	20"	17'	19'	300
126	10'	69"	45"	65"	48"	10'	12"	23"	42"	133"	24"	99"	20"	18'	20'	400

ELEVATION, FLOOR PLAN AND OUTLINE DIMENSIONS OF IMPROVED GAS PRODUCER

NOTE—The above illustrations and dimensions will serve for both the "Sharp-Bassett" Improved Standard Gas Producer and the "Sharp-Bassett" Combined Steam and Gas Generator when figuring space requirements for installations, with the exception of dimension (I) which is increased 10 in. on the combined steam and gas generator



"SHARP-BASSETT" IMPROVED GAS PRODUCER POWER PLANT
Gas engine direct connected to electric generator

THE SMITH GAS ENGINEERING CO.
Clean Gas Producer Plants
DAYTON, OHIO

FACTORIES: LEXINGTON AND MORaine (NEAR DAYTON), OHIO
SOLE CANADIAN REPRESENTATIVE: THE CANADIAN ALLIS-CHALMERS, LTD., TORONTO

Products.

Designers and builders of GAS PRODUCER PLANTS for power service and industrial heating, including Plants to furnish Gas for Melting, Annealing, Heat Treating and Re-heating Metals and Glass, also for Enameling Ovens and Foundries for Baking and Drying.

Special types of PRODUCERS designed for Anthracite, Bituminous and Lignite Coals; TAR EXTRACTORS; GAS CLEANING PLANTS.

Recording Gas Calorimeter; Gas Valves for hot and cold Gas, Tar Extracts for coke oven or producer gas, etc.

Experience.

THE SMITH GAS ENGINEERING Co. is a pioneer in gas producer work, Smith suction gas producers having been in successful commercial operation since 1902. Over 80,000 h.p. have been installed, ranging in size from 25 to 3,000 h.p. in single units, operating on a wide range of fuels, and furnishing gas for both power and heating. The company numbers among its customers some of the largest and best known manufacturers in the country, who installed Smith producers after thorough and detailed examinations by their own engineers, which showed the remarkable economies to be obtained by their use.

Economy.

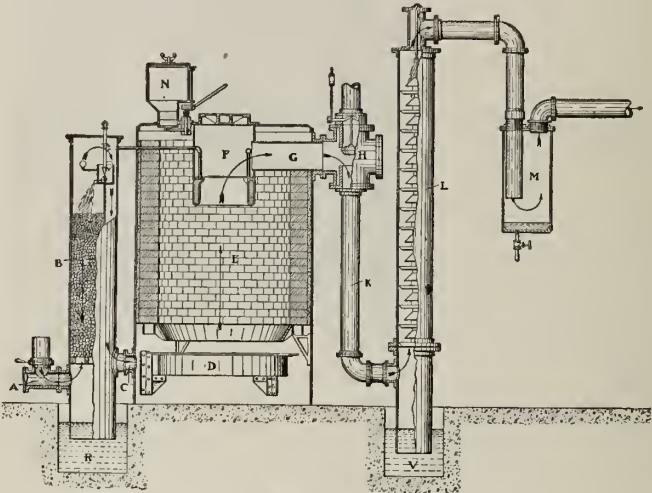
The increasing cost and scarcity of fuel of all kinds and high labor costs make it imperative in every industry to utilize both in the most efficient manner. Producer gas is rapidly becoming recognized as the most efficient and desirable agent to use where power or heating operations are necessary. Because it can be generated simply and easily direct from coal, the most widely distributed and cheapest natural fuel, it furnishes, in connection with the gas engine, the cheapest power known. It is easily applied to the heating of furnaces and ovens with marked economy over other fuels, and requires a remarkably small amount of skilled labor in its manufacture and application. These advantages are being daily demonstrated in numerous plants and in widely diversified industries where Smith suction gas producers have replaced other types of apparatus.

RELATIVE OPERATING COSTS—200 H.P. STEAM AND GAS POWER PLANTS

Type of engine	Fuel	Cost per ton	Fuel consumption per b. h. p. hour, lbs.	Total coal, tons	Total fuel cost per year of 3000 hrs.	Relative fuel costs per cent
Simple steam. . . .	Bituminous coal	\$3. 00	8	2400	\$7200. 00	640
Compound steam non-condensing.	Bituminous coal	3. 00	5	1500	4500. 00	400
Compound steam condensing. . . .	Bituminous coal	3. 00	3	900	2700. 00	240
Producer gas. . . .	Anthracite coal	5. 00	1	300	1500. 00	133
Producer gas. . . .	Lignite	2. 50	1. 75	525	1315. 00	117
Producer gas. . . .	Bituminous	3. 00	1. 25	375	1125. 00	100

Type of Plant.

The general arrangement of the complete plant and the method of operation are shown in the diagrammatic cross section. The essential parts are the saturator (B)



75 H.P. TYPE "E" PRODUCER

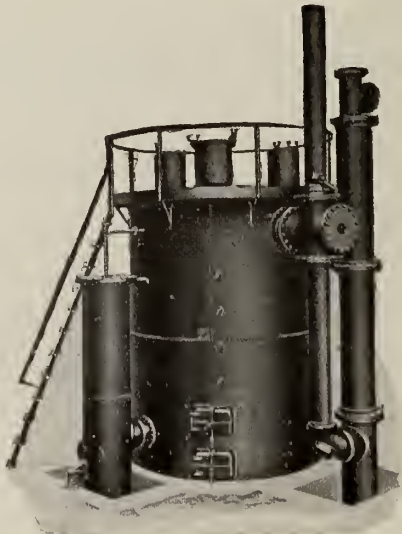
for supplying a fixed proportion of hot air and steam for the gas making; the generator (E), where the gas making occurs; the scrubber (L), for cleaning the gas; the moisture trap (M) for removing any entrained water from the gas; the necessary piping for connecting the various parts; and auxiliary equipment, gauges, valves, and tools necessary for operation. For furnace work, producers are equipped with positive pressure exhausters.

The operation described is the same for all types of Smith gas producers with the exception of type CF which is of the down-draft type.

Type "E" Producer.

Type "E" producer is designed for anthracite coal only. It is suited to either fuel gas or power service. Producers are of the suction type; but when gas is to be delivered under pressure, the plant is equipped with suitable exhauster and pressure regulator for delivering the gas to the mains without the use of a gas holder.

Type "E" producers are built in 11 sizes ranging from 25 to 300 h. p. For fuel service they will burn from 25 to 400 lbs. of coal per hour. They are guaranteed to deliver 75% of the heating value of the coal in gas of at least 135 B.t.u. per cu. ft. when producer is operating at rated load.

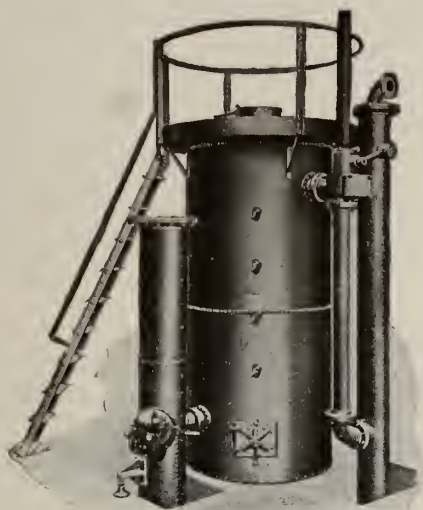


TYPE "E" SUCTION PRODUCER, 300 H. P.
Showing scrubber and saturator complete

Producer is charged and cleaned once in 24 hours when operating on 10-hour service. It is charged every 6 hours when operating continuously. There are no shut-downs for cleaning or charging.

Gas cleaning equipment consists of a steel pipe filled with cast iron, cone shaped baffles. Gas passes up through the baffles counter to the flow of water. This arrangement gives the best cleaning effect, and is very economical in use of water.

Type "E" producers are equipped with flat grates. The larger units have grates with rocking centers operated by a compressed air cylinder. This type of grate keeps the center of the fire clean without hand labor, and prevents loss of fuel when the fire is cleaned.



TYPE "E" SUCTION PRODUCER, 75 H.P.
Note simplicity

Type "EP" Producer.

Type "EP" producer is designed to operate on charcoal or coke, which fuels contain small quantities of tar. This producer is identical with Type "E" machine, except that a mechanical scrubber is added to the gas cleaning equipment.

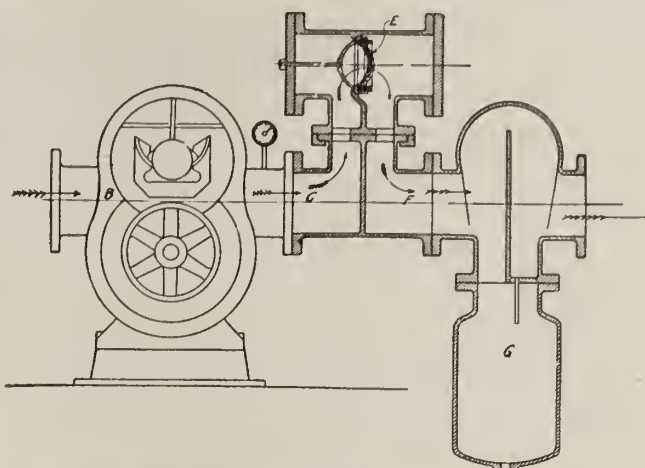
DIMENSIONS, TYPES "E" AND "EP" PRODUCERS

H. p.	Foundation in ft.		Required minimum height, ft.
	Suction	Pressure	
25	4½ x 4½	4½ x 8½	20
35	5 x 5	5 x 9	20
50	5½ x 5½	5½ x 9½	20
75	6 x 6	6 x 10	20
100	6½ x 6½	6½ x 10½	20
125	7 x 7	7 x 11	22
150	7½ x 7½	7½ x 11½	22
175	8 x 8	8 x 12	22
200	8½ x 8½	8½ x 12½	22
250	9 x 9	9 x 13	22
300	10 x 10	10 x 14	22

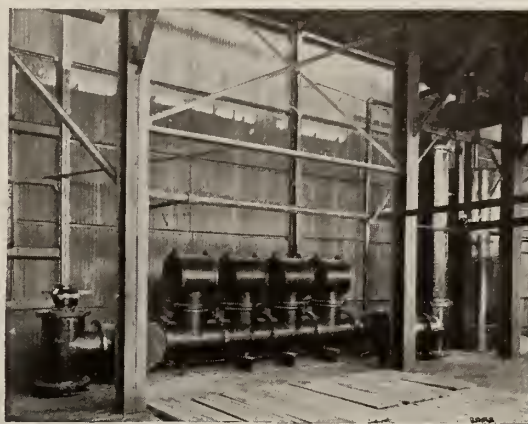
Type "BF" Producer.

Type "BF" producer is designed to operate on bituminous coal only. The producer proper is identical with the Type "E" machine. The cleaning equipment consists of the Type "F" tar extractor in addition to usual type of baffle scrubber. Baffle scrubber is used only to cool the gas. Gas is drawn from the scrubber by a positive exhauster and forced through Type "F" tar extractor, which consists essentially of a housing in which is located a diaphragm of glass wool. The tar enters this diaphragm in the form of fog floating in the gas. During its passage through the diaphragm it is agglomerated into large drops which fall out of the gas current, by gravity, into trap provided for that purpose.

Any desired degree of gas cleanness can be secured by use of this equipment. Engines are operated continuously for periods of several months upon gas



SECTION OF SMITH TYPE "F" TAR EXTRACTOR



A SMITH TYPE "F" TAR EXTRACTOR HAVING CAPACITY OF 200,000 CU. FT. OF GAS PER HOUR

Producer gas cleaned by this apparatus can be distributed over a wide area and handled in the same manner as natural or illuminating gas. Gas cleaned by this process can be distributed under high pressure from a central community plant, or to any number of furnaces and engines in a large factory.

cleaned in this way, and no trouble whatever is experienced from accumulation of tar in manifolds or of valves.

Other Types of Producers.

Two other notable types of Smith producers are Type "CF" producer for lignite and Type "G" producer for bituminous coal with mechanical stoking and poking on units of 600 to 3,000 lbs. per hour.

Catalogues and Bulletins.

THE SMITH GAS ENGINEERING Co. will be pleased to mail catalogues and bulletins of any of the equipment illustrated or mentioned above, together with any engineering data desired.

References.

Armstrong Cork Co., Beaver Falls, Pa.
U. S. Cast Iron Pipe & Foundry Co., Bessemer, Ala.
National Lamp Works of General Electric Co., Cleveland, Ohio
Timken-Detroit Axle Co., Detroit, Mich.
Ford Motor Co., Detroit, Mich.
Ford Motor Co. of Canada, Ltd., Walkerville, Ont.
J. M. Horton Ice Cream Co., Brooklyn, N. Y.
Staten Island Shipbuilding Co., Port Richmond, N. Y.
American Cotton Oil Co., Guttenberg, N. J.
Reliance Manufacturing Co., Massillon, Ohio
Robbins & Meyers Co., Springfield, Ohio
Jeffrey Manufacturing Co., Columbus, Ohio
Crucible Steel Company of America, Harrison, N. J.
San Antonio Portland Cement Company, San Antonio, Tex.
Halcomb Steel Co., Syracuse, N. Y.
Kellogg Toasted Corn Flake Co., Battle Creek, Mich.

MORGAN CONSTRUCTION CO

GAS PRODUCER DEPARTMENT
WORCESTER, MASS.

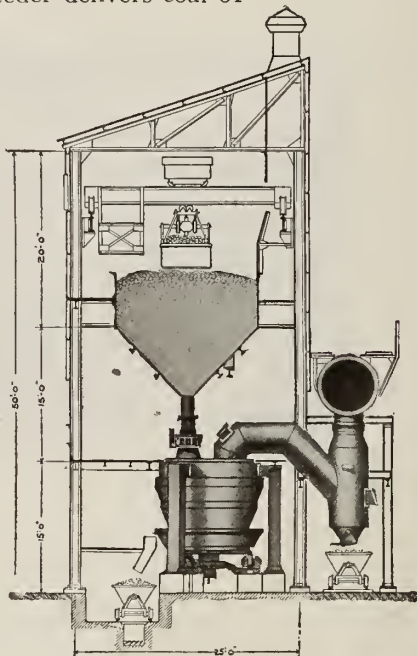
Product.

MORGAN PRODUCER-GAS MACHINE.

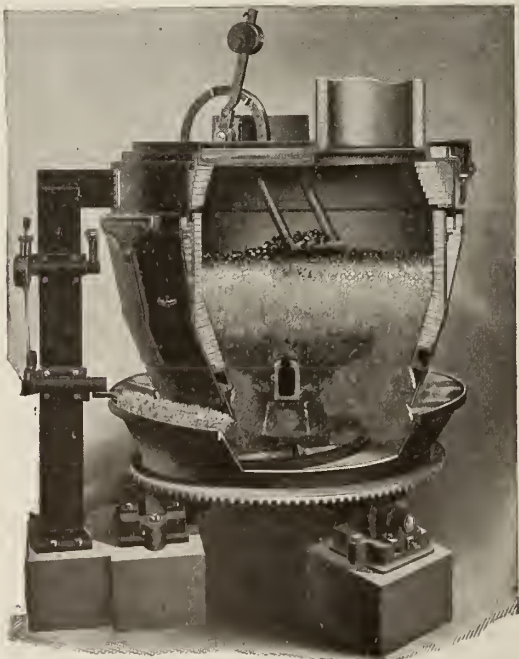
Description.

The Morgan producer-gas machine converts a larger quantity of coal into gas of the best known quality than is possible with any other type of mechanical gas producer without disturbance of the fuel bed by pokers and without manual labor.

A measuring feeder delivers coal of any size up to 4-in. cubes, direct from the overhead bin on to the fuel bed at frequent intervals, without action on the part of the operator, whose work is confined to regulating the speed to correspond with the demand for gas. The coal is properly spread and the surface continuously leveled by the water cooled bar which floats on the fuel, and permits any practicable variation in height of surface or thickness of fuel bed.



INSTALLATION DIAGRAM OF MORGAN GAS PRODUCER



SECTION OF POKERLESS PRODUCER-GAS MACHINE
Feeder not shown

Ash is removed mechanically at one point into a chute by a spiral shaped plow, held stationary during one complete revolution of the ash pan, and then released automatically; no manual labor.

The development of a closed feeder, operating without manual action, together with the other improvements noted, makes it possible for one man to attend to the gasification of 9 tons of coal per hour.

The fire brick lining has been reduced in thickness around the hottest zone, and is surrounded by a water jacket which keeps the inner surface cool enough to prevent adhesion of clinker.

Operating Results.

One prominent customer took continuous 12-hour samples of the gas day and night for 2 weeks, with the following average results:

AVERAGE ANALYSIS OF 12-HOUR GAS SAMPLES CONTINUING FOR 2 WEEKS

Date	CO ₂	C ₂ H ₄	CO	H ₂	CH ₄	B. t. u. in gas	
						U. S. steel standard	Total at 32° Fahr.
Feb. 2-14, incl., 1914	2.8	0.6	27.4	11.2	3.5	160.5	180.0

Four Morgan producer-gas machines were installed in the above plant to do the work usually requiring 6 mechanical gas producers. During a period of 4 months' test, 3 machines made all the gas required, working at an average rate of over 30 tons of coal per day.

Another customer, operating open hearth furnaces, analyzed an 8-hour continuous sample of the gas practically every day. The average for 5 months was 3.5% CO₂, 28.8 CO, and 182 B. t. u.

Further experimenting gave them the following gasifying capacities and disclosed the fact that the quality of gas does not suffer at these high working rates:

GASIFYING CAPACITY OF PRODUCER-GAS MACHINE

[Date	Net tons coal per day	Operating hours per day	Pounds coal per hour	B. t. u. of gas	
				U. S. steel standard	Total at 32° Fahr.
September 21-22	32.35	23.70	2730	167.0	188.0
September 22-23	36.00	23.05	3120	168.5	190.0
September 23-24	34.15	22.05	3100	165.0	186.0
September 24-25	37.35	22.90	3260	165.5	186.5

Uniformity.

The experience of users is that the gas from these machines is exceptionally uniform in quality. The president of a well-known iron and steel company recently wrote voluntarily:

"The regularity of the product makes it next to natural gas and we are very much pleased with the results."

Installations.

The leading steel companies, in the United States, Great Britain and France, are installing these machines as fast as they can be built. There are 375 in operation, giving results which place them in a class entirely beyond the reach of the ordinary mechanical gas producer. The Bethlehem Steel Co. alone has 46, and the Cambria Steel Co. has recently ordered 51.

A list of important installations furnished on request.

THE ANTHONY COMPANY

Liquid Fuel Engineers

9 Jackson Avenue
LONG ISLAND CITY, N. Y.

Products.

ANTHONY NEBULYTE OIL and OIL GAS BURNERS; ANTHONY NEBULYTE OIL SPRAYS for Water-gas Plants and SPRAYS for all liquids; OIL and GAS BURNING EQUIPMENT for industrial heating systems.

Also Air Washers, Spray Cooling Systems, Paint or Oil Spraying Apparatus, and Sprinklers.

Engineering Service.

THE ANTHONY COMPANY is prepared to redesign present equipment of any kind enabling any one to avail themselves of the advantages of oil or gas fuel.

The engineering staff is also prepared to discuss all heating problems and design special oil or gas fired apparatus for specific needs.

Having designed a great variety of successful industrial heating systems, Anthony engineers have wide experience in this field to place at a client's disposal.

Employment of their services leads to conservation of fuel, speeding up of production, and better quality of treated material.

Application of Fuel Equipment.

Anthony equipment is applicable wherever stills, evaporating pans, dryers, kilns, forges, furnaces or other pieces of apparatus require heat.

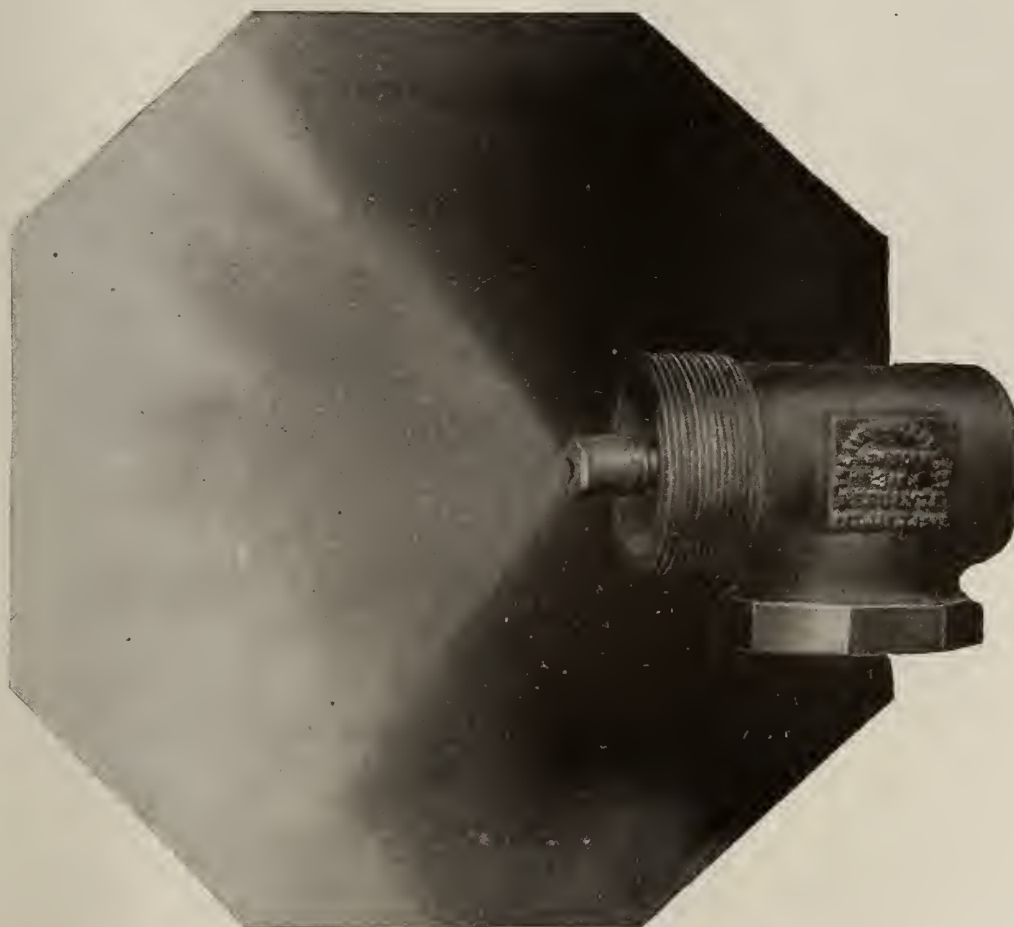
Low and high pressure designs to suit every requirement.

Anthony Nebulyte Sprays for Water-gas Plants.

In operation of water-gas plants, Nebulyte sprays give perfect atomization, positive control and uniform distribution of oil.

Anthony Nebulyte Sprays for All Purposes.

Sprays supplied of definite capacity and throw which can be utilized for many purposes, such as: cooling, aerating, atomizing, gasifying, mixing, absorbing gases and vapors, and for all purposes where it is desired to distribute a liquid in finely divided form over a large area, or through a large volume.



THE ANTHONY NEBULYTE SPRAY
Note the mist of liquid

HAMMEL OIL BURNING EQUIPMENT CO., INC

FACTORY AND MAIN OFFICE
PROVIDENCE, R.I.

PORTLAND, ME.
BOSTON, MASS.

NEW YORK, N. Y.
JACKSONVILLE, FLA.

PHILADELPHIA, PA.
LOS ANGELES, CAL.

Products.

HAMMEL OIL BURNERS; HAMMEL PATENT OIL BURNING FURNACES; OIL PUMPING SETS.
Also, Hammel Special Designed Oil Burning Furnaces; Hammel Oil Firing Valves; Automatic Pump Governors; Self-cleaning Oil Strainers; Fuel Oil Heaters; Oil Burner Governors and Draft Gages.

Hammel Oil Burners.

The Hammel oil burner is of the inside mixer type and built upon scientific principles. The features which distinguish the Hammel as an ideal oil burner are that, in normal service, it will not carbonize; parts subject to wear, due to grit in oil, can be renewed in five minutes at a cost of a few cents; heavy Mexican oil is burned with perfect results.

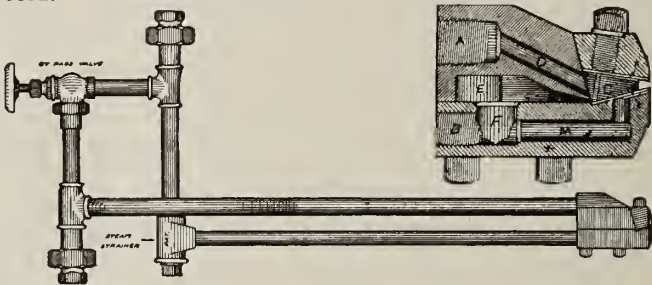
Advantages of Hammel Oil Burners.

HIGHER EFFICIENCY—Due to more perfect combustion and better heat distribution.
REDUCED COSTS OF FUEL HANDLING AND MAINTENANCE—No expensive conveying or elevating systems

are necessary. Firing tools and grate bars are eliminated.

INCREASED BOILER CAPACITY—Converting from coal to fuel oil means increased capacity of from 10% to 75%, generally 40% to 60%.

ABSENCE OF SMOKE—Smoke entirely eliminated except for short periods while burners are started up from cold.



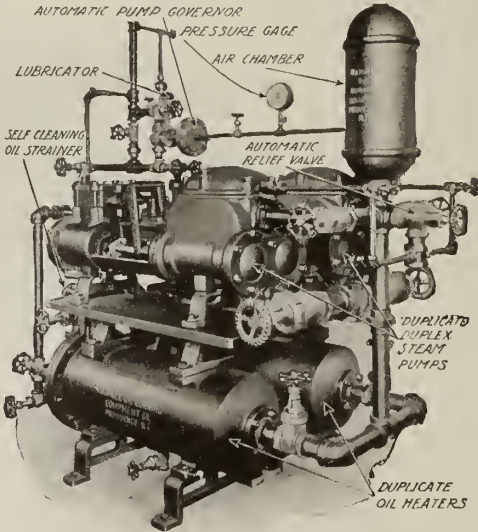
HAMMEL OIL BURNER SHOWING SECTIONAL VIEW OF MIXING CHAMBER

A—oil inlet; B—steam inlet; C—mixing or atomizing chamber; D—oil inlet duct; E—equalizing steam chamber; F—steam entrance; K-K—removable steel plates; M—outlet for condensation; N—outlet for duct M



BOILER PLANT OF A LARGE PUBLIC SERVICE CORPORATION, EQUIPPED WITH HAMMEL BURNERS AND FURNACES

This is the largest oil-burning plant in the world. Consists of sixteen 707 h. p. and sixteen 808 h. p. Stirling water tube boilers. 300 kw. hours are delivered to switchboard for each barrel of oil burned



HAMMEL DUPLICATE DOUBLE HEATER OIL PUMP SET

TESTS ON B. & W. BOILER EQUIPPED WITH HAMMEL PATENT FURNACES AND BURNERS
BY A LARGE PUBLIC SERVICE CORPORATION

Date	Duration of test, hours	Steam pressure, lbs.	Steam temperature, deg. Fahr.	Superheat deg. Fahr.	Factor of evaporation	Feed water temperature, deg. Fahr.	Temperature of flue gases deg. Fahr.	Draft under damper, in. water	Draft in furnace, in. water	CO ₂ , %	Steam used by burners, %	Kind of oil	Gravity of oil, deg. Be.	Heat value of oil, B.t.u.	Horsepower of boiler	Boiler horsepower developed	Builders rating, %	Water evap. per lb. of oil burned—actual	Water evap. per lb. of oil—F. & A., 212° Fahr.	Comb. boiler and furnace efficiency, %
June 22	7	151.9	466.5	99.7	1.105	212	474	140	.040	13.2	1.83	Okla. fuel	25.9	19322	600	734	122	14.48	16.00	81.8
" 23	9	149.9	467.5	101.7	1.105	212	480	152	.045	14.4	1.94	"	26.0	19326	600	843	160	14.63	16.19	82.8
" 24	8	147.4	451.8	87.2	1.102	206	431	.055	.030	13.6	1.95	"	25.9	19364	600	624	104	14.46	15.94	81.7
" 25	9	148.5	446.7	81.6	1.113	188	426	.035	.020	14.3	2.03	"	25.9	19276	600	619	103	14.53	16.27	83.6
" 27	9	161.3	496.5	125.7	1.124	209	507	.460	.200	14.4	1.97	"	26.3	19280	600	1076	179	14.04	15.79	80.9
" 29	9	159.6	490.2	119.7	1.116	212	508	.410	.210	13.8	1.99	"	25.9	19270	600	989	165	14.04	15.68	80.5
July 2	9	151.1	452.7	86.3	1.122	188	415	.033	.020	14.4	2.30	"	26.0	19179	600	629	105	14.02	15.75	81.7
" 3	8	154.9	464.5	97.3	1.124	192	477	.157	.070	14.0	1.91	"	26.1	19267	600	796	133	13.59	15.29	78.6
" 22	9	145.4	428.8	65.2	1.114	183	357	.090	.066	13.4	1.97	Okla. crude	30.3	19580	600	550	91	14.73	16.43	81.4
" 23	8	154.3	417.1	45.1	1.108	180	283	.080	.120	12.3	1.96	"	30.1	19380	600	332	55	14.67	16.27	81.5
" 24	9	142.1	417.3	55.3	1.109	183	282	.045	.085	11.8	1.96	"	30.2	19310	600	332	55	14.64	16.23	81.6
" 25	9	145.5	427.5	63.8	1.113	183	374	.070	.090	13.4	1.95	"	30.3	19297	600	474	79	14.60	16.26	81.8
" 27	6	148.0	435.2	70.3	1.119	182	386	.066	.065	14.1	1.95	"	30.1	19360	600	673	112	14.61	16.35	81.9
" 28	6	148.2	434.4	69.3	1.113	185	403	.050	.054	14.4	1.84	"	30.2	19360	600	655	109	14.64	16.31	82.3
" 29	11	149.4	438.5	72.9	1.124	178	412	.057	.064	14.4	1.83	"	30.4	19480	600	637	106	13.88	15.61	77.7
" 31	9	210.0	472.3	80.2	1.128	187	496	.300	.160	14.2	2.00	"	30.3	19479	600	959	160	14.20	16.02	79.8

HOSKINS MANUFACTURING COMPANY

Electric Furnaces, Pyrometers and Heat Resistant Alloys

Buchanan Street and Lawton Avenue
DETROIT, MICH.

SALES OFFICES

BOSTON, MASS., Tremont Building
PITTSBURGH, PA., Oliver Building

NEW YORK, N. Y., Grand Central Terminal
CHICAGO, ILL., Otis Building

Products.

ELECTRIC HEAT TREATING FURNACES, PYROMETERS and "CHROMEL" HEAT RESISTANT ALLOYS in the form of Wire and Castings.

Electric Furnaces.

The chief advantage of these furnaces is the very close and easy control of the temperature, and the practical elimination of "scale" on the parts being heat treated. They are especially advantageous in the heat treatment of tools and other small metal parts. The furnaces shown here are described in detail in Catalogues 80 and 101-S.



HOSKINS ELECTRIC HEAT TREATING FURNACES

TYPE FB—This furnace is the one shown on the right in the above illustration. Its maximum safe operating temperature is about 2000° Fahr., and its most common use is for the heat treatment of carbon steel parts or for preheating high speed steel. It operates only on alternating current, 110-, 220- or 440-volt line, and requires the use of a transformer. The temperature is controlled by a series of selective switches, shown mounted on the furnace stand. Made in muffle, crucible and tube designs.

DATA, TYPE FB MUFFLE FURNACE

Type and number	Chamber dimensions			Full load, kw.
	Width	Height	Length	
FB-202	4 1/2"	3"	9"	2.75
FB-204	7 3/8"	5"	12 1/2"	6.00
FB-205	12"	5"	12 1/2"	8.00
FB-206	12"	8"	19"	12.50
FB-207	12"	8"	26"	15.00
FB-208	12"	8"	33"	20.00

FB-202 requires the use of a rheostat, but the other sizes, FB-204 to FB-208 inclusive, do not.

TYPE FC—The Type FC furnace is the one shown at the left in the above illustration. In the muffle design, it produces temperatures up to 2500° Cent. and is designed primarily for the heat treatment of high speed steel. It operates on alternating current only and requires a transformer. The resistor material is a series

of carbon strips, and by controlling the pressure of these plates against each other, the temperature can be very closely regulated.

DATA, TYPE FC MUFFLE FURNACE

Type and number	Chamber dimensions			Full load, kw.
	Width	Height	Length	
FC-204	6 1/2"	5"	12"	15.0
206	12"	8"	18"	30.0

Indicating and Recording Pyrometers.

The main feature of Hoskins pyrometers is the fact that the user can make his own thermo-couples. The advantages of this are understood when it is realized that this is practically the only part of the pyrometer equipment requiring renewal. Complete details about this feature and the instruments themselves are given in Catalogue 3-S.

Hoskins pyrometers of the indicating type, high resistance design, are provided with both milli-volt and temperature scales, supplied in ranges of 1000°, 1500°, 2000° and 2500° Fahr., and the equivalent Centigrade scales.

The Recording pyrometer illustrated here makes a single 12- or 24-hour continuous temperature record. It records every 30 seconds, a metal point being pressed against a carbon sheet at the back of a translucent chart, thus making a series of dots. No ink is used.

Hoskins multiple recording pyrometer, not illustrated here, will make any number of temperature records from 1 to 10. Supplied in ranges of 1000°, 2000° and 2500° Fahr. The record appears very distinctly as a series of red inked dots on a green chart.



INDICATING PYROMETER, TYPE HE



PORTABLE PYROMETER, TYPE HA



RECORDING PYROMETER, TYPE HR

"Chromel" Castings.

"Chromel" is a pure nickel-chromium alloy that resists oxidation better than any other known commercial metal used for high-temperature work. Tell us the problem.

AMERICAN GAS FURNACE CO.

Specialists in the Use of Gas for Mechanical Heating Processes

24 John Street
NEW YORK, N. Y.

Products and Services.

AMERICAN OIL GAS MACHINES; GAS BLAST FURNACES; HEATING MACHINES; BLOWPIPE BURNERS; AUTOMATIC HEAT CONTROLLERS; CARBON GAS GENERATORS; CARBONIZING MACHINES; PRESSURE BLOWERS; COMPLETE EQUIPMENT for MECHANICAL HEATING PROCESSES, using Gas as Fuel.

GAS ENGINEERS.

Scope of Use.

These products are applicable to all heat treating processes requiring precision.

Gas as Fuel.

After an experience of over 35 years in utilizing gas in mechanical heating processes in heating operations, we find no fuel possesses so high a degree of efficiency. A positive air blast inducts the gas which is injected into combustion chamber—a properly proportioned mixture of both, under absolute control.

Gas has been proved the best and also the cheapest fuel, when measured by net results.

American Oil Gas Machine.

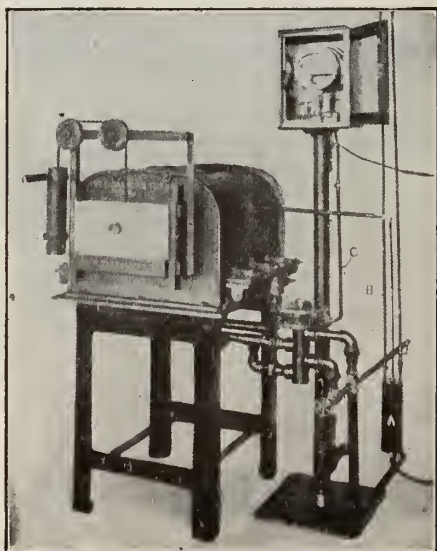
Converts naphtha into gas, without by-products. No waste. By reason of its purity, it is the best fuel gas known for heating metals, and is delivered under a constant and uniform pressure and is equal to standard city gas. The machine generates gas automatically in quantities as consumed up to its capacity. Machine delivered complete; requires no gasometer or storage tank.

SIZES—Made in 3 regular sizes, converting from 5 to 25 gals. of naphtha per hour into a perfect fuel gas.

Automatic Heat Controller.

Gas blast furnaces operated with this heat controller will not vary more than 5° Fahr. from any temperature to which instrument is set.

Controller consists of 2 parts: (1) pyrometer arranged so that dial pointer movement indicates and controls temperature; (2) pneumatic valve attached to furnace, operated



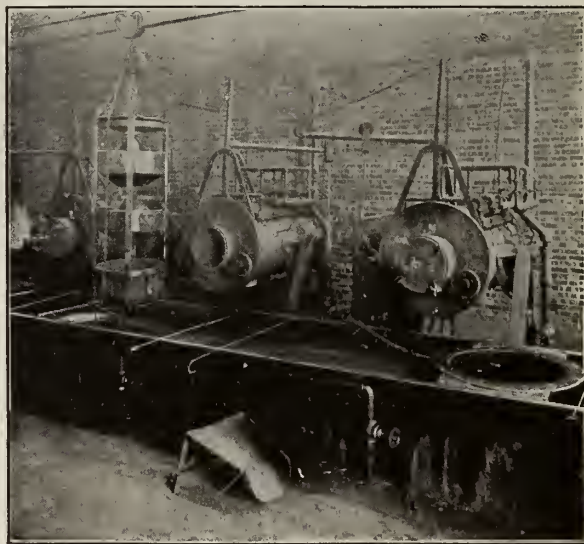
COMPLETE INSTRUMENT, OR HEAT CONTROLLER, CONNECTED TO OVEN FURNACE

by same air pressure supplied to furnace for combustion and admitting both gas and air in correct proportion to maintain heat wanted, thus effecting a considerable saving of gas, as well as maintenance cost, and assuring uniform results.

A Case Hardening Plant.

In case hardening, the first operation is to carbonize exterior of work so that it can be hardened; second, the hardening process. Plant consists, therefore, of a carbonizing machine and reheating machine or furnace, placed according to available space, and quenching tank.

NEW PROCESS CARBONIZING—By this new process of carbonizing the surface of wrought iron or low carbon steel is converted into high carbon steel to any practical depth required for case hardening the exterior uniformly and leaving a soft core.



NEW PROCESS CARBONIZING PLANT
One of many plants now in daily operation

In this machine the work is packed in gaseous instead of solid carbon. With this process, city or natural gas can be used as the carbonizing agent.

The machine is built in different sizes and when necessary proper fixtures can be supplied for holding the work firmly in the retort while rotating, to prevent it from becoming marred or bruised. Quotations on request. State conditions and requirements fully.

QUENCHING BATH MACHINE—An automatic quenching bath furnished for small work not requiring reheating, but quenched direct from retort on completion of carbonizing process.

CARBONIZING PROCESS—Work contained in the evenly heated, slowly revolving cylindrical retort is constantly and uniformly exposed to a carbon-charged atmosphere under pressure, and absorption of carbon begins as soon as work is sufficiently heated to attract it without the use of old style solid carbons or packing in boxes.

Gas Furnaces and Heating Machines.

GAS BLAST FORGES—Will develop required heat in a few minutes. Used in machineries for tool dressing and forging, *drop forging*, etc.

Types—Bench forges, for forging and tempering small tools or small pieces of metal; tool room forges; gas forges, for drop forgings, for heating blanks of various lengths, for hardening large lathe tools, for forging cutlery, for special work of many varieties, etc.; rod heaters; forges, and babbitt melters.

OVEN FURNACES—For annealing and hardening; die hardening furnaces; case hardening furnaces.

CYLINDRICAL FURNACES—For annealing, hardening and carbonizing.

Types—Round annealers, for wire and light stock coiled; circular, for heating large rims, rings, disks, dies and other circular steel blocks; for hardening rolls, shafts, long blades, etc. Made in various sizes.

TEMPERING MACHINES
—For drawing temper *after hardening*.

Types—Oil tempering, designed to heat oil or tallow not exceeding 600° Fahr., and to control temperature so as to draw any desired temper required in dies, cutters, punches, knives, shear blades, and other cutting tools; air tempering, used to draw "spring temper" and for all work which must show a temper color—air being injected into heating chamber and heated to any required degree, then forced into working space under positive pressure. Where temperature exceeds 600° Fahr., hot air coloring and tempering machines made in various sizes to meet different requirements are recommended; also recommended for "*carbonia*" (or gun-metal) finish.

MELTING FURNACES
For crucibles and cast iron pots.

Types—Regular crucible, for melting gold, silver, copper, brass, nickel, also test melts of iron and steel.

SOFT METAL FURNACES, WITH CAST IRON POTS AND VATS—For melting babbitt, aluminum, zinc, britannia, type metal, etc.; also *cyanide and lead hardening furnaces*.

SOLDERING FURNACES
—For soldering brass tubing; also, soldering furnaces for many other purposes.

ADJUSTABLE TIRE HEATERS—For expanding tires for shrinking same on wheels; readily adjustable to different sizes.

MUFFLE FURNACES—For enameling and assaying. Muffles necessary only when work is such that products of combustion must be excluded from heating chamber containing the work, or when air draught through heating space is required. Muffles not necessary for metal

work. Muffle enclosed by a fire-clay chamber. Burners project into combustion chamber horizontally from opposite sides and force flame into space surrounding muffle, causing its equal distribution.

ASSAY CUPELLING FURNACES—For assaying, cupelling and scorifying—built on plan of our other muffle furnaces, with air draught through muffle.

ANNEALING FURNACES—For bars, rods, strips and pipe. Made to order, of any desired size.

BRAZING TABLES AND FURNACES—Convenient forges for brazing joints in various positions. Blow-pipes pivoted and hinged so as to be easily adjusted to any desired angle or height. Rim brazing furnace, for brazing tires, rims and similar work.

GAS BLAST RADIATORS—For japanning or enameling ovens. Illustration shows what this company supplies for japanning ovens, core ovens, drying kilns or heating of any enclosed cubic space which may be specified; radiator used exclusively for work which does not emit fumes or gases liable to be ignited from open burners. Positive pressure of air is necessary. Enclosed burner for indirect heating also manufactured.



GAS BLAST RADIATOR NO. 3

HEATING MACHINES—Furnaces provided with carrier devices for automatic transmission of work through uniformly heated space, for hardening, annealing, brazing and tempering uniform size work in quantities.

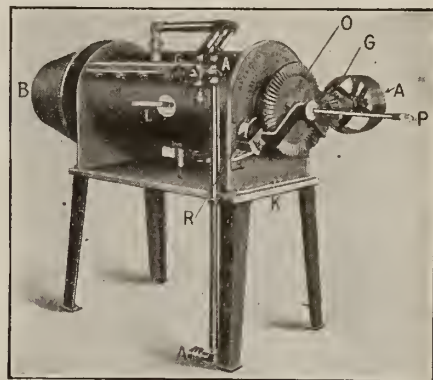
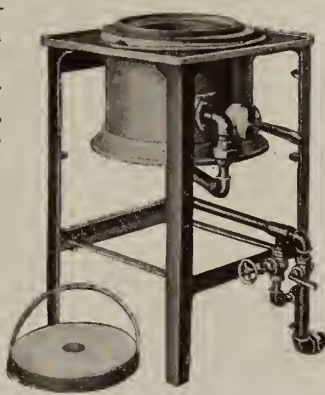
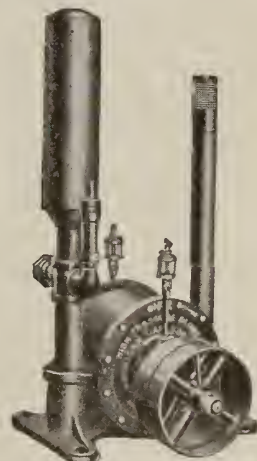
Kind of Work Treated—Lock washers, bolts, springs, pens, cups, cones, ball bearings, etc., for hardening or annealing. Pencil ends, ferules, grease cups, cartridge shells, etc., for annealing.

POSITIVE PRESSURE BLOWERS—Made in 7 different sizes. An air blast under an average pressure of 1 lb. to the sq. in. is indispensable for the operation of all American furnaces and heating appliances. Proper blast can best be applied by this type of blower.

OTHER FURNACES AND HEATING MACHINES—The AMERICAN GAS FURNACE CO. manufactures many other kinds of appliances to meet special requirements. Full particulars on application.

FUEL—All appliances can be used with natural, artificial or naphtha gas. Kind of gas must be specified when ordering.

WHEN ORDERING—State fully all conditions and requirements.

HEATING MACHINE NO. 51
For tempering and coloring steelworkCONTINUOUS HEATING MACHINE
For hardening and annealing, work passing through a uniformly heated retort. Discharges automatically. Made in various sizesLEAD HARDENING FURNACE
For hardening or tempering in lead

POSITIVE PRESSURE BLOWER

PARKS-CRAMER COMPANY

General Agents for the Merrill Process of Industrial Heating
1102 Old South Building
BOSTON, MASS.

WORKS: FITCHBURG, MASS., AND CHARLOTTE, N. C.

Products.

MERRILL PROCESS OF INDUSTRIAL HEATING. (Patented Jan. 1, 1918, Sept. 3, 1918, and other patents pending and applied for.)

For Air Conditioning Equipment, see pages 1010-11.

Merrill Process.

This is an apparatus for supplying heat at high temperatures for industrial processes, and conforms to certain general requirements which may be briefly stated as follows:

The temperature range of the heating medium exceeds that of the material being heated, to insure a rapid transfer of heat. In other words, there is ample thermic head.

The apparatus is safe and durable. Damage from excessive pressure and danger from explosions or fire hazard have been avoided.

The temperature and the rate of heat transfer are under quick and positive control at all times.

A special, non-explosive fluid, mechanically circulated, passes through a scientifically constructed heat absorber. Thence it is delivered through pipes to the apparatus to be heated—jacketed kettles, oven coils, stills, tanks, etc. After delivering a certain predetermined portion of its heat, the circulating fluid returns through the pump to the absorber for re-heating. The entire system is under a slight static pressure from an expansion tank, open to the atmosphere. The only added pressure, rarely exceeding 5 lbs., is that required to maintain circulation against internal frictional resistance.

The absorber and fuel supply may be located at any reasonable distance from the manufacturing apparatus—completely isolated in a fireproof room if the product is inflammable. All fire risk is thus avoided. There is no explosion hazard from the circulating fluid.

The circulating fluid is of the first importance. A special mineral fluid free from carbon is used; also free from inflammable distillate or vapor pressure. Its copyrighted name is Meprolene. It has a safe working temperature of 600° Fahr. With dry saturated steam, a pressure of 232 lbs. per sq. in. is reached at only 400° Fahr. Superheating may carry this temperature higher, but is of little use for industrial heating on account of its low specific heat and its inefficiency due to the loss of the latent heat of vaporization.

Meprolene will stand most severe flash and fire tests. It withstands high temperatures for indefinite periods. It does not carbonize, distill or "crack." It is made especially for the Merrill Process and is sold only for it.

Absorber.

Peculiar requirements for transferring heat, not found in other engineering construction, necessitated long experimenting and careful design. The absorber coil rests on a Dutch oven furnace especially designed for

the type of fuel used. Expansion strains and radiation losses are amply provided for. Insulated clean-out doors provide proper accessibility. The low pressure fuel oil burners prolong the life of furnace linings.

The absorber coil is a series of tube elements expanded into nested return elbow units. Compact in construction, efficient in distribution of heating surface, easy of examination and repair.



A 600,000 B.T.U. PER HOUR ABSORBER COIL

Circulating Plant.

Proper design of the circulating plant is of vital importance. The pump must circulate, without pulsation, a material which when cold is extremely viscous, and when hot is more fluid than water and more difficult to confine. Ample safety devices are installed to protect all parts of the system against unintelligent operation.

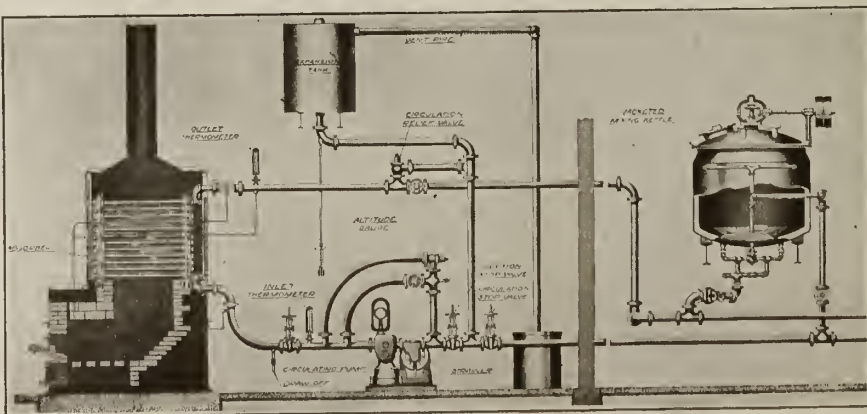
Applications.

The Merrill Process began in the asphalt-using industries five years ago. Its early apparatus, relating to road construction, is still in use. The system as now developed, however, is applicable to the following industries:

Chemical plants, rubber works, asphalt melting and coating plants, melting and refining works, oven heating, japanning plants, paper coating mills, canning factories, shoe shops, plants using hot calender rolls or presses, varnish, paint and shellac works.

Each case is a separate engineering problem. On request, preliminary data sheets will be furnished, from which tentative estimates may often be submitted. These must invariably be checked later by a personal inspection of local conditions before a definite contract price can be quoted. Parks-Cramer engineers are always available for consultation.

Installations require specially trained mechanics, hence must invariably be made by the construction force of this company.



TYPICAL MERRILL PROCESS SYSTEM CONNECTED TO A LARGE JACKETED KETTLE

BAYLEY MANUFACTURING CO.

Builders of Heating, Ventilating and Drying Apparatus

732-748 Greenbush Street
MILWAUKEE, WIS.

Products.

PLEXIFORM FANS; PRESSURE BLOWERS, FANS for Forced and Induced Draft; CHINOOK HEATERS; STEAM ENGINES; LEATHER DRIERS; ALFALFA DRIERS; SHAVINGS EXHAUST FANS.

Also Steam Traps and Blast Gates.

Plexiform Fans.

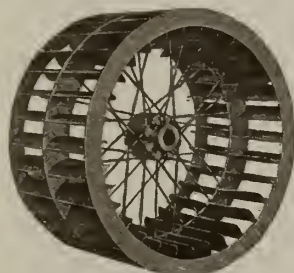
The Plexiform fan is of a design that makes for great strength in construction, lightness and efficiency. Its characteristics and distinguishing features are:

The maximum air from the minimum of housing.

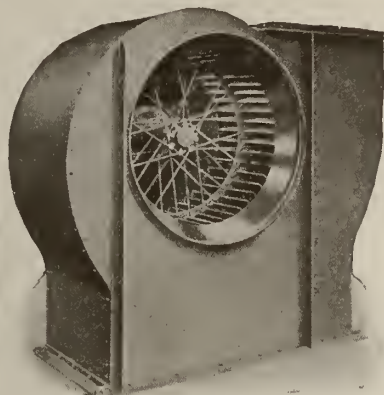
Large and practically unobstructed inlet and outlet openings.

Free and noiseless delivery of air, without the use of arbitrary cut-offs.

A type of construction adapted for handling high temperature as well as low temperature gases, and for double width, double inlet fans as well as single width, single inlet fans.



BLAST WHEEL FOR PLEXIFORM FAN



PLEXIFORM FAN

Suitable for practically all applications where maximum of air (at low or medium pressures) is desired, and especially where space conditions limit and where horsepower expenditure is a prime factor.

It is used generally as a component part of indirect systems of heating and ventilating for schools, churches, theaters, hospitals, penal institutions, industrial buildings; for forced and induced draft applications; for drying; for ventilating purposes, and for the handling of dust laden air, etc.

Shavings Exhaust Fans.

Type "B" shavings exhaust fans for handling refuse from saw-mills, planing mills, cotton gins, wood-working establishments of all kinds.



TYPE "B" FAN



TYPE "B" BLAST WHEEL

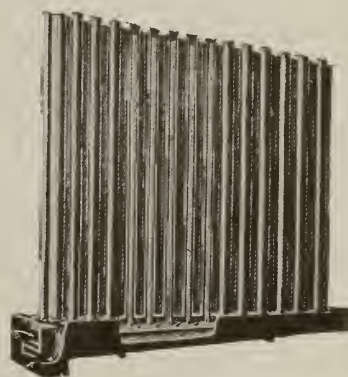
Type "B" shavings exhaust fan is designed to reach its highest efficiency at a medium speed. Peculiar, in that its blast wheel is of the multiple bladed type and that its construction permits of repair.

Chinook Heaters.

A staggered tube, indirect heater, built without the use of return bends, elbows, nipples or left-hand threads. The circulation is accomplished by the use of a pipe within a pipe. The Chinook heater is not subjected to the ravages of unequal expansion and contraction, as each tube is independent of any other.

It is used principally in connection with the Plexiform fan for heating and ventilating public buildings, and for drying. It is also used as indirect radiation independent of fans, for cooling water and for condensing exhaust steam.

It is shipped set up or knocked down, depending on size and installation conditions.



CHINOOK HEATER

Steam Engines.

Vertical and horizontal steam engines for high and low pressures, built for direct connection to fans and generators, and for belt connections.

Leather Driers.

Both loft and tunnel systems for drying wet stock, and tunnel systems for re-drying finished leather.

Alfalfa Driers.

A continuous tunnel system for curing alfalfa directly from the mower and delivering the cured hay to the grinder. Also adapted for the drying of hemp, clover, hops, etc.



VERTICAL ENGINE

AMERICAN BLOWER COMPANY

DETROIT, MICH.

WORKS: DETROIT, MICH.; TROY, N. Y.; WINDSOR, ONT., CANADIAN SIROCCO Co.

BRANCH OFFICES AND AGENCIES

ATLANTA, GA., Atlanta Trust Co. Building
BOSTON MASS., 10 High Street
CHARLOTTE, N. C., ISAAC HARDEMAN
816 Realty Building
CHICAGO, ILL., Marquette Building
CLEVELAND, OHIO, Swetland Building
DENVER, COLO., HOWARD H. FIELDING
(Heating and Ventilating), Boston Building
DETROIT, MICH., 1450 David Whitney Building
INDIANAPOLIS, IND., Lemcke Annex Building

KANSAS CITY, MO., Interstate Building
LOS ANGELES, CAL., Hollingsworth Building
MINNEAPOLIS, MINN., 501 South 6th Street
NEW YORK, N. Y., 141 Broadway
PHILADELPHIA, PA., 1328 Chestnut Street
PITTSBURGH, PA., Empire Building
ROCHESTER, N. Y., Insurance Building
SAN FRANCISCO, CAL., 667 Mission Street

SALT LAKE CITY, UTAH, Boston Building
ST. LOUIS, MO., 1221 Boatmen's Bank Building
WASHINGTON, D. C., 301 Southern Building
CALGARY, ALTA., 605 West 2nd Street
MONTREAL, QUE., McGill Building
VANCOUVER, B. C., Credit Foncier Building
WINDSOR, ONT., McDougall and Banwell Streets
WINNIPEG, MAN., 567 Banning Street

Products.

Manufacturers of AIR WASHERS; HEATING, VENTILATING, PURIFYING, COOLING, HUMIDIFYING, DEHUMIDIFYING and DRYING EQUIPMENT; "SIROCCO" FANS; MECHANICAL DRAFT and BLAST APPARATUS; FANS and BLOWERS for all purposes; VERTICAL SELF-OILING ENGINES; TILTING STEAM TRAPS ("DETROIT" SYSTEMS); DRY KILNS for Timber Products.

Fans and Blowers.

The AMERICAN BLOWER COMPANY's lines of fans and blowers include a type of machine to meet every air handling problem, from a small office fan to a complete ventilating or heating system for the largest factories and public buildings. The superiority of these fans is proved by their adoption in the world's largest plants.

"ABC" fans are adapted to heating, ventilating, exhausting, purifying, cooling, humidifying, dehumidifying and drying equipment in office, public, educational and industrial buildings.

"Sirocco" Fans.

"Sirocco" fans in all sizes are regularly constructed with full housings; larger fans are built, however, with seven-eighths housings. Housings being small for any given capacity, it is usually possible to use full housed fans.

Full housed fans, up to and including No. 6, are adjustable as to discharge, it being possible with the same fan to change the discharge to any direction desired and to shift the pulley from one side of the fan to the other. This can not be done with the seven-eighths housed fans, each fan being constructed to meet the requirements of individual installation. If desirable, double discharge fans can be furnished.



SINGLE INLET AMERICAN "SIROCCO" FAN

Full housed. Left hand. Top horizontal discharge, inlet side

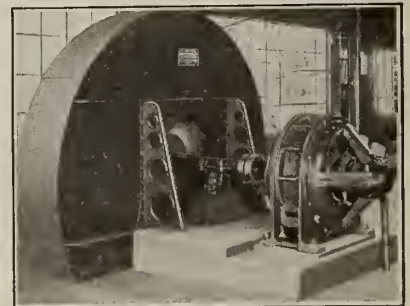
Single inlet fans are constructed with either overhung wheel or pulley, as conditions require. Double inlet fans can not be built with overhung wheels.

"Sirocco" fans may be engine, motor or turbine driven, either direct connected or by belt.

Pressure Blowers and Exhausters.

PRESSURE BLOWERS—Blowers of this type are especially designed and constructed for delivering air at high pressures.

They are built in standard sizes, which are suitable for all purposes for pressures up to 16 ozs. per sq. in.; and special blowers are built to give a pressure up to 24 ozs. per sq. in. The speeds at which the standard blowers operate are generally too high to permit of driving by direct connected motors, but special blowers are built for such requirements.



SPECIAL TYPE P BLOWER WITH D. C. MOTOR

Pressure blowers are particularly adapted for supplying the air blast for cupolas and forges; for blowing heating and melting furnaces for plates, billets, rivets, etc., using either oil, gas, coal or coke for fuel; for furnishing air for cooling the moulds in glass plants; blowing scale from dies and forging hammers; glass blowing, and kindred applications.

EXHAUSTERS—Designed and built especially to withstand strains of high pressure duty, such as in pneumatic systems, metal mine and tunnel ventilation, gas exhausting, etc.

Cast Iron Blowers and Exhausters.

Installed as exhausters, these fans are especially adapted to handling gritty dust, such as comes from emery wheels, tumbling barrels, rattlers, etc., which quickly cuts into and destroys sheet steel. The sandy

exterior of cast iron, however, gives a certain amount of protection.

They are also adapted to the removal of smoke from forge fires, steam from cooking vats or kettles, in dye works, breweries, packing houses or rubber factories; blowing coal dust or powdered coal into rotary kilns or other furnaces; ventilating toilet rooms in public buildings; in fact, they are adapted to any work within their capacity.

As blowers, they are particularly adapted for furnishing the blast for heating plates, rivets, etc., in furnaces burning coal or coke; for blowing of forge fires; for supplying draft to steam boilers; and for use in connection with mechanical stokers.

Disc Ventilating Fans.

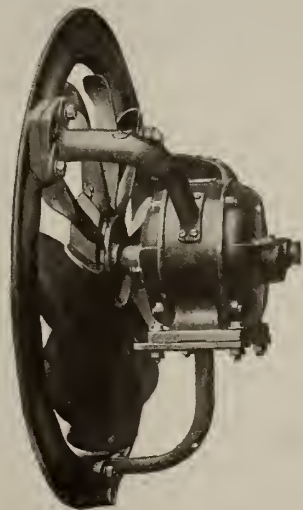
Adapted to ventilation of all types of buildings, for removal of smoke, noxious fumes and gases, steam and dust; to heating and drying in connection with heating apparatus, either furnaces or steam coils. Also more economical and effective than aspirating coils frequently employed to assist draft in ventilating shafts or eduction flues in large public buildings.



TYPE D FAN WITH STANDARD BASE AND PULLEY

Ventura Disc Ventilating Fans.

Ventura disc ventilating fans handle large volumes of air freely, or against pressures, up to 1-in. water gauge. They have 10 broad blades riveted to a large central disc, which absolutely prevents a back flow of air through the center when working against pressure.



VENTURA FAN—WALL TYPE, MOTOR DRIVEN
Pulley outfits can also be furnished

For ventilating rooms and buildings; for ventilating small mines or at any mine where a disc fan (engine or motor driven) can be used, with capacities of 650 to 100,000 cu. ft. per minute, resistance not exceeding 1-in. water gauge.

Mechanical Draft.

"Sirocco" multiblade fans have met with unprecedented success in this class of work. Many of the largest and speediest warships afloat are equipped with "Sirocco" fans to supply draft.

Two of the largest power plant boilers in the world are supplied with draft from "Sirocco" fans. For very high speed high pressure work, reinforced "Sirocco" wheels are available.

ADVANTAGES—The advantages that can be derived from the use of artificial draft are many, though largely dependent upon one another. Being so interwoven, to enlarge upon each one separately apparently involves repetition, yet the distinctive features are present and very evident. The points of superiority of mechanical draft produced by centrifugal fans as compared with chimney draft are as follows:

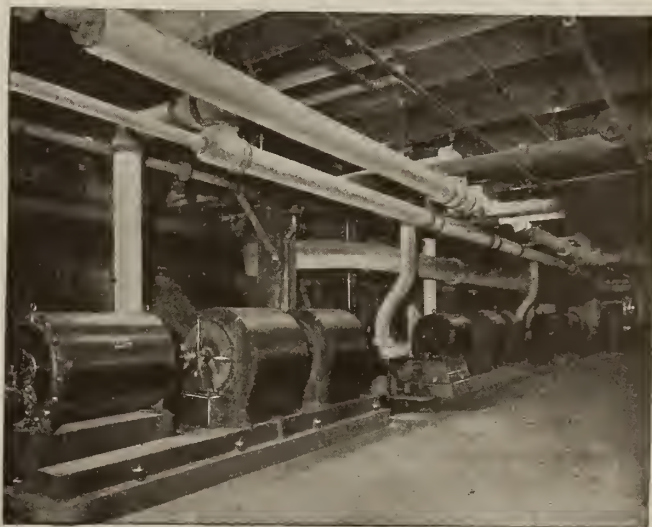
Lower first cost; smaller operating expense; cheaper fuel; increased and improved combustion; smaller boiler plant; more thorough utilization of waste gases; absolute independence of atmospheric conditions; better regulation; economy of space; smoke prevention; greater adaptability.

INDUCED DRAFT—A few of the important advantages of induced draft over forced draft are as follows:

Draft Not Shut Off While Firing—It is never necessary to shut off the draft when firing, as there is no pressure in the combustion chamber to force scorching gases and dust out of the firing doors when they are opened. The ash pit can be cleaned at any time without shutting off draft.

Boiler Room Ventilated—Air drawn into furnaces from boiler room is replaced by fresh outside air. Forced draft has a tendency to force smoke and ill-smelling gases through crevices in boiler setting. No injurious gases can escape, as all crevices are under a suction.

Cleaner Boiler Flues—Boiler flues can be kept cleaner, as there is less lifting effect at fire and consequently ashes and dirt are not carried in suspension and deposited in places where velocity of gases is lowered, to same extent as is the case with forced draft.



"SIROCCO" TURBINE DRIVEN BLOWERS
Supplying forced draft for two 2365 h.p. boilers, the largest in the world

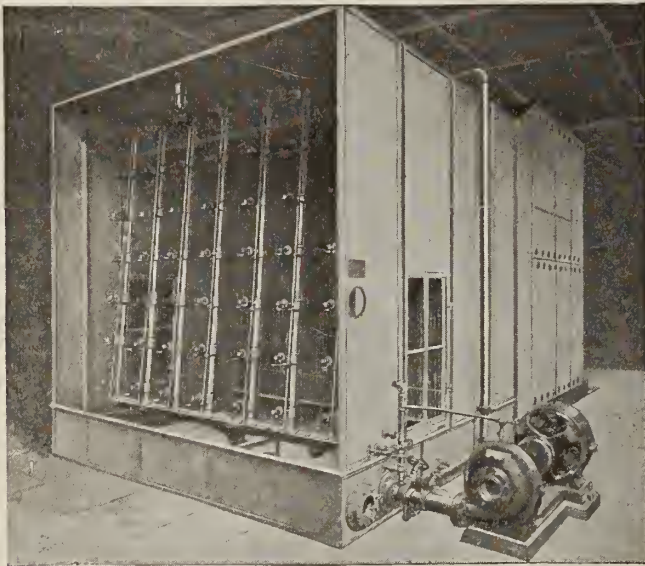
Boilers Uninjured—Liability of boilers being injured is reduced to a minimum with induced draft, being no greater than with natural draft.

FORCED DRAFT—Whenever the greater portion of resistance offered by a boiler system to the flow of air is encountered at the furnace, it is advisable to use forced draft. This is particularly the case when hollow blast grates or underfeed stokers are used, as under these circumstances, if an induced draft fan were employed, the high suction which would have to be maintained throughout the entire system would result in excessive leakage.

Air Purifiers or Washers.

All the improvements made in air washers for the past 18 or 20 years are embodied in the "Sirocco" purifier. The nozzles are adjustable, and can be flushed while in operation without affecting the cleansing effect of the machine. The scrubbing and eliminator surfaces are arranged so as to create low resistance through the purifier; hence, low operating cost.

They are built in sizes with capacities of 3,500 to 300,000 cu. ft. of air per minute.



"SIROCCO" PURIFIER

One of the eight recently installed by the Ford Motor Company

Humidifying Systems.

The contract department of this company is prepared to undertake the work of installing complete systems for humidifying textile mills, bakeries, rubber drying, or similar work requiring accurate and automatic control of the atmospheric conditions in manufacturing processes.

Cooling, Dehumidifying or Temperature Drying Systems.

The AMERICAN BLOWER COMPANY is prepared to furnish complete installations on a guarantee of results for low temperature drying or other cooling work including refrigerating equipment. Some of the largest and most successful work of this kind in the country has been done by the company and includes match drying rooms, cheese storage houses, capsule drying systems, film drying, chocolate dipping and coating processes in biscuit plants, fermentation rooms, drying materials susceptible to injury at high temperatures.

"ABC" Unit Heater.

This compact, portable apparatus provides an ideal method for heating factories of all kinds, particularly small or medium sized buildings. One or more units can be placed in a room where heat is most desirable. As extensions to the plant are made, additional units can be installed. The fan is driven by a motor, turbine or a pulley.

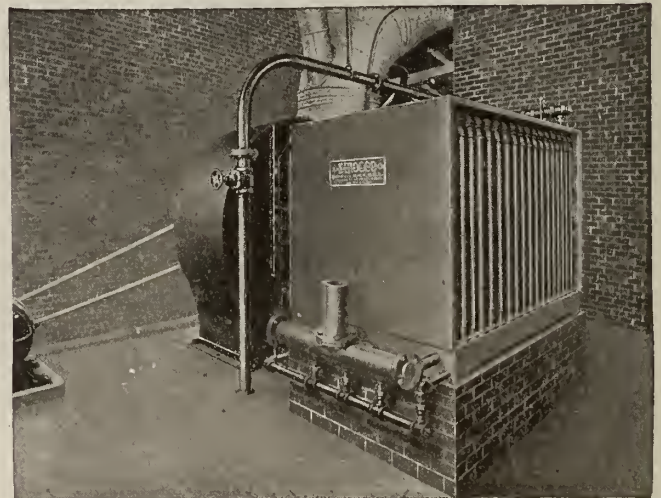


"ABC" UNIT HEATER

"ABC" Heaters.

"ABC" pipe coil heaters are admirably adapted for heating and ventilating factories and all occupied buildings requiring a large volume of air freshly warmed by steam or hot water. "ABC" heaters are also well adapted for drying and cooling purposes.

The capacity of "ABC" heaters is extremely flexible, as they are made in sizes up to 40 pipes wide, and from 2 ft. to 12 ft. high.



"ABC" PIPE COIL HEATERS ON FACTORY HEATING SYSTEM

Vertical Steam Engines.

"ABC" vertical enclosed self-oiling steam engines are built in 3 types, with or without automatic speed control:

Type "A" single cylinder up to 60 h. p.

Type "E" double cylinder up to 120 h. p.

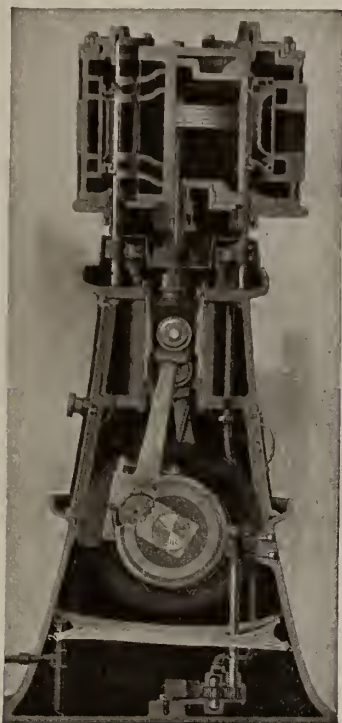
Type "X" cross compound up to 120 h. p.

"ABC" engines are adaptable for direct connection to centrifugal pumps, electric generators, stokers, fans and blowers.

With variable speed attachment they are successfully used to drive paper mill machinery.

They operate without noise or vibration. Oil is not forced, but flows by gravity, each bearing surface being individually supplied with its proper proportion.

"ABC" engines have run continuously from 6 months to 1 year, without adding new oil to original supply or making an adjustment.



TYPE X ENGINE—VERTICAL

Showing arrangement of interior lubricating mechanism



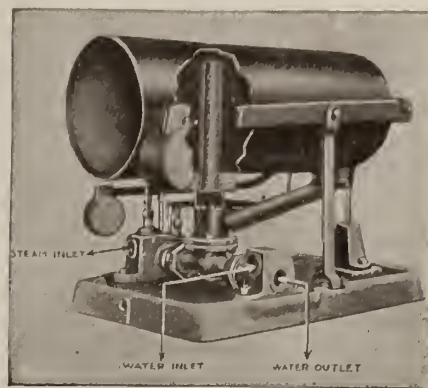
"ABC" TYPE A ENGINES DRIVING CENTRIFUGAL PUMPS
Used for barometric condenser service

"Detroit" Systems for Handling Condensation.

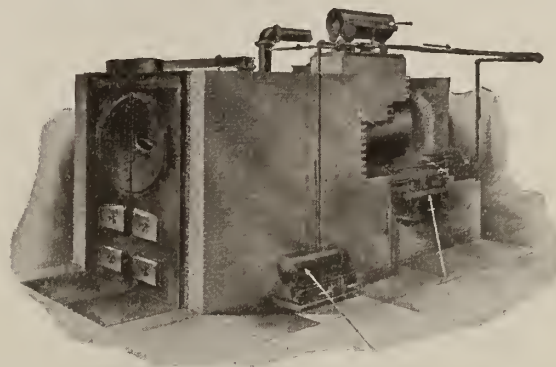
Designed to automatically return condensation directly to boiler without loss of heat units. To meet various conditions, these systems are manufactured and used as required according to the following types:

(1) Single system, used when steam pressure at receiving tank is sufficient to raise water to return trap above boiler. (2) Double system, used when steam pressure on return lines is insufficient to raise water to trap above boiler, as in exhaust steam heating. (3) Combination system, used when a wide variation in steam pressure exists, as exhaust in daytime and live steam at night. (4) Metering system, used when feed water is to be measured. (5) Boiler feed system, used to feed boiler

in place of a boiler feed pump. (6) Vacuum system, a double trap installation, used when desirable that vacuum, or lower trap, receives condensation by its vacuum and lifts it to return trap on top of boiler. (7) Lifting or pumping systems, used for raising water from one level to another. (8) Systems for handling condensation in low pressure heating installations.



DETROIT RETURN TRAP
No working parts inside the tank



THE "DETROIT" DOUBLE SYSTEM

Method of connecting up "Detroit" return traps for double trap system. Arrow indicates direction of flow of condensation

Special Drying Systems.

"ABC" dryers can be designed to meet the requirements of almost every material. "ABC" engineers have designed successful systems for drying such material as glue, enamel on metal surfaces, cereals, leather, salt, soap, pottery, varnish, cloth, asbestos, ginger, starch, tobacco, paper, cocoa, sugar, powders, etc.

Dry Kilns for Timber Products.

Built in 2 types: Forced circulation (with fan); natural circulation (without fan). For drying all kinds of woods and wood products.

"ABC" kilns are equipped with the new and improved *straight pipe* heating coils. "ABC" kilns produce a first class product, free from checks, stains, and other imperfections. "ABC" kilns dry uniformly, eliminating the possibility of case hardening. Controllable under all outside weather conditions.

Engineering Service.

If those parties considering the installation of ventilating or heating systems will communicate with the Engineering Department of this company, as to their plans along these lines, this department will suggest the kind of equipment best fitted for the plans which they have in mind. The company's sales engineers are located at points shown on page 964, or information may be secured direct from the Engineering Department at the home office.

BUCKEYE BLOWER COMPANY

Manufacturers of Ventilating Apparatus

COLUMBUS, OHIO

Products.

BUCKEYE DISC FANS.

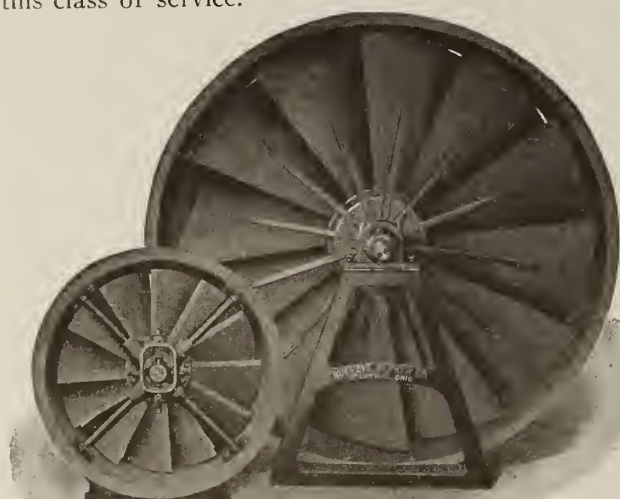
BUCKEYE MULTIBLADE
FANS.

Adaptability.

Buckeye fans are eminently suited for mechanical ventilation, forced or induced draft, mine ventilation, dry kiln where hot blast is used, waste heat installations, any mechanical system operated in limited space and for service as exhausters.

Notable Advantages.

BUCKEYE DISC FAN—To successfully overcome a moderate amount of resistance usually encountered in mines, industrial plants, etc., all sizes of Buckeye disc fans are built with 12 blades so assembled and secured as to overlap one another. This construction enables the Buckeye fan to maintain a higher pressure than ordinary disc fans, and therefore renders it more suitable for this class of service.



Type A

Type B
BUCKEYE FANS

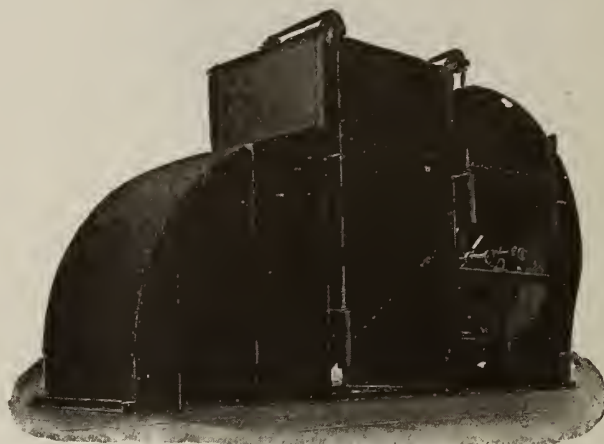
BUCKEYE MULTIBLADE FANS—The large, unrestricted openings in comparison to the size of the wheel, peculiar to this type of fan, permits large volumes of air to be handled with moderate velocities and minimum power consumption.

Buckeye fan wheels are carefully balanced before shipment on a special knife edge balancing apparatus, so that they remain in any desired position when supported on this balance. This insures smooth, quiet running at either high or low speed while delivering maximum volume of air for power consumed.

For a given amount of air the diameter of multi-blade wheel is smaller than in any other type. Thus to maintain the same tip speed, more revolutions per minute are required. This allows the use of a higher speed motor or engine, thus making, in some cases, a great saving in cost.



TRADE-MARK



BUCKEYE REVERSIBLE MULTIBLADE FANS

Buckeye Disc Fans.

These fans were carefully designed for continuous and efficient service. They are heavy duty fans substantially built of the highest quality of materials, and are rigidly assembled and finished in a workmanlike manner. They will successfully withstand the severe service to which industrial ventilating fans are subjected.

The fan hub is a single casting, accurately bored for the shaft and carefully machined for receiving the blades which are hot riveted to two parallel flanges provided around the hub. A large cast iron disc is used as a companion member to the hub, to which the various blade braces are hot riveted. The hub and disc are each secured to the shaft by a common key but with separate set screws.

This large center hub provides the strongest possible method of rigidly mounting the 12 fan blades. It also effectively prevents any backflow through the center where the linear velocity of the fan wheel becomes too low to create a high static pressure. Each blade is made of heavy gauge steel, overlapping the one next to it, and is riveted to both sides of the center hub. Each blade is further braced to an extra supporting disc mounted behind the hub.



BUCKEYE DISC FAN BLADES
Showing rigid bracing

The fan wheel is keyed to a shaft of the finest quality of cold rolled carbon steel.

The casing of blue annealed sheet steel completely encircles the fan wheel, making the fan a self-contained unit. All casings are stiffened with two angle flanges, which, together with ring oiling bearings, etc., are standard with all Buckeye disc fans.

The smaller sizes of Buckeye disc fan (type A) are supported in the casing by extra heavy wrought iron tubes, cast into a central yoke which houses the bearing. These fans are ready to install in a brick or other solid masonry partition wall, or are more usually furnished with heavy cast iron bases, making them independent of the wall for support.

The 6-, 7- and 8-ft. sizes are made with pillow blocks mounted on cast iron pedestals which are bolted to a flat base (type B). This base also supports the casing. The 9-, 10- and 12-ft. sizes are generally mounted on a concrete pedestal.

All wheels are carefully balanced before shipping, and run smooth and quiet at high speeds, delivering a maximum volume of air for the power consumed.



36-IN. DISC FAN, HYATT BEARINGS



TYPE C DISC FAN, DIRECT CONNECTED TO MOTOR

Buckeye Multiblade Fans.

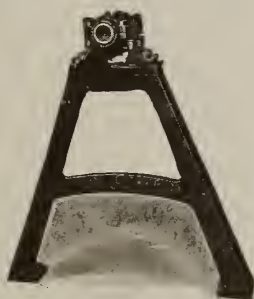
The correct design, expert construction and high grade of materials used combine to make this fan an efficient ventilating agent.

The bearings which this company manufactures for all Buckeye fans are of the ring oiling, self-aligning, babbitted type. The oil reservoir is unusually large, and is equipped with a sight level oil cup. Where desired, water jacket, babbitted bearings or roller bearings may be had at a slight increase in cost.

Housings are made of best grade blue steel sheets rigidly braced and stiffened with angle iron.



BUCKEYE MULTIBLADE FAN WHEEL



FLOOR STAND AND SHAFT BEARING

Shafts are of the highest grade turned steel, properly ground and accurately machined to sizes required.

The peculiar design of the Buckeye multiblade fan wheel insures a saving of approximately 30% in power over the old, large type wheel. The blades are all formed in dies, thus insuring exact uniformity in curvature and pitch which are essential for the high percentage of efficiency that this wheel develops.

Buckeye multiblade fans are regularly built in size 5 and larger, with overhung pulley. The bearings are rigidly supported on the sides of the fan housing. If desired, these fans can be furnished with bearings independent of the housing and supported upon heavy cast iron floor pedestals.

Size 4 and smaller are built with overhung wheel. The casting and bearings are supported upon a rigid, cast iron pedestal and are so arranged that the casting may be removed from the pedestal and replaced to comply with any hand or discharge.

Buckeye fans are usually furnished for belt drive, but can be furnished for rope, chain or gear drive as desired.

Direct connected Buckeye multiblade fans can be furnished for any available power, and in any required size or type. They can be constructed to fit any special conditions and arranged for either single or double inlet, and single or double discharge, as desired. They can be used for either blowing or exhausting.

Double inlet fans are more efficient than single inlet, and should be used wherever possible.



BUCKEYE MULTIBLADE FAN DIRECT CONNECTED TO MOTOR

Information Required When Ordering.

In order to furnish dependable data on fan installation that will absolutely comply with client's conditions and requirements, the following information is necessary:

- (1) The volume of air that fan is to deliver.
- (2) The resistance, or static pressure, that it will operate against.
- (3) The restrictions in regard to the speed of fan or power, if any.
- (4) Any restrictions as to power consumption.
- (5) Any restrictions as to space for fan or power, such as height, width, or length of floor space available for the apparatus.
- (6) Type of motive power to be used.

Services and Facilities.

Buckeye fans are designed and built by expert mechanics in modern shops equipped with the latest improved machinery.

The location of the shops near 16 steam lines and 8 interurban lines assures prompt shipments.

The company maintains a special engineering department, which is prepared to co-operate with mining engineers, superintendents and operators in the solution of difficult ventilation problems in their application to industry.

This service is at the disposal of clients, and does not entail any obligation whatever.

BUFFALO FORGE COMPANY

Heating, Ventilating, Forges, Mechanical Draft Equipment; Punches and Shears
BUFFALO, N. Y.

BRANCH OFFICES IN PRINCIPAL CITIES

Products.

HEATING and VENTILATING EQUIPMENT:

Heaters
Centrifugal Fans
Exhaust Fans
Blowers
Disk Fans

FORGES

MACHINE TOOLS:

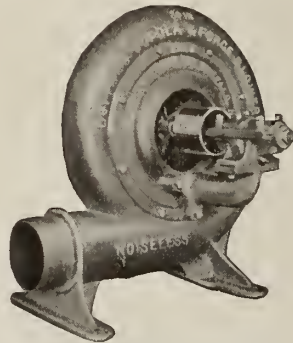
Bar Cutters
Punches and Shears
Drill Presses

Buffalo Steel Pressure Blowers.

For supplying blast to forge fires, cupolas and furnaces where pressures from 4 to 14 oz. are required.

They have a solid cast iron peripheral shell which absolutely prevents leakage.

Removable cast iron side plates make the blast wheel and shaft easily accessible.



BUFFALO STEEL PRESSURE BLOWER
Bottom horizontal discharge

B Volume Blowers and Exhausters.

These blowers and exhausters are used for pressures up to 6 oz. For removing fumes or gases, in connection with dust and refuse removal, in organ blowing, in forge and furnace blowing and all similar work they are supreme.



B VOLUME BLOWER

Buffalo Heating System.

The Buffalo heating system consists of three elements: the heater, the fan, and a system of distributing ducts.

BUFFALO HEATERS—The heater is in sections, each consisting of four rows of vertical 1-in. pipe screwed into a cast iron base. The coils are tightly enclosed on top and sides by a sheet steel casing through which the fan draws air.

BUFFALO FANS—The fan is a Buffalo conoidal or planoidal of size selected for the particular service required in each case.

DUCTS—The ducts distributing the warm air are usually of sheet metal, overhead, but may be incorporated into the building construction or be placed underground.

ADVANTAGES—The advantages of the Buffalo fan system of heating lies both in its flexibility of operation and economy. Equipped with direct radiation a building heats up slowly and with no uniformity. This is especially true of a high building, where the chimney

action draws all the warm air up under the roof and allows the heat to escape through the roof.

A fan system with the proper amount of reserve can heat a building quickly, and the arrangement of the duct outlets throws the warm air down into the working area.

The chief points of the Buffalo system may be summarized as follows:

- (1) Perfect ventilation regardless of exterior conditions.
- (2) Uniform and proper distribution of heat.
- (3) High efficiency of heating surface (3 to 5 times that of direct radiation).
- (4) Greatest economy in operation.
- (5) Utilization of exhaust steam.
- (6) Prevention of drafts by production of a plenum.
- (7) Independent regulation of heating and ventilating effects.
- (8) Great flexibility in operation to suit varying conditions, affording maximum economy.
- (9) Ease of control, which prevents overheating.
- (10) Great compactness, affording an economy of space and reducing the cost of steam connections.

- (11) Perfect drainage, making less repairs necessary and giving a lower rate of deterioration than with direct radiation.
- (12) Lower cost of installation.
- (13) The entire apparatus is easily portable and is, therefore, a permanent asset.

Catalogue No. 401 and others.

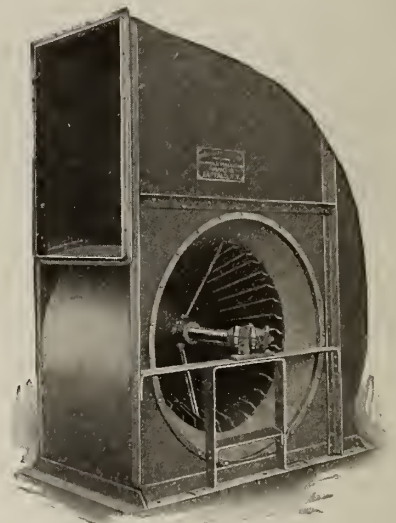
Buffalo Slow Speed High Efficiency Mill Exhausters.

These machines are designed especially for conveying and removing shavings, sawdust, grain, cotton, dust, bark, etc. They are built to withstand hard continuous service and are reversible for any direction of discharge.

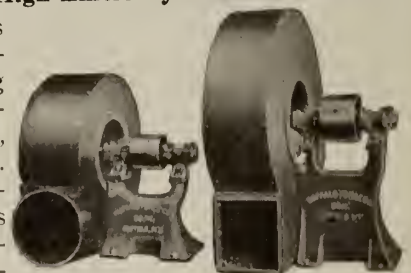
Catalogue No. 410.



NIAGARA CONOIDAL WHEEL



THREE-QUARTER HOUSING, NIAGARA CONOIDAL FAN

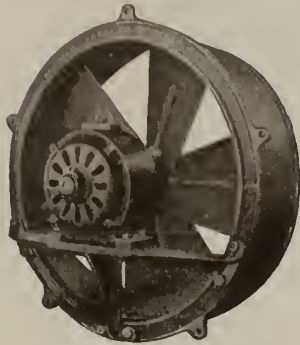


STANDARD EXHAUSTER

SLOW SPEED HIGH EFFICIENCY EXHAUSTER

Buffalo Electric Disk Fans.

Produce the greatest results at lowest cost in cooling workshops, loft buildings, restaurants, kitchens and for carrying off smoke and fumes when no ducts are needed. Their operation is noiseless and no attention, except occasional oiling, is required.



DISK FAN (SMALL SIZE)



DISK FAN (LARGE SIZE)

Buffalo Combination "Armor Plate" Punches and Shears.

These machines are built up of plates of steel with a tensile strength of 75,000 lbs. per sq. in. Since this is more than seven times as strong as cast iron, it makes possible a large capacity machine of light weight. They are built up in various styles to meet individual requirements.

Catalogue PS gives complete data.

Buffalo No. 10 Bar Cutter.

This machine weighs 300 lbs. and is especially favored by contractors for construction work on buildings because of its portability. It is built up of two steel plates (tensile strength 75,000 lbs.), bolted and riveted together. All working parts enclosed. Stripper on side prevents metal binding and roller prevents dulling of knives.

Buffalo Open Throat Angle Shears.

Buffalo open throat angle shear is a compact machine. Its big feature is the open throat, which permits entering the material from the front of the machine instead of inserting through the sides.



NO. 10 CONTRACTOR'S BAR CUTTER



NO. 4-B COMBINATION PUNCH AND SHEARS



NO. 2. OPEN THROAT ANGLE SHEAR AND TEE CUTTER

Forges.

Buffalo rivet forges for rivet heating on structural work are light, compact and strong and will stand a large amount of rough handling.

Blacksmith forges of both the portable and stationary types and for every conceivable purpose make selection of this type of equipment a simple matter.

Catalogues Nos. 100 and 108 give detailed information on all sizes.



NO. 210 RIVET FORGE
Largest capacity, quickest heat, easiest operation



BUFFALO NO. 332-H STEEL CONTRACTORS FORGE
Equipped with Buffalo No. 200 Silent Blower and "Vulcan" Tuyere

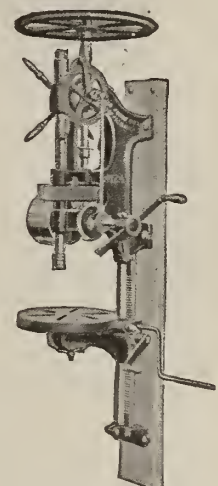
Buffalo Drills.

Buffalo drills are designed in a large variety of styles and sizes to meet every conceivable need.

Catalogue No. 210 gives complete data on other styles.



NO. 615 DRILL



NO. 124 CAP-STAN LEVER DRILL

CARLING TURBINE BLOWER CO.

72 School Street
WORCESTER, MASS.

BRANCH OFFICES

BIRMINGHAM, ALA.
BOSTON, MASS.
CHICAGO, ILL.

CLEVELAND, OHIO
DENVER, COLO.
HARTFORD, CONN.

LOUISVILLE, KY.
NEW YORK, N. Y.
PHILADELPHIA, PA.

SAVANNAH, GA.
ST. LOUIS, MO.
WASHINGTON, D. C.

Products.

STEAM and ELECTRIC TURBO UNDER-GRATE BLOWERS for boilers and furnaces; VOLUME BLOWERS and EXHAUSTERS for gas producers and industrial uses; PRES-SURE BLOWERS for oil burning systems; STEAM POWER TURBINES.



regulating valve, thus giving automatic control. This feature also maintains a steady steam pressure. Peak loads are easy to overcome, as the blower will rapidly increase the rate of combustion, making the work much easier for the fireman.

Carling Turbo Undergrate Blower.

Supplies the necessary air volume and pressure for successfully burning the lowest grades of fuel, effecting savings of 10% to 30%. All the heat value can be obtained from screenings, culm, coke breeze, lignite and similar grades. Exhaust steam from turbine is mixed with air from fan, cutting down clinker formation. With high grade bituminous coal, better combustion is obtained than is possible with chimney draft and 100% to 200% more steam can be obtained, as the blower produces desired draft independent of chimney and weather conditions.

One or more blowers may be operated from one

Built in standard sizes with normal capacities from 50 to 500 b. h. p. for continuous operation at 100% above rating. Usual steam consumption of this type of blower is from 1% to 2%.

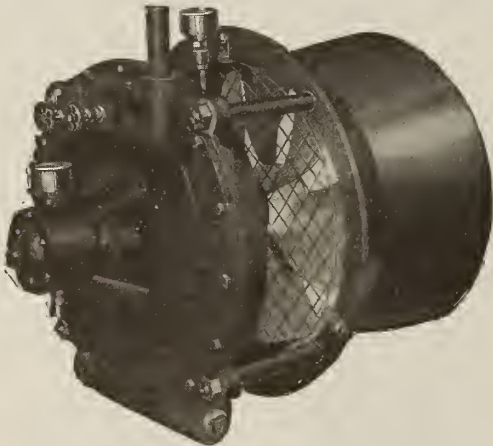
CONSTRUCTION—Design is substantial and construction is heavy. Turbine rotor and fan are larger in diameter than is found in usual practice. Ball bearings are the only parts in metallic contact and subject to wear. These may be quickly replaced with Carling patent construction at slight expense. Fan and turbine are designed as a unit, mounted on one common shaft. Lubrication is practically automatic and is the only point of attention necessary in operation. Three nozzles are supplied on the turbine with valves which may be regulated for increasing or decreasing speed and air pressure. Turbine rotor is made of bronze and buckets of cupro nickel, eliminating corrosion. Fan wheel is of the propeller type, cast in one piece of aluminum bronze. Fan casing is made on the Venturi principal, giving an easy flow of air at highest efficiency. Operation is very quiet, as turbine is enclosed and fan housing has been especially designed to eliminate air noise through the wheel. Blade spacing in all rotors is 110 or more per inch of diameter. Blades have been especially designed for this work in accordance with the latest practice, giving a maximum of steam economy. Construction of turbo unit as a whole is superior for durability and each machine is guaranteed against defects for one year.

INSTALLATION—The Carling undergrate blower is easy to install, as it is shipped all set up, ready to run. Usually set in side wall of boiler or may be placed in front center wall or at rear of boiler with a duct extending through the bridge wall. When set in front center wall with Carling air ducts and dampers, 2 boilers may be operated from 1 blower. Cost of installation is low and can be made by almost any one in a few hours.

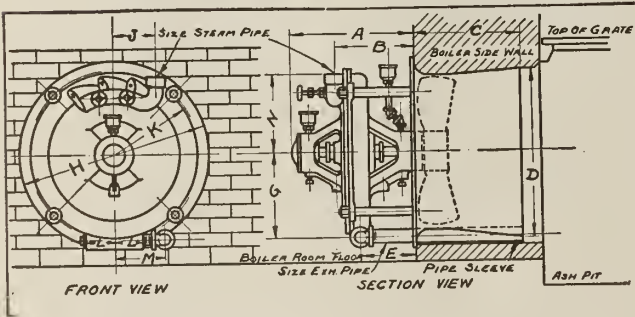
Carling Volume Fans.

Designed for delivering large volumes of air at pressures ranging from 1/4 to 6 oz. Supplied either as blowers or exhausters. This type of fan has a wide range of industrial uses, being especially adapted for gas producers and furnaces, small stokers, installations, low pressure oil systems, conveying materials, etc.

Standard arrangement is right-hand bottom horizontal. Standard construction is with fan casing of cast iron and fan wheel of steel plate, all parts painted with acid resisting paint. Removable side plates on fan casing give quick access for inspection. Fan wheel is mounted direct on one common shaft with the turbine, eliminating couplings and belt troubles. Speed may be varied by regulating valves. Only 2 bearings need be oiled and practically no attention is required. Unit may be placed in any position on account of perfect balance.



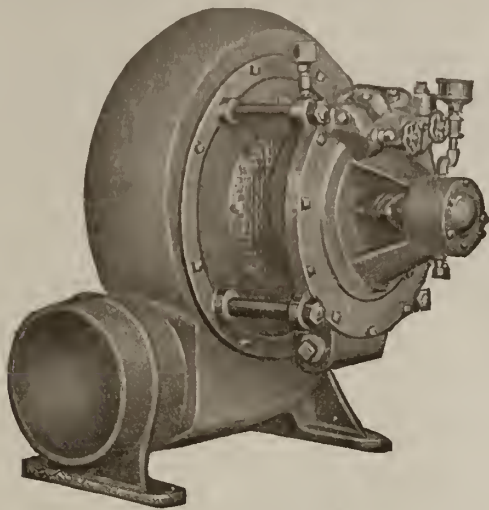
CARLING TURBO UNDERGRATE BLOWER



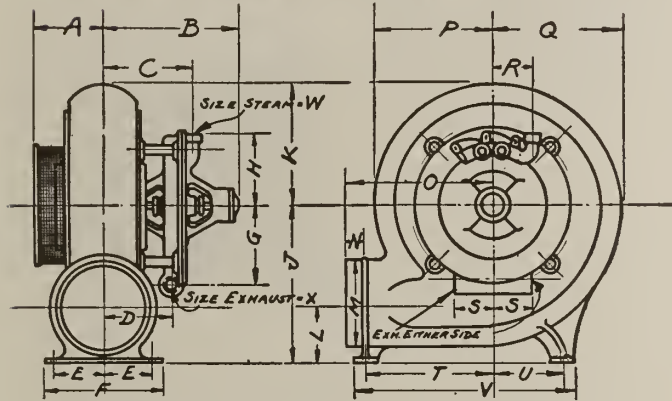
DIMENSION DIAGRAM, CARLING TURBO UNDERGRATE BLOWER
All dimensions are in inches

Size	Size													Net weight, lbs.
	A	B	C	D	E	G	H	J	K	L	M	N	Steam Exhaust	
12	13 3/4	7 1/2	15	15 1/4	5	8	18 1/4	3 7/8	8	3	6	7	3/4	190
14	13 3/4	7 3/8	15	17 1/4	5	8	20 1/4	3 7/8	8	3	7 3/4	7	3/4	210
16	17	10 7/8	15	19 3/4	7 3/4	10	22 1/4	4 3/4	10	4	6 3/4	9	3/4	340
18	17	10 7/8	15	21 1/4	7 3/4	10	24 1/4	4 3/4	10	4	6 3/4	9	3/4	360
20	18	10 7/8	15	23 3/4	7 3/4	12	26 1/4	6 3/8	12	6	8 1/2	11	1	420
22	18	10 7/8	15	25 1/4	7 3/4	12	28 1/4	6 3/8	12	6	9 1/2	11	1	430
24	18	10 7/8	15	27 1/4	7 3/4	12	30 1/4	6 3/8	13 1/4	6 11	11	1 1/4	2	450

Built other than standard for special requirements. Casing and wheel can be constructed of aluminum, bronze or other material for acid fumes.



CARLING VOLUME FAN



DIMENSION DIAGRAM, CARLING VOLUME FAN
All dimensions are in inches

Size	A	B	C	D	E	F	G	H	J	K	L
3-BV-12	6	16 ³ / ₄	10 ¹ / ₂	7 ⁷ / ₈	4 ¹ / ₂	11	8	7	14	10 ⁷ / ₈	5 ⁵ / ₈
4-BV-12	7	16 ³ / ₄	10 ¹ / ₂	7 ⁷ / ₈	4 ¹ / ₂	12	8	7	15 ⁷ / ₈	12	6
5-BV-16	8	21	14	10 ³ / ₄	5 ¹ / ₄	13	10	9	18	13 ⁵ / ₈	7
6-BV-20	9	21	14	10 ³ / ₄	5 ¹ / ₄	14	12	11	20 ³ / ₈	16 ³ / ₄	7 ³ / ₈
7-BV-20	10	21	14	10 ³ / ₄	7 ¹ / ₄	18	12	11	23 ³ / ₈	18 ³ / ₄	8 ³ / ₈

Size	M	N	O	P	Q	R	S	T	U	V	W	X	Net weight, lbs.
3-BV-12	7 ⁵ / ₈	2 ¹ / ₂	13 ⁵ / ₈	10 ⁵ / ₈	11 ¹ / ₂	37 ³ / ₈	3	10 ⁷ / ₈	47 ¹ / ₈	18	3 ³ / ₄	1 ¹ / ₄	260
4-BV-12	8 ⁷ / ₈	2 ³ / ₄	14 ¹ / ₂	11 ¹ / ₂	12 ¹ / ₂	37 ³ / ₈	3	11 ⁵ / ₈	8 ¹ / ₂	23 ¹ / ₂	8 ¹ / ₄	1 ¹ / ₄	300
5-BV-16	10 ¹ / ₂	2 ¹ / ₂	17 ¹ / ₄	12 ⁵ / ₈	14 ³ / ₈	43 ³ / ₄	4	14 ³ / ₈	6 ¹ / ₄	23 ³ / ₈	8 ¹ / ₄	1 ¹ / ₂	420
6-BV-20	11 ³ / ₄	2 ¹ / ₂	19 ¹ / ₂	15 ³ / ₈	11 ¹ / ₂	63 ³ / ₈	6	17 ¹ / ₄	10 ¹ / ₄	30 ³ / ₈	1	2	600
7-BV-20	14	2 ¹ / ₂	22 ¹ / ₈	18 ¹ / ₂	19 ⁵ / ₈	63 ³ / ₈	6	19 ¹ / ₄	10 ³ / ₄	33 ¹ / ₂	1	2	900

AIR PRESSURE CAPACITIES, SPEEDS AND HORSEPOWERS OF CARLING VOLUME BLOWERS

Size	1/2 oz.=.87 in. water			1 oz.=1.73 in. water			2 oz.=3.47 in. water		
	R.p.m.	C.f.m.	H. P.	R.p.m.	C.f.m.	H. P.	R.p.m.	C.f.m.	H. P.
3-BV-12	980	438	.098	1387	621	.310	1965	888	.987
4-BV-12	859	585	.130	1216	828	.414	1724	1174	1.300
5-BV-16	776	837	.186	1098	1185	.593	1556	1688	1.870
6-BV-20	635	1185	.263	898	1677	.839	1274	2382	2.650
7-BV-20	582	1372	.305	823	1941	.971	1168	2752	3.060
8-BV-20	499	1986	.440	706	2810	1.405	1001	3983	4.430
9-BV-24	411	3299	.783	581	4668	2.334	824	6641	7.300
10-BV-24	309	4488	.997	494	6350	3.175	702	9003	9.900

Size	3 oz.=5.20 in. water			4 oz.=7 in. water			6 oz.=10.40 in water		
	R.p.m.	C.f.m.	H. P.	R.p.m.	C.f.m.	H. P.	R.p.m.	C.f.m.	H. P.
3-BV-12	2414	1090	1.615	2794	1261	2.29	3436	1551	3.86
4-BV-12	2119	1447	2.135	2452	1667	3.03	3015	2051	5.13
5-BV-16	1912	2071	3.08	2212	2397	4.36	2721	2948	7.37
6-BV-20	1563	2923	4.33	1809	3382	6.15	2225	4160	10.40
7-BV-20	1434	3377	5.00	1660	3208	7.10	2041	4806	12.00
8-BV-20	1229	4888	7.25	1422	5656	10.20	1748	6957	17.40
9-BV-24	1012	8150	12.10	1171	9431	17.10	1440	11598	28.90
10-BV-24	861	11050	15.00	966	12786	27.90	1225	15726	27.00

Carling Pressure Blower.

Of the same general construction as the volume fan.

It does not deliver as much air, but has a pressure range up to 1 lb. and is used mostly on oil burning systems, forge fires and other requirements for high pressures.

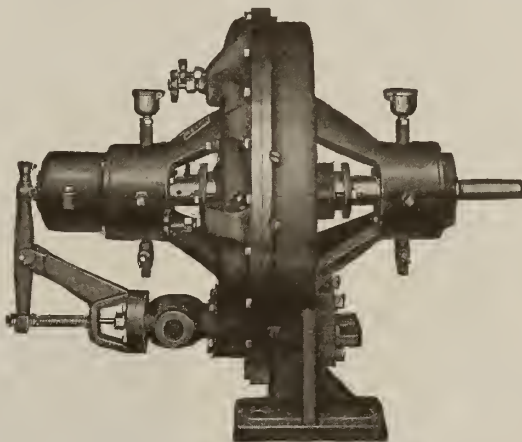
Carling Steam Power Turbine.

Especially designed to meet the demand for small steam turbines. Built in sizes from 1 to 50 h. p.; speed ranges from 1200 to 5000 r. p. m., with 12-, 16-, 20-, and 24-in. single or double stage rotors, with or without constant speed governor. For ordinary conditions, two 12A turbines will develop up to 8 h. p.; 16A up to 15 h. p.; 20A up to 30 h. p. and 24B up to 50 h. p. Carling reduction gears supplied for various speed ratios. All parts interchangeable.

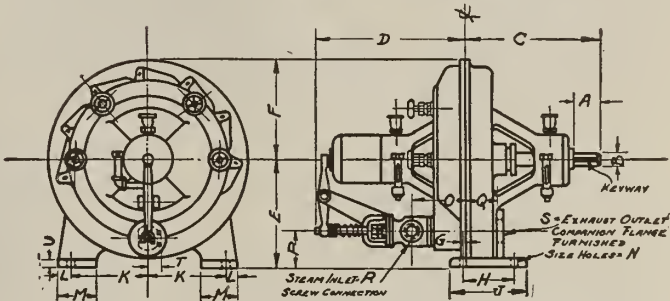
Rotors are of bronze and buckets of cupro nickel, designed for highest steam economy. Shaft is of heavy section, mounted on 2 ball bearings, the latter held in place by the Carling patent method, so that they may be replaced quickly at little expense.

Carling turbines can be supplied with coupling for direct connection to pumps, generators, blower fans and similar drives; supplied with a pulley for belt connection or made to operate in a vertical position. Special designs built for particular requirements.

Briefly the advantages of the Carling turbine are: high efficiency for power developed; great economy in the use of oil; only 2 bearings to lubricate; freedom from repairs; no reciprocating parts; even drive rotation; exhaust steam contains no oil; can be placed in any position; no special foundations required; perfect balance; requires little space and practically no attention.



CARLING STEAM POWER TURBINE



DIMENSION DIAGRAM, CARLING STEAM POWER TURBINE
All dimensions are in inches

Size	A	B	C	D	E	F	G	H	J	K	L	M
12-A	2½	3⅜	11⅞	12¾	8	7½	¼	4¼	6¼	5	1¼	3
16-A	4	1¼	16⅞	16⅝	10	9¾	¼	5	7½	7¼	1¾	4
20-A	4¼	1¼	16⅞	16⅝	12	11¾	¼	6	8½	9	1½	4½

Size	N	O	P	Q	R	S	T	U	Key-way	Net weight, lbs.	Shipping weight, lbs.
12-A	¾	4⅝	2⅞	3⅞	¾	2	2¼	¾	⅜	160	220
16-A	⅞	7⅞	3⅞	3⅞	1	2½	2¼	1	⅝	330	400
20-A	⅞	5¾	3⅞	3⅞	1¼	2½	2⅞	1	⅝	410	480

CLARAGE FAN COMPANY

KALAMAZOO, MICH.

BRANCH OFFICES AND AGENCIES

NEW YORK, N. Y., 149 Broadway
BALTIMORE, MD., Light Street and Key Highway
CLEVELAND, OHIO, 662 Rockefeller Building
DETROIT, MICH., 69 Buhl Block
BOSTON, MASS., 120 Milk Street
ST. LOUIS, MO., 2211 Olive Street

CHICAGO, ILL., 111 West Washington Street
ROCHESTER, N. Y., 437 Mercantile Building
INDIANAPOLIS, IND., 821 Hume-Mansur Building
MINNEAPOLIS, MINN., 305 Metropolitan Bank Building
TORONTO, CANADA, 1409 Royal Bank Building

Products.

HEATING and VENTILATING APPARATUS; FANS, BLOWERS, EXHAUSTERS, AIR WASHERS, PIPE COIL HEATERS; STEAM ENGINES.



Clarage Special Bearings.

If a fan or blower is to give the very best of service the bearings must be faultless. In any centrifugal machine the point of greatest wear occurs in the bearing.

Clarage special bearings are protected against wear. Felt washers are provided at each end of the bearing case, fitting snugly around the shaft. The felt washers prevent the entrance of dirt and grit into the bearing and thereby save the inner sleeves from injury. Clarage bearings are self-oiling, and self-aligning in all planes.

These superior bearings are now furnished on all Clarage fans and blowers. The best fan bearings made.



CLARAGE FAN BEARING
OPEN FOR INSPECTION

Multiblade Fans.

The Clarage multiblade fans are guaranteed to be equal, if not superior, to any fans built for handling large volumes of air against comparatively low pressures.

For heating or ventilating installations in public building, factory, mine or tunnel, these fans are especially suitable. The unusually high efficiency obtained, quietness of operation, small space required and adjustable features of the design, are all points in which they have been found superior to other types. Every wheel is guaranteed to be amply strong for working against static pressures even as high as 5-in. water gage.

For convenience in specifying, these fans are numbered according to the approximate diameter of the wheel in feet: No. 1, 1-ft. wheel; No. 2½, 2½-ft. wheel, etc. Sizes up to and including the No. 10.

Full-housed fans, up to and including the No. 3 size, are built with cast iron side plates, and, therefore, adjustable and reversible for hand and discharge; 16 different directions of discharge can be obtained with one fan.



CLARAGE MULTIBLADE
FAN WITH OVERHUNG
WHEEL

This arrangement leaves inlet unobstructed

Multiblade fans are built in full-housed and ¾-housed arrangements.

Single width fans are furnished with either overhung wheel or with overhung pulley. Double width fans can not be built with wheel overhung.

Clarage multiblade fans can be motor, engine or turbine driven, either by belt or direct connected.

Pipe Coil Heaters.

Clarage pipe coil heaters consist of a cast iron base, which forms a steam reservoir on one side of the partition wall and condensation reservoir on the other, and 1-in. pipes rising in pairs connected at the top with elbows and a short nipple.

These heaters are well adapted for heating all types of buildings requiring large volumes of warm air. They can be used with success in drying and evaporating installations.



CLARAGE PIPE COIL HEATER

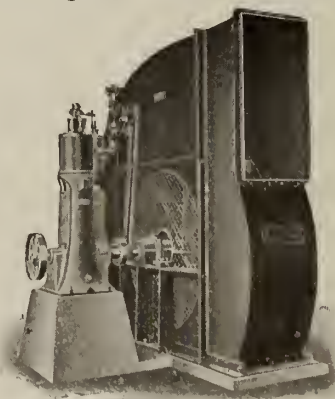
Vento Heaters and Air Washers.

In connection with Clarage fans this company is prepared to furnish cast iron vento heaters and air washers or any accessories necessary or desirable for a complete heating and ventilating unit.

Steel Plate Fans and Blowers.

Especially designed and constructed for furnishing mechanical draft, either as forced or induced draft fans; built unusually heavy to stand the strain of continuous operation. They are also adaptable for heating and ventilating, exhausting fumes and gases or in any installation, where large volumes of air are handled at low pressures or at pressures 3- to 6-in. water gage.

Built in either full-housed or ¾-housed arrangements and with any angle of discharge. Fans are regularly constructed either single or double inlet. The single inlet fans are required where it is not desirable to draw the air or gases over the pulley, motor or engine. Sizes Nos. 25 to 300.



CLARAGE STEEL PLATE FAN FOR
FORCED DRAFT

Driven by Clarage steam engine

The sizes No. 80 and smaller are reversible and adjustable for 16 different directions of discharge.

Steel plate fans can be motor, engine or turbine driven, by belt or direct connected.

Standard Exhaust Fans.

Clarage standard "SP" exhaust fans are built heavier and more rugged than most exhaust fans. These fans are used for elevating and conveying sawdust, shavings and blocks as encountered in the lumber mills; dust and lint from polishing and emery wheels; cotton, wool or grain; smoke vapors or air alone. They are particularly suitable, however, where the heavy materials pass through the fan and where strength and rigidity of construction are necessary to withstand the wear and tear of such service.

Sizes Nos. 25 to 160. Fans in sizes No. 80 and smaller are reversible and adjustable for 16 different directions of discharge. Belt or direct motor driven.

Style "C" exhausters are furnished with high efficiency, multiblade wheels which run at lower speeds and save power. Used for exhausting and conveying, in installations where the materials do not pass directly through the fan. Built in sizes Nos. 30 to 60, reversible and adjustable for 16 different directions of discharge. Belt or direct motor driven.

Cast Iron Fans.

In almost every manufacturing plant Clarage Type C.I. fans can be used to advantage; either as single inlet exhaust fans or as double inlet blowers. Four sizes, Nos. 5, 6, 7, and 9, the number indicating the diameter in inches of the inlet or outlet. Built reversible and adjustable in every way.

For handling explosive or poisonous gases cast iron fans are built airtight; furnished with flanged connections for inlet and outlet.



CLARAGE STANDARD "SP" EXHAUST FAN



CLARAGE STYLE "C" EXHAUST FAN
Multiblade wheel partly removed from housing



CLARAGE CAST IRON FAN, INLET SIDE

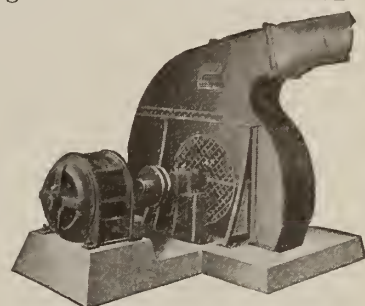
Pressure Blowers.

Clarage style "C" pressure blowers are suited for operation at comparatively high speeds and against pressures up to 12-oz. water gage. Furnished with multiblade wheels, with peculiarly shaped blades, these fans are exceedingly efficient. Adaptable for furnishing air under pressure to oil burning furnaces, foundry cupolas and forges. Built in sizes No. 30 to 60. Reversible and adjustable for 16 different directions of discharge. Belt or direct motor driven.

Special pressure blowers are designed for operation against high pressures (8 to 30 oz.) and for direct connection to standard speed electric motors. Bearings are supported independently of housing, thus eliminating vibration. Each fan is built for the duty specified, with any angle of discharge. First cost is about one-third cost of rotary blower for the same duty; the maintenance cost is negligible, and satisfactory performance is guaranteed.



CLARAGE STYLE "C" BLOWER ARRANGED FOR BELT DRIVE



CLARAGE SPECIAL PRESSURE BLOWER

Vertical Self-oiling Steam Engines.

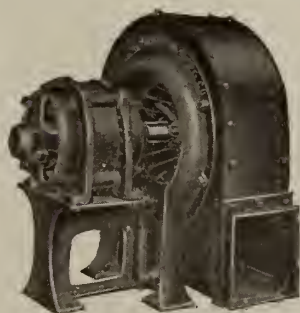
Clarage steam engines are fully enclosed. Adaptable for direct connection to fans, blowers, pumps, motor generators, etc. Engines are built in 4 classes to operate on different steam pressures from 10 to 250 lbs., capable of developing up to 40 horsepower.

Clarage Service.

The Engineering Department of the CLARAGE FAN COMPANY has compiled elaborate data covering capacities, etc., for every Clarage product. The department will gladly co-operate with engineers in supplying this information, and by recommending, without obligation, the proper Clarage Equipment to use.



AUTOMATIC HIGH PRESSURE ENGINE



STYLE "C" PRESSURE BLOWER DIRECT CONNECTED TO MOTOR



MULTIBLADE FAN, FOR HEATING AND VENTILATING, DRIVEN BY CLARAGE LOW PRESSURE STEAM ENGINE



STEEL PLATE FAN ARRANGED FOR ENGINE DRIVE, UNDERGROUND DISCHARGE AS FREQUENTLY USED IN DRYING INSTALLATION

COPPUS ENGINEERING & EQUIPMENT CO.

Manufacturers of Blowers, Fans and Turbines

340-350 Park Avenue
WORCESTER, MASS:

For Branch Offices, see Page 732

Products.

TURBO BLOWERS, Propeller and Centrifugal Types, for Undergrate Draft, Ventilation and other purposes.

For Turbo Boiler Feed Pumps and Steam Turbines, see page 732.



selection. One can not afford *not* to take advantage of this company's wide experience, as this experience, more than mere calculations, will solve all blower problems.

Write for data sheet and send the necessary data so that conditions can be studied from every angle and a report will be furnished with this company's recommendations.

Coppus Turbo Blowers, (Type C).

Built with either single- or double-stage impulse turbine, entirely enclosed, on the same shaft with a propeller fan.

Coppus construction insures quiet operation and high economy at the most efficient fan speeds. Turbine is provided with convenient hand valves for individual nozzle control. The steam chamber is small, yet of ample cross section to prevent condensation.

The life of the machine depends largely upon the life of its bearings, and the life of the bearings is largely determined by their lubrication. It is very essential to give a great deal of attention to proper lubrication of the bearings on turbo undergrate blowers on account of the severe conditions under which they operate. The Coppus lubricating system is designed to take care of these exacting requirements. It is absolutely dustproof, requires little attention, can not get out of order with ordinary neglect and abuse, and no matter if any oil is used up, a constant oil level will be maintained in the upper chamber of the motor bushing.

The Coppus turbo blower is the only blower in which the fan does not overhang the bearing and in which the exhaust steam is discharged into the fan casing when desired, where it mixes thoroughly with the air. All stuffing boxes have been eliminated.

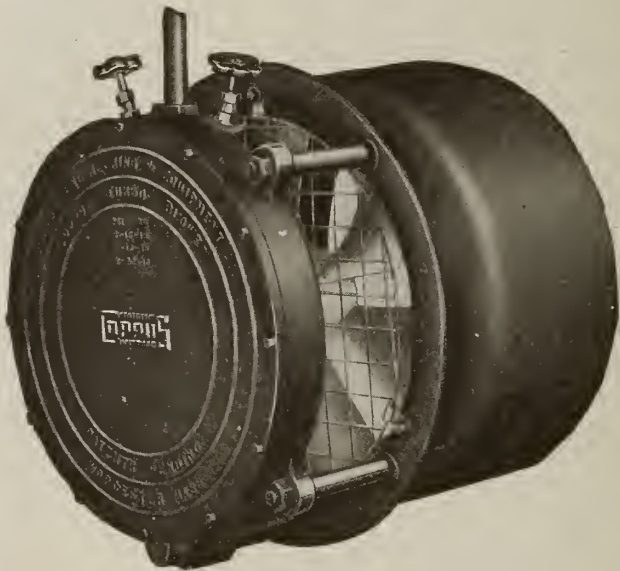
It delivers more air, size for size, at any specified pressures and uses 25% to 75% less steam than any other turbo blower made. This claim can be proved by comparative tests.

Special attention has been given to the fan casing in order to insure the highest efficiency. The casing hugs the fan and is expanded immediately beyond, relieving the choking effect on the air by the casing, greatly eliminating friction and preventing the formation of eddy currents. This feature (Patent No. 1,308,982) has gone through all the tribunals of the United States Patent Office, during 4 years of interference proceedings and this company has been awarded priority of invention of the expanded casing to the exclusion of all others.

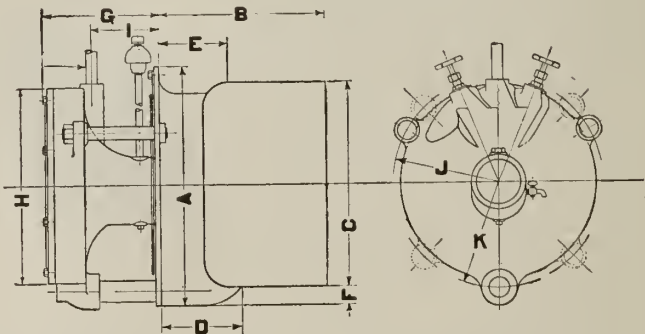
For low steam consumption, high air delivery, simplicity of operation, low cost of upkeep and reliability, the Coppus turbo blower has proved a generally accepted leader.

How to Choose the Size Blower Best Adapted to Any Boiler.

This company's advice is, do not try ; let the Coppus engineers do it. This will save considerable time and will avoid trouble and disappointment. It is not only a question of blower capacity, but the conditions under which the blower must operate that enter largely into its



COPPUS TURBO BLOWER, TYPE C



DIMENSION DIAGRAM OF COPPUS TURBO BLOWER, TYPE C

Size, fan	Size, turbine	Steam inlet	Number of nozzles	All dimensions are in inches										
				A	B	C	D	E	F	G	H	I	J	K
10	9	1/2	1	14 1/2	15	*12 1/2	6 3/4	5 1/4	1	9 1/4	10 5/8	5	6 1/2	6 1/2
12	12	3/4	2	18	15	*14 1/2	6 3/4	5 1/4	1 1/2	9 1/4	14 1/4	4 7/8	7 1/2	7 1/2
14	12	3/4	2	20	15	*16 1/2	6 3/4	5 1/4	1 1/2	9 1/4	14 1/4	4 7/8	7 1/2	8 3/8
16	16	1	3	21 1/2	15	*18 5/8	7 1/4	6 1/4	1 1/2	10 1/2	17 3/4	6 1/8	9 1/2	9 5/8
18	16	1	3	23 1/4	15	*20 5/8	7 1/4	6 1/4	1 1/2	10 1/2	17 3/4	6 1/8	9 1/2	10 3/8
20	20	1	3	26	15	*23 3/8	7	6 1/4	1 3/8	10 1/2	21 3/4	6 1/8	11 1/2	11 1/2
22	20	1 1/4	3	28	15	*26 5/8	6 3/4	6 1/4	1 1/2	10 1/2	21 3/4	5 1/2	12 3/4	12 3/4
24	20	1 1/4	3	30 3/4	15	*30 1/4	6	6 1/4	3/8	10 1/2	21 3/4	5 1/2	12 3/4	13 3/4

*May be made smaller if lack of space demands it.

†Drawing shows 2 studs, exhaust pipe being the third support. Dagger indicates 4 studs as shown in dotted lines.

CROWELL MANUFACTURING COMPANY

Pressure Blowers, Rotary Air Compressors and Vacuum Pumps

296-298 Taaffe Place
BROOKLYN, N. Y.

Products.

Sole manufacturers, under patents, of POSITIVE PRESSURE BLOWERS or ROTARY AIR PUMPS, for use with Gas or Oil, in connection with Furnaces, Blowpipes, Burners, etc.; ROTARY AIR COMPRESSORS or VACUUM PUMPS, for use in connection with all Laboratory Work, Chemical and Steam Heating Plants, Vacuums, etc. Air Receivers.

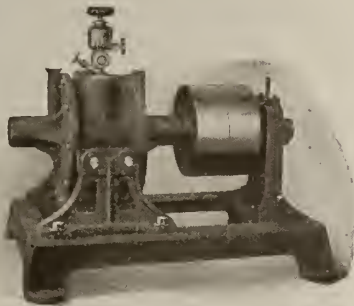
Positive Pressure Blowers.

Adapted for all purposes requiring air under pressure of 1 to 8 lbs. per sq. in., or any degree of vacuum not exceeding 20 ins.

Construction, same in both types, consisting of an internal drum and shaft carrying sliding blades or pistons operating in close contact with cylinder walls, giving simple positive action under lowest speeds. No springs, gears, valves, or unbalanced parts, and pressure not dependent upon high speeds or centrifugal force.



TYPE "A"



TYPE "B"

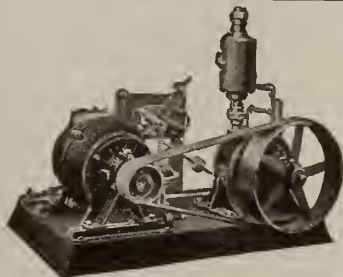
POSITIVE PRESSURE BLOWERS

DATA, POSITIVE PRESSURE BLOWERS, TYPES "A" AND "B"

GENERAL DETAILS TYPES "A" AND "B"										TYPE "A"			TYPE "B"		
Size number	Free air capacity		Rev. per min., max. speed	Approx. h. p. at 3 lbs. pressure	Pulleys, ins.	Pipe size, inlet and outlet, ins.	Net weight, lbs.	Floor space, ins.	List price	Net weight, lbs.	Floor space, ins.	List price	Net weight, lbs.	Floor space, ins.	List price
	Cu. ins. per rev.	Cu. ft. per min. at max. speed													
1	20	6.9	600	1/4	4x1	1/4	24	10 x 6 1/4	\$26.00	42	14x10	\$37.00	42	14x10	\$37.00
2	45	13	500	1/2	4x1 1/2	1/2	34	12 1/2 x 6 1/2	34.00	55	16x11	46.00	55	16x11	46.00
3	125	25.3	350	3/4	6x2 1/2	3/4	90	22 x 14	53.00	145	25x20	66.00	145	25x20	66.00
4	280	40.5	250	1	6x3	1	170	28 x 17	66.00	240	30x23	80.00	240	30x23	80.00
5	460	53.2	200	1 1/2	10x3	2	225	34 x 20	100.00	330	37x25	125.00	330	37x25	125.00
6	690	79.8	200	2	12x4	2	320	38 x 22	135.00	570	41x25	165.00	570	41x25	165.00
8	1050	121.5	200	3 1/2	14x6	2 1/2	575	48 x 22	195.00	790	50x27	245.00	790	50x27	245.00
10	1660	192	200	5	18x6	3	770	54 x 28	270.00	1050	56x33	324.00	1050	56x33	324.00
12	3390	392.3	200	7	20x6	4	1300	60 x 31	468.00	1770	62x36	534.00	1770	62x36	534.00

Rotary Vacuum Pump, Type "C."

Specially designed and adapted for steam heating plants. It automatically keeps line clear without attention of any kind after having once been set up for



ROTARY VACUUM PUMP, TYPE "C"

work. Mounted on iron base in connection with Sprague motor and automatic diaphragm switch.

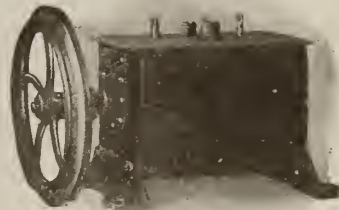
DATA, TYPE "C" ROTARY PUMP MOTOR DRIVEN OUTFIT*

No. 1-C, with 1/2 h. p. motor, for	4,000 sq. ft. or less of direct radiation
" 2-C, " 1/2 " " " "	10,000 " " " " " "
" 3-C, " 1 " " " " "	20,000 " " " " " "
" 4-C, " 2 " " " " "	45,000 " " " " " "
" 5-C, " 3 " " " " "	55,000 " " " " " "
" 6-C, " 4 " " " " "	75,000 " " " " " "
" 7-C, " 5 " " " " "	110,000 " " " " " "

* Prices furnished on receipt of specifications as to voltage and current available and exact description of motor wanted.
SPECIAL NOTE—All types and sizes of pumps are also furnished with motor drive as above, to order only, and according to specifications.

Rotary Vacuum Pump, Type "O-D."

Specially adapted for vacuum work; can exhaust to a vacuum of from 29 1/2 to 30 ins. (mercury column). Fitted in oil immersion box, which makes it leakproof, or can be used without box. Capacity about 2 cu. ft. of free air per minute, requiring 1/4 h. p. to operate.

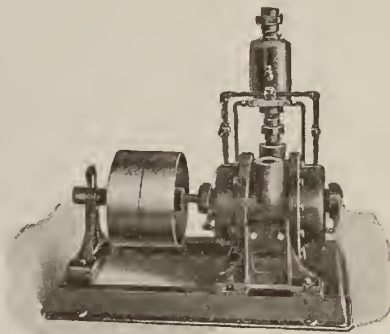


TYPE "O-D" PUMP IN OIL IMMERSION BOX

Price (with oil box), \$65.00—(without), \$52.00
Weight (with oil box), 50 lbs.—(without), 20 lbs.

Rotary Compressor or Vacuum Pump, Type "D."

Single stage pump, designed for working pressure of 25 lbs. per sq. in., or vacuum of from 29 1/2 to 30 ins. (mercury column). It is of simple, positive and durable action, having no valves, springs, gears or unbalanced parts, and requiring no special foundation.



TYPE "D" COMPRESSOR OR VACUUM PUMP

DATA, TYPE "D" ROTARY COMPRESSOR OR VACUUM PUMP

Size number	Free air capacity		Rev. per min., max. speed	Approx. h.p. at 15 lbs. pressure or 29 ins. of vacuum	Pulleys tight and loose, ins.	Pipe size, inlet and outlet, ins.	Approx. net weight, lbs.	Floor space, ins.	List price
	Cu. ins. per rev.	Cu. ft. per min. at max. speed							
1-D	15	4.3	500	3/4	6x2	1/4	70	13x18	\$ 75.00
2-D	40	9.2	400	1	8x2	3/4	115	14x22	88.00
3-D	100	17	300	2	12x4	1	250	19x34	118.00
4-D	280	40.5	250	4	14x4	1 1/2	425	23x38	198.00
5-D	400	46	200	5	18x6	2	580	26x44	225.00
6-D	600	69.4	200	6 1/2	18x8	2	725	26x55	295.00
8-D	1000	115.7	200	9	20x8	2 1/2	1150	30x64	400.00
10-D	1650	190.9	200	12	22x10	3	1675	36x70	600.00
12-D	3390	390	200	20	24x10	4	2150	38x75	1000.00

ROBERT GORDON, INC.

Heating and Ventilating Equipment

TELEPHONE:
HAYMARKET 3740

630 West Monroe Street
CHICAGO, ILL.

AGENCIES

PITTSBURGH, PA., R. M. ZIMMERMAN, 403 Wabash Building TORONTO and MONTREAL, CAN., E. J. WOODISON Co., LTD.

Products.

Manufacturers of MECHANICAL HOT BLAST HEATERS (patented).

M. & L. Unit Heaters for Steam; Air Dryers, Air Conditioning Systems.

Designers and constructors of Power Plants complete, Heating and Ventilating Systems, Air Conditioning Systems, Dryers, Sheet Metal Work and Light Structural Work of all descriptions.

Engineering Services.

The Engineering Organization is well equipped for both the entire design of Power Plant Work complete, and the Contracting Department has every facility and wide experience in the handling of all Power and Piping jobs of any size in any part of the country.

Correspondence is invited on their engineering and designing services or for estimates on their own or engineers' plans of any size, anywhere.

References to work which this organization has completed in various parts of the country will be furnished on request to interested engineers or owners.

Wide experience as consultants with engineers on work in our line has saved many thousands of dollars to owners. Two examples of this are the combination power plant and heating system of the Saginaw Products Division of the General Motors Company, Saginaw, Mich.; and the Peerless Foundry Co., Cincinnati, Ohio, on the mechanical hot blast heaters; both of which plants were specified by Frank D. Chase, Inc.

Adaptability of Mechanical Hot Blast Heater.

Designed for heating, ventilating and air conditioning of foundries, machinesthops, warehouses, mills, factories, manufacturing plants, industrial buildings, sheet metal plants, pattern shops, garages, etc.

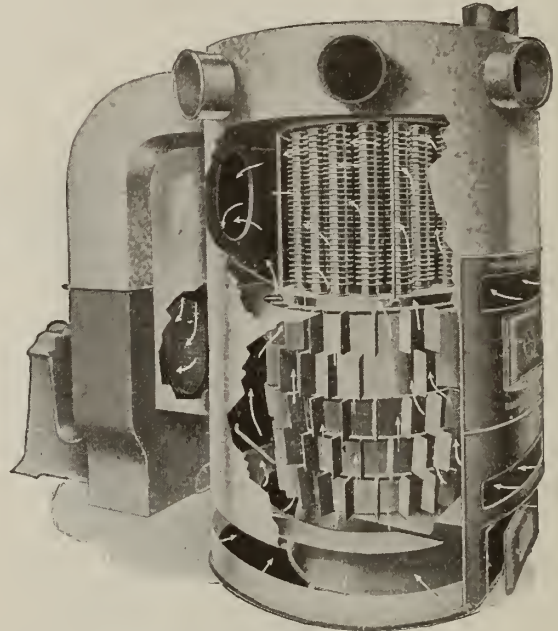
This company will co-operate with engineers in specifying these heaters properly.

Description and Advantages.

The heater consists essentially of a large cast iron stove with a series of heat chambers enclosed in sheet metal casing. The castings are of high grade gray iron and the casings of best grade galvanized iron.

The efficiency of these furnaces is at least five times as great as any form of steam or hot water heating. This is obtained by the direct application of the air to the heated surfaces, whereby losses incident to conversion and transmission through pipes or ducts are eliminated.

The circulation is indicated by the arrows in the illustration. By this system of heating the natural circulation of air is given impetus through the use of a multivane fan. Thus by forced circulation a large volume of warm air is obtained, instead of a small volume of hot, burnt air as where natural circulation exclusively is depended upon.



MECHANICAL HOT BLAST HEATER
Patented

The heating or radiating surface is greatly increased by means of radiating fins on the fire pot, combustion chamber and radiator tubes. These fins being staggered, the air is frequently broken up during its passage through the various heating chambers.

The warm air produced by heater absorbs and condenses steam and gas arising from foundry moulds, thus leaving the building clear of these objectionable elements.

Heat capacities range from 100,000 cu. ft. to 500,000 cu. ft. with one unit.

Fuels.

The fuels used—domestic coke, foundry coke, bituminous and anthracite coal, lignite, fuel oil, natural and artificial gas.

Cost.

The initial cost will not exceed one-third that of any other form of heating, and in many cases has run as low as one-eighth the cost of high grade steam or hot water plants.

Operating Cost.

FUEL EXPENSE—The fuel consumption is from one-half to one-fourth that of any other form of heating, due to the scientific construction of the radiating surfaces.

LABOR EXPENSE—A licensed engineer or fireman is not needed to operate the heater, nor any skilled help. It can be operated with common labor.

ILG ELECTRIC VENTILATING CO.

Fans, Blowers, Exhausters and Unit Heaters

150 Whiting Street
CHICAGO, ILL.

BRANCHES

NEW YORK, N. Y., 13 Park Row
Telephone, Barclay 8787

BOSTON, MASS., TOMPKINS-STODDARD Co., 136 Federal Street
Telephone, Fort Hill 6454

PITTSBURGH, PA., 559 Union Arcade
Telephone, Grant 4325

PHILADELPHIA, PA., 327 Commercial Trust Building
Telephone, Spruce 2099

CLEVELAND, OHIO, 1314 Schofield Building
Telephone, Main 776

DETROIT, MICH., 203 Owen Building
Telephone, Cherry 5231

Products.

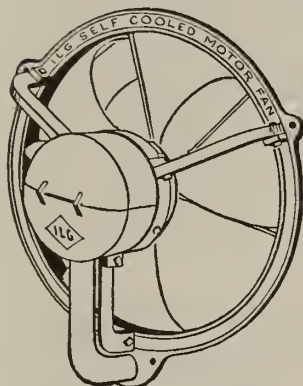
Manufacturers of a complete line of ELECTRIC PROPELLER and DISC FANS, direct connected; EXHAUST FANS; HEATING and VENTILATING FANS; AUTOMATIC LOUVERS and SHUTTERS; POWER ROOF VENTILATORS; UNIVERSAL MULTIBLADE BLOWERS and EXHAUSTERS, direct connected and belted; MOTORS for driving fans and blowers; ILGAIR UNIT HEATERS.

Steel Plate Fans, Ready-to-run Ventilating Sets; Mechanical Draft Apparatus; Fans and Blowers for drying; Humidifiers.

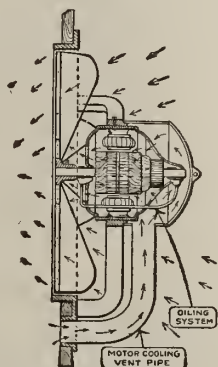
Ilg Self-cooled Propeller Fans.

SELF-COOLED MOTOR—The illustrations below show the Ilg patented self-cooled feature. Experience has proved that open motors can not be used on propeller fans, because dirt and grease are drawn into motor. If fully enclosed motor is used, the motor efficiency is decreased, due to overheating. If partially covered motor is used, the suction eventually draws dirt and grease through the enclosing covers.

Furnished with direct connected motor for any cur-



SELF-COOLED MOTOR
PROPELLER FAN



SECTIONAL VIEW



FACTORY VENTILATED WITH ILG PROPELLER FANS
Equally applicable to stores, etc.

rent or voltage. Sizes 12 to 72 in. Capacities 1000 to 45,000 cu. ft. per min.

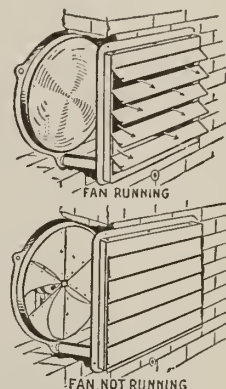
CATALOGUE—Write for condensed catalogue showing complete details on propeller fans.

Ilg Automatic Shutters.

Shutters are moistureproof and need no attention after they are installed. Built of special hard rolled aluminum leaves pressed on Whiting alloy copper coated rods supported in cast iron frame.

When the fan is running, shutter is held open by the force of the air current. When the fan is shut off, shutter closes automatically by gravity.

Made in sizes to correspond with fans.



ILG AUTOMATIC
SHUTTER



EXHAUSTING STEAM AND ACID VAPOR IN STAR CLEANING CO., CHICAGO, USING 24-IN. SELF-COOLED MOTOR PROPELLER FAN EQUIPPED WITH AUTOMATIC SHUTTER

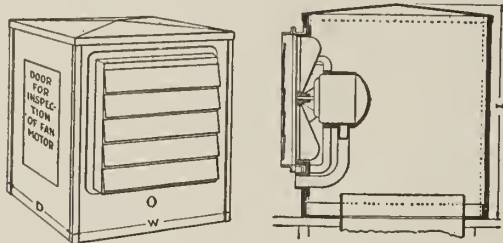


FORTY-FOUR 42-IN. ILG SELF-COOLED MOTOR PROPELLER FANS COOLING MEN WORKING AT FURNACES, McKEESPORT (PA.) TIN PLATE CO.

Ilg Power Roof Ventilators.

There are many types of buildings where roof ventilation provides the only practical means of exhausting foul air. Heretofore the custom has been to use natural gravity ventilators operated solely by the velocity and direction of the wind, therefore unreliable and spasmodic in effect.

With the Ilg power roof ventilator there is a constant suction, created by the Ilg self-cooled motor fan, which is enclosed in the penthouse. The action of the fan draws off the foul air, thereby making room for fresh air as provided by the natural laws of ventilation.



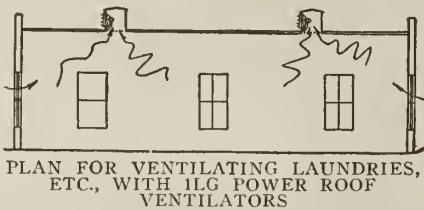
DETAILS ILG POWER ROOF VENTILATOR
AIR CAPACITIES OF ILG POWER ROOF VENTILATORS

[Size of fan, in.	Air delivery per min., cu. ft.	Dimensions		
		D	W	H
18	3,100	24	24	30
20	3,500	24	24	30
24	7,000	30	30	36
30	9,000	36	36	42
36	12,000	42	42	50
42	17,000	52	52	56
48	23,000	58	58	66



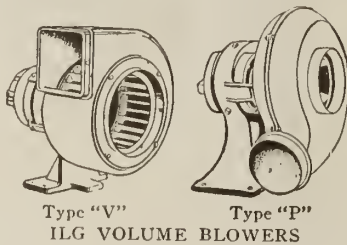
TWO 36-IN. ILG POWER ROOF VENTILATORS INSTALLED ON ROOF AND DIRECTLY CONNECTED TO HOODS OVER FURNACES, IN PLANT OF AMALGAMATED METALS CO., CHICAGO, ILL.

One-story factories, laundries, foundries, etc., are economically ventilated by locating Ilg power roof ventilators directly over spots where ventilation is most needed. Fresh air through windows gives complete circulation.



Ilg Volume Blowers.

TYPE "V"—These blowers have all the features of the larger Universal blowers. They are intended to be used where small volumes of air at low pressures are required and where quiet running is a feature. These machines are universal in discharge and drive.



Type "V" blowers are suitable for the ventilation of

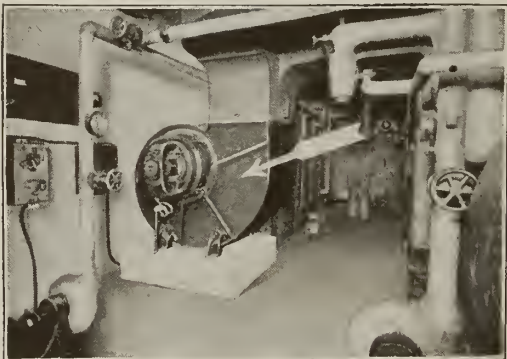
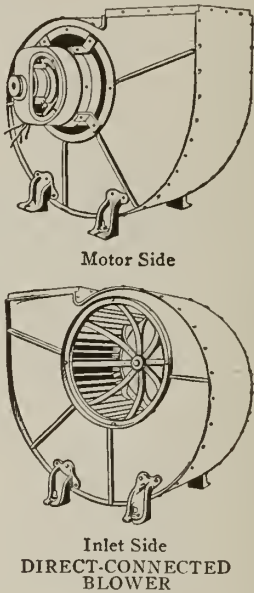
small offices, dark rooms, toilet rooms, picture booths, telephone booths, staterooms on boats, private yachts, residence kitchens.

TYPE "P"—The Ilg direct connected electric volume blowers are applicable for exhausting dust and fumes from laboratories and polishing rooms; removal of steam and heavy vapors from cooking vats in dye houses, breweries, canning factories, etc.

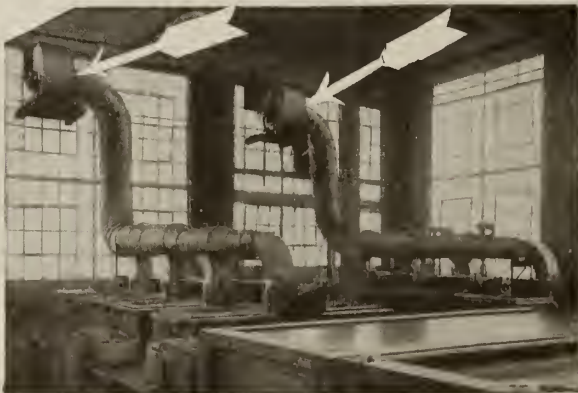
Ilg Universal Multiblade Blowers.

The construction of Ilg blowers and exhausters is a distinct departure from methods heretofore employed. Motor is machined circular and held in cast iron ring bolted to cast iron bowl. Bowl is in turn bolted to cast iron side of blower. On the inlet side, a cast iron inlet flange is bolted to cast iron side. The two cast iron sides of blower are exactly alike, with holes drilled alike; consequently bowl and inlet flange can be interchanged, giving change of drive.

Legs are bolted to cast iron sides, and can be put on in any position, giving any angle of discharge. Wheel is mounted directly on motor shaft and, as motor is pushed up against bowl, the hub of wheel is very close to motor bearing, giving small overhang.



TYPICAL INSTALLATION, ILG UNIVERSAL BLOWER FOR BLAST USE



TWO 50-IN. DIRECT CONNECTED 3-PHASE ILG UNIVERSAL BLOWERS EXHAUSTING FUMES AT PLANT OF BUDD MANUFACTURING CO., PHILADELPHIA, PA.

ILG BELTED BLOWERS—Have cast iron sides with interchangeable bowl and inlet flange.

Pulley and wheel are overhung on shaft, supported in two bearings in cast iron bracket.

One nameplate—Ilg—covers the unit for customers' protection.

CATALOGUE—Write for condensed catalogue showing complete details on blowers.

Literature showing specific application of Ilg fans and blowers, for drying, cooling, oxygen supply, heating and ventilating, will also be mailed.

Ilgair Unit Heaters.

In the production of the Ilgair unit heater the ILG ELECTRIC VENTILATING CO. has originated a new engineering principle, affording an effective and economical means of heating which complies with all the scientific laws of air circulation.

The Ilgair unit heater is a cabinet, open at both ends, in which is housed an ordinary 2-stack radiator and an Ilg self-cooled motor propeller fan. This cabinet acts as a heating chamber for the air which is drawn in over the heated coils on the intake side at low velocity (about 1000 ft. per minute) and discharged in volume at high velocity (about 2500 ft. per minute).

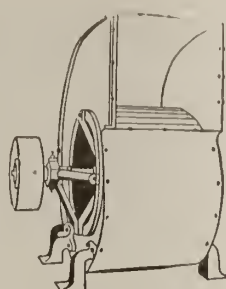
Each unit constitutes a separate heater, and both the volume and distribution of the heat is controlled at its source. This unit system speeds up the heating, increases distribution and makes possible the heating of any particular section of the building without operating the entire system.

No ducts or high speed machinery are required. Instead of having to create and distribute the heat from one limited source of supply, the Ilgair unit heater system provides for a multiple of units depending upon the floor area.

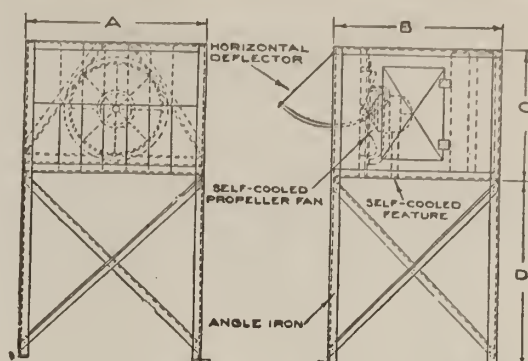
No other heating system affords such flexibility of application. It is a simple matter to rearrange the placing of any one or more units, and if the building is remodeled or enlarged it merely means replacing or installing additional units.

Ilgair unit heaters can be used in summer as cooling outfits and streams of air can be blown in any direction. This is an important feature in plants having processes that give off heat. Unit can also be placed against side walls and connected with outside air to furnish ventilation.

CO-OPERATIVE SERVICE—Layouts furnished as required. Write for further information.

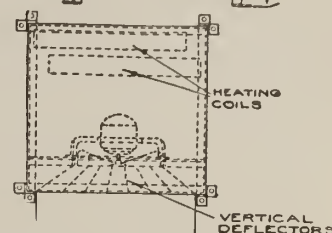


BELTED BLOWER



APPROXIMATE DIMENSIONS

No.	A	B	C	D
18	37	49	36	72
20	45 1/4	56	35 1/4	72
24	55	62	48	72
30	57	69 1/4	57 1/4	72
36	76	72	59 1/2	72



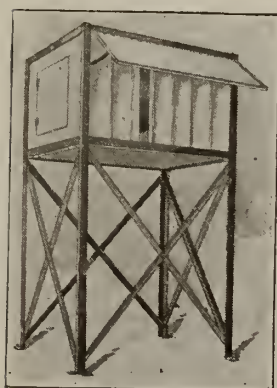
DETAILS AND SPECIFICATIONS OF ILGAIR UNIT HEATERS

Number of unit	Cu. ft. per min.	Radiation, sq. ft.	Approximate over all dimensions	Power input, watts	Weight complete, lbs.
18	2000	96	37" wide 36" high 49" long	200	1550
20	3000	128	45 1/4" wide 35 1/4" high 56" long	220	1900
24	5000	194	55" wide 48" high 62" long	425	2750
30	7000	270	57" wide 57 1/4" high 69 1/4" long	550	3550
36	9000	351	76" wide 59 1/2" high 72" long	850	4700

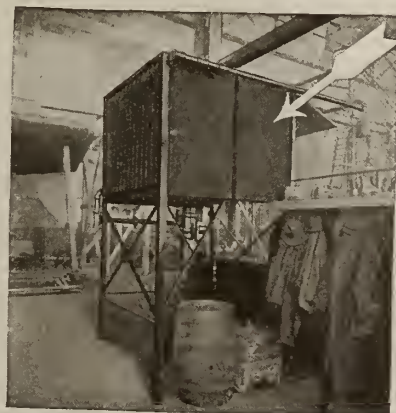


DETAIL OF CEILING TYPE ILGAIR UNIT HEATER

Note patented adjustable deflector throwing warm air to floor.



FLOOR TYPE ILGAIR UNIT HEATER



REAR VIEW FLOOR TYPE SHOWING HEATING COIL AT INTAKE END OF 36-IN. ILGAIR UNIT HEATER



CEILING TYPE 24-IN. ILGAIR UNIT HEATER BLOWING IN TEMPERED OUTSIDE AIR FOR VENTILATION, "HOUSE OF KUPPENHEIMER," CHICAGO

MASSACHUSETTS BLOWER COMPANY

Howard Street, Watertown Post Office
BOSTON, MASS.

SALES OFFICES AND AGENCIES

BOSTON, MASS.
NEW YORK, N. Y.
PHILADELPHIA, PA.
PITTSBURGH, PA.
DALLAS, TEX.

MILWAUKEE, WIS.
OKLAHOMA CITY, OKLA.
ST. LOUIS, MO.
NEW ORLEANS, LA.
SAN FRANCISCO, CAL.

CHICAGO, ILL.
CLEVELAND, OHIO
DETROIT, MICH.
SALT LAKE CITY, UTAH
KANSAS CITY, MO.

BALTIMORE, MD.
ATLANTA, GA.
ALBANY, N. Y.
ROCHESTER, N. Y.
ST. PAUL, MINN.

SEATTLE, WASH.

MONTREAL, CAN.

TORONTO, CAN.

Products.

Manufacturers of FANS, BLOWERS, HEATERS and AIR WASHERS for Heating, Ventilating, Purifying, Cooling, Humidifying, Dehumidifying; FORCED and INDUCED DRAFT, COMMERCIAL DRYING and BLAST EQUIPMENT.

Squirrel Cage Multiblade Fans.

For heating, ventilating, drying and mechanical draft the squirrel cage fan will meet every requirement, except for moving material. Built in all sizes from 6-in. diameter wheels and up.

Steel Plate Blowers and Exhausters.

Adapted for same purposes as the squirrel cage type fan. Can be designed for moving materials.

Massachusetts Propeller and Disc Fans.

For moving large volumes of air under low pressures. Built for pulley drive or direct connection to motors or engine. Built in all sizes from 12-in. diameter and up, for horizontal or vertical shaft.

Cone Fans.

Designed for installations where the conditions will not permit the usual housing.

Planing Mill Exhausters.

Steel plate shell sufficiently thick to withstand abrasive action of material handled. No exposed bearings. Any discharge.

Portable Service Sets.

Standard sizes. Right- or left-hand discharge. Belt or direct drive.

Pipe Coil Heaters.

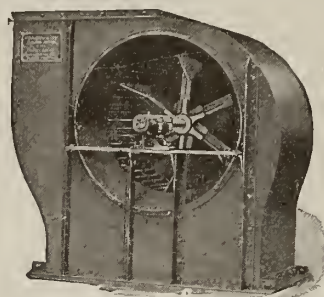
For hot water and steam. Adapted for high and low pressure work. Made in return bend and miter types.

Air Washers.

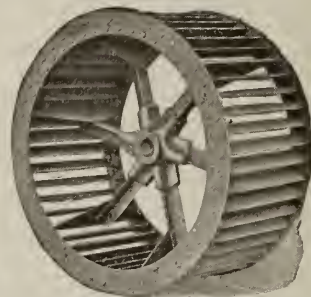
For purifying, cooling, humidifying and dehumidifying air for industrial and commercial purposes. Made in all sizes.

Drying and Cooling Systems.

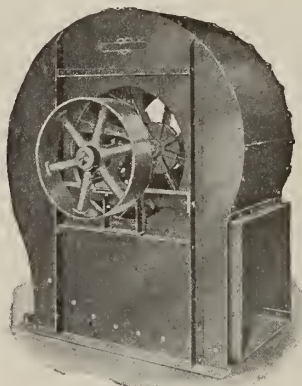
Dry kilns and cooling and ventilating systems designed and equipped to meet any requirements.



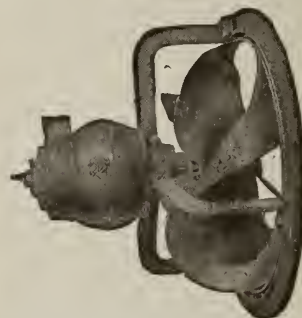
MODIFIED SQUIRREL
CAGE FAN



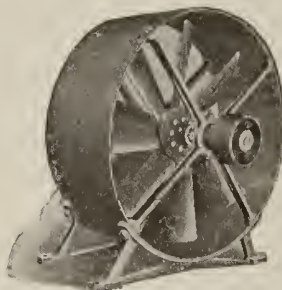
MODIFIED SQUIRREL
CAGE FAN WHEEL



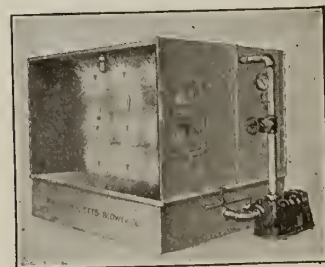
STEEL PLATE FAN



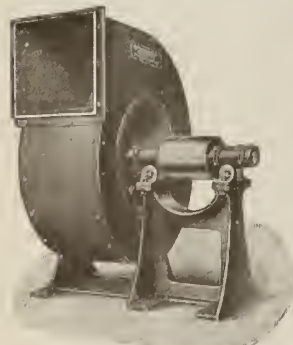
MASSACHUSETTS DAVIDSON
PROPELLER FAN, DIRECT
CONNECTED MOTOR



DISC FAN WITH PULLEY



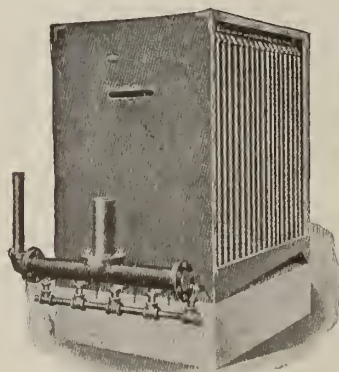
MASSACHUSETTS AIR
WASHER



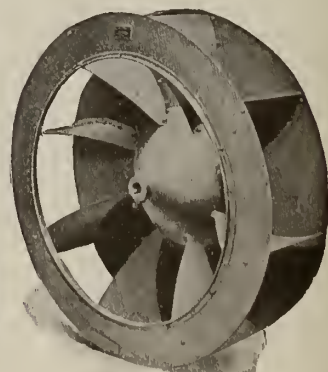
PLANING MILL EXHAUSTER



PORTABLE SERVICE SET
Motor side



COIL HEATER



CONE FAN WHEEL

SKINNER BROS. MFG. CO., INC.

Manufacturers and Distributors of Patent Air Heaters

ST. LOUIS, MO.

MAIN OFFICE AND PLANT NO. 1, Tenth and Tyler Streets; PLANT NO. 2, Boyle and Vandeventer Avenues

BRANCH OFFICES AND AGENCIES

CHICAGO, E. MEHRING COMPANY, 175 West Jackson Boulevard
CLEVELAND, CLEVELAND AIR ENGINEERING Co., Hippodrome Annex
DENVER, HOWARD H. FIELDING, Boston Building
LOS ANGELES, R. B. GUERNSEY & Co., Hollingsworth Building
NEW YORK, SKINNER BROS. MFG. CO., INC., Flatiron Building

PITTSBURGH, PITTSBURGH HEATING Co., 8 Wood Street
PORTLAND, W. G. McPIERSON & Co., 19th and Wilson Avenues
SAN FRANCISCO, J. E. O'MARA, 443 Minna Street
WASHINGTON, D. C., U. D. SELTZER ENGINEERING Co., Evans Building

Products.

BAETZ PATENT FAN HEATER UNITS; SKINNER PATENT DIRECT FIRED FAN BLAST HEATER UNITS.
Skinner Patent System Fan Blast Dryer Outfits.

Baetz Patent Air Heater.

For steam, either exhaust or high or low pressure, 6 sizes and 4 types are made, as shown in Fig. 1, with fan wheels of steel plate or multi-blade construction for either motor, line shaft, steam engine, gas or gasoline engine drive. These units are built to occupy the least possible floor space and range from 4 sq. ft. to 36 sq. ft. The fan is made double inlet and is located near the floor directly under a closely nested pipe coil, made in two sections to permit easy removal and give a free air passage through same. The fan exhausts the cooler air on the floor and discharges same up through the coil and out into the room at low velocity through the large diameter directing elbow outlet. If desired, more than one elbow may be installed for special cases. In drying work, one or more sheet metal ducts can be carried from heater outlets for distribution to several drying chambers. The fan wheel is mounted on a polished steel shaft, supported by two large ring-oiling, self-aligning bearings, bolted firmly in place on shelves cast rigidly in each inlet plate casting. Standard outfits consist of all parts as illustrated in Fig. 1, except motor, motor belt and elbow outlet. Headers are threaded for screwed fittings, but will be furnished with standard companion flanges on request.

Uses—Heating and ventilating all types of factories, industrial plants, garages, machine and railroad shops.

Drying of all kinds of materials, including fruits, vegetables, candy, etc.

Steam vapor removal from packing plants, paper mill machine and beater rooms to prevent precipitation.

ADVANTAGES—No sheet metal ducts are required. No foundation required other than good floor construction carrying 175 lbs. In mild weather sufficient heat

will be obtained by natural stack effect heating without running the fan; in normal freezing weather medium fan speed and in coldest weather maximum fan speed, thus requiring smallest possible horsepower and steam consumption, while giving greatest possible flexibility of operation. All units are portable, also self-contained and can be connected with factory labor. The steam coils are good for any steam pressure from atmospheric to 125 lbs.

Any vacuum valves, traps, or steam accessories can be applied in the same way as with any steam coil.

City or well water can be circulated through the coils, which will give a greater cooling effect, also lower the relative humidity depending on the circulating water temperature.

If the units are not required for use in the summer, they can be stored in another part of the plant, thus giving more floor space for manufacturing during this period; but continued use in summer is recommended, owing to proved value in summer cooling and ventilation.

GUARANTEE—All workmanship and materials guaranteed one year from date of shipment. This company also guarantees any inside average temperature, if given complete data on building and building construction, amount and kind of steam available.

LITERATURE—For steam systems write for following literature:

Descriptive pamphlet No. 50.

List and addresses of users, No. 80.

Catalogue No. 101, giving full description.

Direct Fired Type.

For plants having no available steam, this type illustrated in Fig. 2 is furnished. All internal heating construction made of heavy cast iron with deep cup shaped joints filled with special oxide cement. Fan construction and other parts same as for steam coil type (Fig. 1).

Standard units consist of complete outfit as shown (Fig. 2), with the exception of motor, motor belt, directing elbow and smoke pipe, but collar connections for smoke pipe and air directing elbows are also furnished. Send for descriptive pamphlet No. 60.

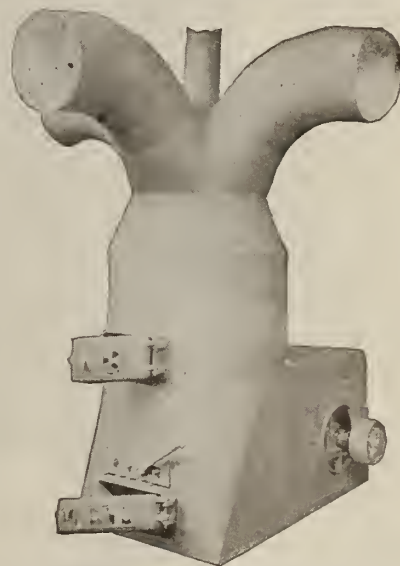


FIG. 2. TYPES DF AND DFS, SKINNER DIRECT FIRED FAN BLAST HEATER

FIG. 1. TYPES OC, NC, OCS AND NCS BAETZ FAN HEATER

THE SPENCER TURBINE CO.

Manufacturers of Turbine Blowers and Exhausters
HARTFORD, CONN.

SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

Products.

TURBINE BLOWERS and EXHAUSTERS: Spencer Turbo-compressors, Spencer Vacuum Cleaners, Spencer Organ Blowing Apparatus (the Orgoblo).

Turbo-compressors.

Spencer turbo-compressors are built to meet the needs of modern industrial conditions frequently requiring continuous operation for many days where absolute dependability is most essential. They are built for service and combine simplicity and practicability with sturdy and rugged construction.

CONSTRUCTION—The Spencer plate steel, double wall, reinforced construction gives a maximum of strength with a minimum of weight.

FOUNDATION—As the motor and compressor form one compact and integral unit no special foundation is required.

BEARINGS—Consist of 2 motor bearings and 1 ball thrust bearing designed with a liberal factor of safety.

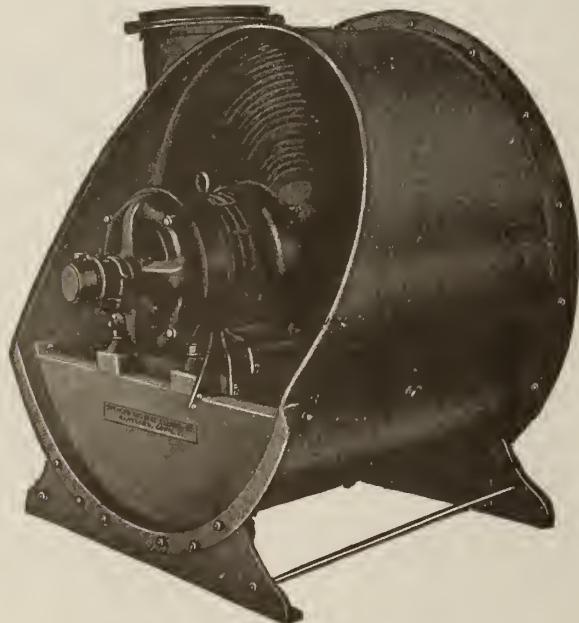
MOTORS—Of the highest grade, standard type. Spencer turbo-compressors are furnished equipped with 60-cycle alternating current or direct current motors of any standard voltage.

OPERATION—Spencer turbo-compressors operate at 1750 r. p. m., generally considered by electrical engineers to be the most efficient and practical motor speed, and this one feature has obtained for them rapidly increasing recognition and preference over others.

SPECIAL FEATURES—(1) A slow speed, low velocity wide clearance multistage turbine.

(2) Retains its efficiency permanently; no contacts or even close clearances, hence no chance for wear.

(3) Direct connected, self-contained unit, avoids necessity for belts, gears or chains, with their resultant losses and noises.



MOTOR END SPENCER TURBO-COMPRESSOR

(4) Constant pressure, with no pulsations nor surging, even when operated idle or under partial loads.

(5) Current consumption inherently decreases in proportion to reduction of volume of air used, eliminating all auxiliary governors.

PRESSURES—The Spencer line of turbo-compressors for 1-lb., 1½-lb. and 2-lb. pressures meets a wide demand for an efficient equipment of the “slow-speed” turbine type to use in supplying air for oil and gas burning furnaces, foundry cupolas, etc.

CAPACITIES, SPENCER TURBO-COMPRESSORS

1-LB. PRESSURE		1½-LB. PRESSURE		2-LB. PRESSURE	
Catalogue number	Volume, cu. ft. per min.	Catalogue number	Volume, cu. ft. per min.	Catalogue number	Volume, cu. ft. per min.
1005	600	1507	675	2010	600
1007	1000	1510	900	2015	1000
1010	1300	1515	1350	2020	1300
1015	2000	1520	1800	2025	1650
1020	2700	1525	2250	2030	2000
1025	3350	1530	2700	2035	2350
1030	4000	1535	3150	2040	2700
1035	4700	1540	3600	2050	3350
1040	5400	1550	4500	2060	4000
1050	6750	1560	5400	2075	5000
1060	8100	1575	6750	20100	6700
1075	10000	15100	9000	20125	8100
				20150	10000

For other pressures, write for bulletin.

Spencer Vacuum Cleaners.

Turbine, or multistage fan type exhausters, of the wide clearance, constant potential, low velocity type. Motors direct connected; no belts or gears. No water or sewer connections required.

Current consumption varies in direct proportion to work being done, through inherent self-governing characteristics of turbine.

Simplicity of design, and high grade construction insures low maintenance cost.

Turbine, with extremely wide clearances, and absolutely no close fitting parts, is ideal type of exhauster for handling dirt-laden air. No cloth bags or screens.

Entire system designed to produce correct air stream conditions, to do universal vacuum cleaning with uniform efficiency, speed and thoroughness.

Superiority of cleaning implements and accessories universally acknowledged. All floor tools provided with completely controllable swivel, enabling the operator to reach the dirt with ease and rapidity.

SIZES AND TYPES—Spencer cleaners are manufactured in sizes suitable for all buildings, from smallest residences, to largest skyscrapers, hotels, factories, and business buildings.

Particularly adapted for school buildings. Central plants installed for cleaning entire group of college or similar buildings.

SERVICE—The engineering department is glad to co-operate with engineers or architects in laying out piping systems, drawing specifications or submitting recommendations regarding any vacuum cleaning problems.

REFERENCES—The finest examples of all kinds of buildings throughout the country are equipped with Spencer systems.

Write for list and complete information.

Catalogues.**DRYING APPARATUS:**

- 220. Lumber Drying
- 243. Paper Drying

HEATING AND VENTILATING:

- 228. Multivane Fans
- 238. Multivane Fans; Performance Charts
- 230. Heaters
- 227. Heating and Ventilating Layouts; Blue Print Book
- 149. Disc Propeller Fans
- 201. Electric Dust Blowing Sets
- 237. Ready-To-Run Ventilating Sets
- 1011. Heating and Ventilating Factories
- 1012. Heating and Ventilating Schools
- 1013. Heating and Ventilating Public Buildings
- 1014. Heating and Ventilating; Book Complete

MECHANICAL DRAFT:

- 236. Forced Draft Fans
- 224. Turbo Undergrate Blowers, Design 3
- 98. Treatise on Mechanical Draft
- 256. Steam Turbines
- 217. D. C. Type "D" Motors
- 259. Vertical Engines

PLANING MILL FANS AND DUST CONVEYING SYSTEMS:

- 185. Slow Speed, Low Power Planing Mill Exhauster
- 233. Slow Speed, Low Power Reversible and Convertible Planing Mill Exhauster, Design 6
- 261. Pneumatic Dust Collecting and Conveying Systems
- 234. Steel Plate Blowers and Exhausters
- 252. Steel Plate Fan; Performance Charts

POWER APPARATUS:

- 239. Vertical Single Cylinder Steam Engines
- 256. Steam Turbines
- 264. Electrical Apparatus
- 217. Type "D" D. C. Motors
- 239. Steam Engine Generating Sets
- 255. Gasoline Electric Generating Sets
- 256. Steam Turbine Generating Sets
- 150. Fuel Economizers
- 222. Fuel Economizers in Paper Mills
- 223. Fuel Economizers in Textile Mills

PRESSURE APPARATUS:

- 257. Positive Pressure Blowers
- 258. Design 4 and 5 Pressure Blowers
- 265. Steel Pressure Blowers
- 242. Monogram Blowers and Exhausters

VACUUM CLEANERS:

- 244. Stationary Vacuum Cleaners
- 248. Architects' Hand Book
- 1024. Portable Vacuum Cleaners

MISCELLANEOUS:

- 195. General Catalogue
- 250. Architects' and Engineers' Data Book.
Carefully prepared, giving full technical information usually required. Contains 960 pages of invaluable information covering heating and ventilating. Price \$10.00.

Publications.

The Sturtevant line is so varied, that a comprehensive presentation in one publication is undesirable. This company, has, therefore, issued a special bulletin on each particular line covering the mechanical details.

Engineering Service.

As each installation is unique, it is usually necessary that an engineer analyse the conditions before making recommendations.

The engineering staff of the B. F. STURTEVANT COMPANY has been trained to analyse all conditions and to properly apply the company's apparatus accordingly.

Consult this department, which is at the disposal of architects and others without obligation.

Sweet's Catalogue.

The following pages, devoted to a partial list of the Sturtevant line, are intended to assist engineers and architects in making specifications on the main points of Sturtevant equipment.

If more information is desired, consult the nearest sales office.

Types of Sturtevant Fans and Their Uses.

CENTRIFUGAL FANS—Multivane Fans (Design 3)—For supplying fresh air under pressure and for removing foul air. They are usually installed in connection with piping or duct work. Piping may be applied to inlet or outlet, or both.

PROPELLER FANS—Sturtevant Propeller Fan—For exhausting foul air from rooms or similar enclosed spaces. They can not be used efficiently against static pressures greater than $\frac{1}{8}$ or $\frac{3}{16}$ in. and therefore will not operate to advantage with long piping or ducts. They are usually installed in a wall, window or ceiling.

DISC FANS—Sturtevant Disc Fans—For the same classes of service as propeller fans, except that they work efficiently against static pressures as high as $\frac{1}{4}$ or $\frac{3}{8}$ in. and are used with slightly reduced efficiency for pressures up to $\frac{1}{2}$ in.

Choice of Size of Fan.

AIR CHANGES—The tables herein give the volume of air per minute delivered by each fan.

Where a fan must run noiselessly, as in sleeping rooms, low speed fans are recommended. If a fan is so placed that a slight noise is not objectionable, it can run at a higher speed and a larger volume of air handled by the same fan.

In making a choice of fan, the air changes for various types of rooms must be first considered. These changes are shown in the following table:

AIR CHANGES FOR VARIOUS TYPES OF ROOMS

Kind of Room	Number of minutes in which air should be changed completely
Office	8 to 12
Toilet	5 " 7
Kitchens	3 " 5
Lodge room	5 " 7
Theater	8 " 15
Paper mill machine room	8 " 12
Foundry	12 " 18
Cotton mill and machineries	15 " 20
Assembly hall	10 " 15
Smoking room	2 " 4

NOTE—Owing to the wide variation in the ratio of the number of occupants to the size of the room, calculations for offices, schoolrooms, theaters, and assembly halls made according to the above figures should be checked on a basis of air supply per occupant, as crowded rooms may require more air than would be afforded by the above air changes. Good practice recommends 30 cu. ft. per minute for each occupant of an office, or schoolroom, and 20 cu. ft. for theaters and assembly halls. To be on the safe side, the larger fan determined by these methods should be used.

CALCULATION OF STATIC PRESSURES—The resistance of heating systems in inches of water, or static pressure

RESISTANCE OF HEATING SYSTEMS IN INCHES OF WATER OR STATIC PRESSURE AGAINST WHICH FAN MUST WORK

Details of Systems	Static resistance in inches of water—air at 60°
Ordinary resistance for public building ventilation without heaters. Systems well proportioned	$\frac{1}{4}$ in.
Maximum resistance for public building ventilation with complex systems and without heaters. Minimum resistance for public building heating without air washers	$\frac{1}{2}$ in.
Ordinary resistance for public building heating systems, theaters, without air washers. Minimum resistance for public building heating systems with air washers	$\frac{3}{4}$ in.
Ordinary resistance for public building heating systems with air washers	$\frac{7}{8}$ in.
Maximum resistance for public building heating systems with air washers. Minimum resistance for factory heating systems	1 in.
Ordinary resistance for factory and roundhouse heating systems	$1\frac{1}{4}$ in.
Maximum resistance for factory and roundhouse heating systems	$1\frac{1}{2}$ in.

In the above, the term "public buildings" includes schools, theaters, office buildings, hotels, etc. The resistance above is the maintained resistance of the system, that is, the sum of the static pressures on both the inlet and outlet sides of the fan.

sure against which the fan must work, is next considered. The resistance shown in table is the maintained resistance of the system, that is, the sum of the static pressures on both the inlet and outlet sides of the fans.

As propeller fans operate wide open or against no resistance, static pressures are disregarded. In the selection of disc and multivane fans, static pressure is taken into consideration.

Sturtevant Multivane Fans (Design 3).

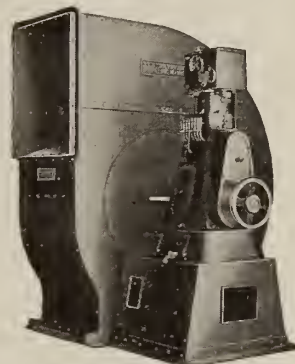
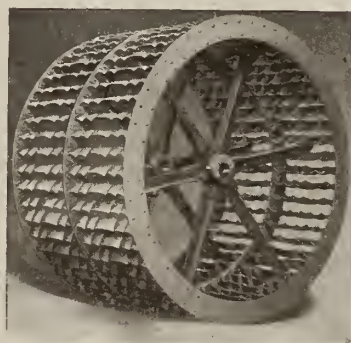
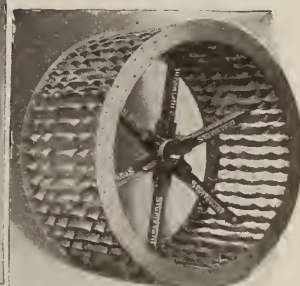
The most efficient commercial fans on the market. Service tests under the most trying conditions have proved conclusively that they will deliver a given amount of air at a given pressure at an expenditure of considerably less power than other types.

They occupy small space and their light weight permits them to be suspended from ceilings or supported by structural iron work.

The great rigidity of their construction makes them very durable and they may be depended upon for long service, with minimum repairs.

The compactness of these fans is of great value, as they may be placed in positions impossible for other types.

Made in overhung wheel, overhung pulley, full housed and seven-eighths housed types, for direct connection to motors, steam turbines, and high speed engines.

**STURTEVANT OVERHUNG WHEEL MULTIVANE FAN (DESIGN 3)****STURTEVANT ELECTRIC MULTIVANE FAN, FULL HOUSED, OVERHUNG WHEEL****STURTEVANT SINGLE WIDTH MULTIVANE FAN, FULL HOUSING, DIRECT CONNECTED TO STURTEVANT VS-7 ENGINE****WHEEL FOR LARGE SIZE MULTIVANE FANS**
Showing double spider and third annular ring**WHEEL FOR MEDIUM SIZE MULTIVANE FANS**

How to Specify Multivane Fans.

GENERAL—Furnish a Multivane Fan that shall be made (single or double) inlet, (single or double) width, (right or left) and, discharge and have (full or seven-eighths) housing.

Wheels shall be not less than in. diameter.

Outlet shall be in. by in.; diameter of the inlet shall be in., total height of the fan housing shall be in.; width in direction of shaft in., and length transverse to shaft in.

Fan shall have a capacity of cu. ft. per minute against a resistance of in. water gage either at the inlet or at the outlet (or at both, taking the sum) and shall operate at approximately r.p.m., requiring approximately b.h.p.

HOUSING—Housing shall be of spiral form constructed of steel plate strongly braced, bolted and riveted to a rigid frame of angle iron.

Side plates and round-about sheet shall be made of No. 11-gage for fans above 45 in. high. The smaller sizes shall have these parts made of No. 14-gage plate.

Outlet shall be rectangular in shape and consist of angle irons bolted to the housing and arranged for connection to a discharge duct.

Inlet shall be of cone shape and so constructed as to allow the wheel to be taken out through the opening caused by the removal of the cone. In the single inlet fan the side opposite the inlet shall be closed by a dished plate bolted to the side of the housing.

Cut-off piece shall be made of a sheet bent 180° upon itself and having the two ends bolted to the spiral sheet, thus leaving no edges of metal which can in any way be acted upon by the air issuing from the outlet so as to produce vibration, and therefore, noise at this point.

VOLUMES AND PRESSURES OF DESIGN 3 SINGLE INLET MULTIVANE FANS

(Table is greatly condensed, but gives a general idea of size fan necessary.)

Volumes and horsepower shown are correct for fans discharging air at 65° Fahr., and density .075 lb. per cu. ft. against continuously maintained resistance

Fan size	¼-in. S. P.			⅜-in. S. P.			½-in. S. P.			⅝-in. S. P.			¾-in. S. P.			⅞-in. S. P.			1-in. S. P.			1¼-in. S. P.			1½-in. S. P.		
	Vol.	r.p.m.	h.p.	Vol.	r.p.m.	h.p.	Vol.	r.p.m.	h.p.	Vol.	r.p.m.	h.p.	Vol.	r.p.m.	h.p.	Vol.	r.p.m.	h.p.	Vol.	r.p.m.	h.p.	Vol.	r.p.m.	h.p.	Vol.	r.p.m.	h.p.
4	1750	314	0.130	2290	392	0.27	2920	470	0.495	2170	470	0.37	3740	588	0.99	2170	549	0.55	1950	588	0.53	4640	745	1.95	3800	745	1.60
	2340	353	0.225	3340	470	0.57	3450	510	0.69	3000	510	0.59	4260	627	1.30	3310	588	0.87	3510	627	1.05	5170	785	2.45	5200	824	2.70
	2820	392	0.35	3760	510	0.76	3920	549	0.92	3590	549	0.83	4750	666	1.65	3930	627	1.20	4150	666	1.40	6120	862	3.55	6210	901	3.9
	3230	431	0.465	4160	549	0.97	4340	588	1.15	4070	588	1.10	5150	705	2.00	4470	666	1.55	5630	785	2.70	6560	901	4.1	7120	980	5.3
5	2390	269	0.180	3120	336	0.365	3040	370	0.43	2960	404	0.50	5100	504	1.35	2960	470	0.75	2660	504	0.72	4210	571	1.45	5190	639	2.20
	3190	302	0.305	3900	370	0.56	3980	404	0.67	4100	437	0.81	5810	538	1.75	4510	504	1.20	4780	538	1.45	5460	605	2.05	7080	705	3.70
	3840	336	0.46	4550	404	0.78	4700	437	0.94	4900	470	1.15	6480	571	2.20	5360	538	1.65	5650	571	1.90	7050	672	3.35	8470	773	5.3
	4410	370	0.63	5130	437	1.05	5450	470	1.25	5560	504	1.50	7030	605	2.70	6100	571	2.10	6320	605	2.45	7740	705	4.05	9100	807	6.2
6	4160	265	0.40	4070	294	0.475	5200	353	0.88	3870	353	0.66	3830	382	0.78	3860	412	0.98	3460	441	0.94	5500	509	1.85	6760	559	2.9
	5000	294	0.60	5940	353	1.00	6140	382	1.25	5350	382	1.05	5450	412	1.25	5890	441	1.55	6250	470	1.85	7130	529	2.70	9240	618	4.8
	5750	324	0.83	6700	382	1.35	6970	412	1.65	6390	412	1.50	6640	441	1.75	7000	470	2.15	7370	500	2.50	8250	559	3.50	10200	647	5.8
	6430	353	1.10	7400	412	1.75	7720	441	2.05	7250	441	1.95	7590	470	2.30	7950	500	2.70	8310	529	3.20	9200	588	4.35	11100	676	6.9
6½	3940	209	0.295	6420	288	0.92	5010	288	0.71	4890	314	0.83	6880	366	1.60	4880	366	1.25	4380	392	1.20	6950	444	2.35	8550	496	3.60
	5260	235	0.50	7500	314	1.30	6570	314	1.10	6760	340	1.35	8420	392	2.25	7450	392	1.95	7890	418	2.35	9010	470	3.4	10300	523	4.85
	6330	262	0.76	8460	340	1.70	7760	340	1.55	8070	366	1.85	9600	412	2.90	8840	412	2.70	9320	444	3.15	11600	523	5.5	12900	575	7.4
	7260	288	1.05	9360	366	2.20	8820	366	2.05	9170	392	2.45	10700	444	3.65	10100	444	3.45	10500	470	4.0	12800	549	6.7	14000	601	8.8
7	4860	188	0.365	6360	235	0.74	8110	282	1.40	6040	282	1.05	5970	306	1.20	6020	329	1.50	5400	353	1.45	8570	400	2.9	2360	424	1.45
	6500	212	0.62	7930	259	1.15	9580	306	1.90	8340	306	1.65	8500	329	1.95	9200	353	2.45	9750	376	2.90	11100	424	4.2	10600	447	4.45
	7820	235	0.93	9270	282	1.60	10900	329	2.55	9960	329	2.30	10400	353	2.75	10900	376	3.35	11500	400	3.90	12900	447	5.5	14400	494	7.5
	8970	259	1.30	10500	306	2.10	12100	353	3.20	11300	353	3.05	11800	376	3.6	12400	400	4.25	13000	424	4.95	14400	471	6.8	15900	517	9.1
8	7000	157	0.52	9160	196	1.05	8920	216	1.25	12000	255	2.35	8610	255	1.75	8680	275	2.2	7800	294	2.1	12400	333	4.2	3400	353	2.1
	9350	177	0.90	11400	216	1.65	11700	235	2.00	14400	275	2.30	12300	275	2.20	13300	294	3.5	14000	314	4.2	16000	353	6.1	15200	373	6.4
	11300	196	1.35	13400	235	2.30	13800	255	2.75	15000	294	4.35	15000	294	3.95	15700	314	4.8	16600	333	5.6	18600	373	7.9	18300	392	8.6
	12900	216	1.85	15100	255	3.05	15700	275	3.65	18100	314	5.5	17100	314	5.2	17900	333	6.1	18700	353	7.2	20700	392	9.8	20800	412	11.0
9	9530	134	0.71	12500	168	1.45	12200	185	1.70	11830	202	2.00	11700	219	2.4	11800	235	3.00	10600	252	2.85	16800	286	5.7	4610	303	2.85
	12700	151	1.20	15600	185	2.20	15900	202	2.70	16400	219	3.25	16700	235	3.8	18000	252	4.75	19100	269	5.7	21800	303	8.3	20700	319	8.81
	15300	168	1.85	18200	202	3.10	18800	219	3.75	19500	235	4.5	20400	252	5.4	21400	269	6.6	22600	286	7.7	25200	319	10.5	2490	333	11.5
	17600	185	2.55	20500	219	4.15	21400	235	5.00	22200	252	5.9	23200	269	7.0	24300	286	8.3	25400	303	9.7	28200	336	13.5	28300	353	14.5
10	12500	118	0.93	16300	147	1.90	15900	162	2.25	15500	176	2.65	15300	191	3.1	15400	206	3.9	13900	221	3.75	22000	250	7.5	27000	280	11.5
	16600	132	1.6	20300	162	2.90	20800	176	3.5	21400	191	4.2	21800	206	5.0	23600	221	6.2	25000	235	7.5	28500	265	11.0	32600	294	15.5
	20000	147	2.4	23800	176	4.05	24600	191	4.9	25500	206	5.9	26600	221	7.1	28000	235	8.6	29500	250	10.0	33000	280	14.0	37000	309	19.0
	23000	162	3.3	26800	191	5.4	27900	206	6.5	29000	221	7.8	30400	235	9.2	31800	250	11.0	33300	265	12.5	36800	294	17.5	40600	324	23.5
11	15800	105	1.2	20600	131	2.4	20100	144	2.85	27000	170	5.3	19400	170	3.95	19500	183	4.95	17500	196	4.75	27800	222	9.5	41200	262	19.5
	21000	118	2.0	25700	144	3.7	26300	157	4.45	32300	183	7.5	27600	183	6.3	29800	196	7.9	31600	209	9.5	36000	235	13.5	46700	275	24.
	25300	131	3.0	30100	157	5.2	31000	170	6.2	36700	196	9.8	33700	196	8.9	35400	209	11.0	37300	222	15.2	41700	248	17.5	51400	288	29.
	29100	144	4.2	33900	170	6.8	35300	183	8.2	40700	209	12.5	38400	209	11.5	40200	222	13.5	42000	235	16.	46600	262	22.	55900	301	35.
12	19400	94	1.45	25400	118	2.95	24800	129	3.5	24100	141	4.1	23900	153	4.85	24100	165	6.1	21600	177	5.9	34300	200	11.5	42200	224	18.
	26000	106	2.50	31700	129	4.55	32500	141	5.5	33400	153	6.6	34000	165	7.8	36800	177	9.7	39000	188	11.5	44500	212	17.	50900	235	24.
	31200	118	3.75	37100	141	6.4	38300	153	7.7	39800	165	9.2	41500	177	11.0	43600	188	13.5	46000	200	15.5	51500	224	22.	57600	247	30.
	35900	129	5.2	41800	153	8.4	43500	165	10.0	45300	177	12.0	47400	188	14.5	49600	200	17.	51900	212	20.0	57500	235	27.	63500	259	36.
13	23600	86	1.75	30800	107	3.6	30000	118	4.3	29300	128	5.0	29000	139	5.9	29200	150	7.4	26200	160	7.1	41600	182	14.0	51300	203	21.5
	31000	96	3.0	38500	118	5.5	39400	128	6.7	40500	139	8.0	41200	150	9.5	44200	160	12.0	47300	171	14.	54000	193	20.5	61700	214	29.
	37900	107	4.5	45000	128	7.7	46500	139	9.3	48400	150	11.0	50500	160	13.5	53000	171	16.0	55900	182	19.	62500	203	26.	70000	225	36.
	43500	118	6.3	50700	139	10.0	52900	150	12.5	55000	160	14.5	57500	170	17.5	60300	182	20.5	63000	193	24.	69700	214	33.	77000	236	44.
14	28000	78	2.1	36700	98	4.3	35700	108	5.1	34800	118	5.9	34500	128	7.0	34800	137	8.8	31200	147	8.4	49400	167	17.0	60900	186	26.
	37400	88	3.6	45800	108	6.5	46800	118	7.9	48100	128	9.5	49000	137	11.5	53000	147	14.0	56100	157	17.0	64100	177	24.5	73400	196	34.
	45000	98	5.4	53500	118	9.2	55200	128	11.0	57500	137	13.5	59900	147	16.0	63000	157	19.5	66400	167	22.5	74300	186	31.	83100	206	43.
	51800	108	7.5	60300	128	12.0	62800	137	14.5	65300	147	17.5	68300	157	20.5	71600	167	24.5	74900	177	29.	82900	196	39.	91500	216	52.
15	32800	72	2.45	43000	91	5.0	41800	99	5.9	40800	109	6.9	40400	118	8.2	40700	127	10.5	36500	136	9.9	57900	154	19.5	71300	172	30.
	44000	81	4.2	536																							

Sturtevant Propeller Fans.

Developed for all conceivable exhaust conditions—for operation in rooms filled with steam, gases, smoke, etc., and are usually installed in a wall, window, or ceiling.

Their advantages are: freedom from noise, great mechanical strength and satisfactory service. Motors are amply large for the work required.

These fans are not designed for operation against static pressure, thus they are not applied in connection with piping systems or ducts.



STURTEVANT ELECTRIC PROPELLER FAN WITH ENCLOSED BI-POLAR MOTOR



STURTEVANT PULLEY PROPELLER FAN

How to Specify Propeller Fans.

There shall be furnished an ... in. propeller fan. Total length of the fan in the direction of the shaft shall be ... in. and the total over all diameter, ... in. Fan shall have a capacity of ... cu. ft. per minute and shall operate at approximately ... r.p.m., requiring approximately ... b.h.p.

Thimble shall be made of cast iron in sizes up to and including 42 in. and of steel plate in larger sizes. There shall be bolted to the flange of the thimble three arms to support the motor and the fan wheel, which latter shall be overhung on the extended motor shaft.

Motor shall be built to operate on current volts, cycles, phase.

DATA, ELECTRIC PROPELLER FANS

D. C., 115, 230 AND 550 VOLTS						A. C., 110 AND 220 VOLTS, SINGLE-PHASE 60 CYCLES: 110, 220, 440 AND 550 VOLTS, POLYPHASE					
Cu. ft. air deld. per min.	Fan size in.	R. p. m.	Shaft h. p.	Dimensions, in.		Cu. ft. air deld. per min.	Fan size in.	R. p. m.	Shaft h. p.	Dimensions, in.	
				Length	Outside diam.					Length	Outside diam.
1800	18	800	.037	14	23	2000	18	900	.052	12	23
2250	18	1000	.072	14	23	2700	18	1200	.124	12	23
3150	24	600	.065	14	31	3200	24	600	.065	15	31
4200	24	800	.154	19	31	4800	24	900	.22	15	31
5150	30	500	.116	19	38	6200	30	600	.199	18	38
6950	30	675	.284	22	38	7400	30	720	.344	18	38
7550	36	425	.176	23	44	8000	36	450	.209	22	44
9750	36	550	.382	26	44	10600	36	600	.495	22	44
9900	42	350	.213	26	52	10100	36	360	.232	24	52
13200	42	470	.514	30	52	12700	42	400	.453	24	52
12600	48	300	.261	30	59	19000	48	450	.880	25	59
17200	48	410	.667	34	59	21600	54	300	.819	27	66
15600	54	260	.307	34	66						
21800	54	365	.849	25	66						
19300	60	235	.383	26	71						
26700	60	325	1.02	26	71						
22800	66	210	.44	26½	78						
32700	66	300	1.29	26½	78						
27600	72	195	.55	27	84						
39000	72	275	1.54	30½	84						
32400	78	180	.64	26½	91						
45800	78	255	1.79	31	91						
37100	84	165	.71	29	99						
52800	84	235	2.07	32	99						

Volumes and horsepowers are for fans operating wide open, in other words, against no resistance.
D. C. fans furnished with regulating rheostats for 50% reduction in speed by armature control.
Motors are of the enclosed type described on page 1001

Sturtevant Disc Fans (Design 2).

Used for exhausting or supplying large volumes of air against low resistance—where the resistance encountered is more than that against which a propeller fan will efficiently operate, and where the resistance is less than that for which centrifugal fans are adapted. Designed to stand on the floor, but can be easily installed in wall or window, as in the case of a propeller fan.



STURTEVANT DISC FAN (DESIGN 2)

How to Specify Disc Fans.

There shall be furnished a disc fan having a capacity of ... cu. ft. per minute against a resistance of in. water gage and shall operate at approximately r.p.m., requiring approximately ... b.h.p. Wheel shall have 12 floats, firmly riveted to the hub. To give additional strength, sizes 42 in. and larger shall have each float braced with supports extending from a special ring on the hub to a point near the outer end of the float. Casing shall consist of steel plate of No. ... gage, suitably supported with angle irons on both inlet and outlet sides. Removable feet shall be bolted to the fan casing.

DATA, DISC FANS (DESIGN 2)

D. C., 115, 230 AND 550 VOLTS										A. C., 2- AND 3-PHASE, 110, 220, 440 AND 550 VOLTS, 60 CYCLES									
Cu. ft. air deld. per min.	Fan size, outside diam. wheel, in.	R. p. m.	Shaft h. p.	Over all dimensions, in.			Cu. ft. air deld. per min.	Fan size, outside diam. wheel, in.	R. p. m.	Shaft h. p.	Over all dimensions, in.								
				Length	Width	Height					Length	Width	Height						
FREE DISCHARGE																			
5600	18	1700	.84	26	20	21	5940	18	1800	1.00	23	20	21						
9920	24	1273	1.5	30	26	27	9300	24	1200	1.25	26	26	27						
15500	30	1020	2.35	32	34	35	13700	30	900	1.55	29	34	35						
22400	36	849	3.4	35	40	41	18900	36	720	2.00	31	40	41						
30400	42	727	4.6	38	46	48	25200	42	600	2.6	35	46	48						
39600	48	637	6.0	43	52	54	37100	48	600	4.95	40	52	54						
50239	54	566	7.6	48	58	60	40100	54	450	3.82	43	58	60						
62000	60	510	9.4	54	65	68	56500	60	450	6.4	46	65	68						
75000	66	462	11.5	61	72	75	72650	66	450	10.4	51	72	75						
89300	72	425	13.5	71	78	81	95000	72	450	16.0	59	78	81						
122000	84	364	18.5	66	91	95	150000	84	450	35.0	68	91	95						
STATIC PRESSURE ¼ IN.																			
2680	18	1328	.42	26	20	21	2070	18	1200	.319	21	20	21						
4750	24	996	.74	26	26	27	3670	24	900	.572	24	26	27						
7440	30	796	1.15	32	34	35	5780	30	720	.90	29	34	35						
10700	36	663	1.65	33	40	41	8280	36	600	1.29	31	40	41						
14600	42	569	2.25	36	46	48	7820	42	450	1.26	35	46	48						
19000	48	498	3.0	39	52	54	15000	48	450	2.3	37	52	54						
21100	54	442	3.75	42	58	60	25100	54	450	3.95	43	58	60						
29700	60	398	4.65	45	65	68													
36000	66	361	5.6	53	72	75													
42800	72	331	6.7	46	78	81													
58300	84	284	9.1	49	91	95													
STATIC PRESSURE ⅜ IN.																			
2590	18	1485	.59	26	20	21	1500	18	1200	.36	21	20	21						
4600	24	1114	1.05	26	26	27	2590	24	900	.64	24	26	27						
7200	30	891	1.65	32	34	35	7300	30	900	1.7	29	34	35						
10400	36	743	2.35	33	40	41	9500	36	720	2.2	34	40	41						
14100	42	636	3.2	36	46	48	12100	42	600	2.9	35	46	48						
18400	48	557	4.15	41	52	54	10340	48	450	2.55	37	52	54						
23300	54	495	5.3	44	58	60	18000	54	450	4.25	43	58	60						
28800	60	446	6.5	50	65	68	29500	60	450	6.7	46	65	68						
34800	66	405	7.9	57	72	75													
41400	72	371	9.4	60	78	81													
56400	84	318	12.5	53	91	95													
Volumes and horsepowers shown are correct for fans discharging air at 65° Fahr., and density .075 lb. per cu. ft. against continuously maintained resistance.																			
Alternating current fans for other frequencies and direct current fans for other speeds, volumes and pressures can be furnished.																			
Motors are of the enclosed type described on page 1001																			

Sturtevant Steel Pressure Blowers.

Designed for all purposes where pressures up to 16 oz. per sq. in. are to be maintained and for forcing air for long distances.

These blowers may be driven by belts from a line shaft or from engine, motor or turbine, or may be driven direct connected to an electric motor, steam engine or steam turbine.

See description of Sturtevant engines, turbines, and motors on page 1001.

Sturtevant steel pressure blowers are used for supplying air blast to cupolas, forges, and to oil, gas and pulverized fuel burners.

They are also used for blowing scale from hammers, furnishing air blast for ventilating and cooling, and draft for coke and coal fires.

Under usual operating conditions, 500 cu. ft. of air per minute are required per ton capacity of cupola. The pressure ranges with the size of the cupola from 12 to 28 in. (7 in. to 16 oz.).

For forge blowing, it is usual to allow from 40 to 60 cu. ft. of air per minute for each sq. in. of tuyere area. The pressure required at the forge averages about 7 in. of water. In small forges, it sometimes drops as low as 4 in. and in large forges it may go as high as 10 or 12 in.

Standard arrangement is bottom horizontal discharge with pulley on the right hand side, as one faces blower outlet. Other hands and discharges can be supplied if required. Steel pressure blowers are also furnished direct connected to electric motors and steam turbines.

The following capacity table is much condensed, but gives a general idea of the size fan required for various conditions.

Wheels are accurately balanced and run smoothly when driven at high-est speeds.

Journal bearings are of unusual length, which makes possible sustained operation for long periods.

Each bearing is cast in a single piece and lined with Sturtevant white metal, which is carefully bored and of great length with efficient oiling features. These bearings are practically non-heating and of great durability.



STURTEVANT STEEL PRES-SURE BLOWER

DATA, STEEL PRESSURE BLOWERS

Size	Capacities						Diam. wheel	Outside diam.- outlet, in.	Extreme dimensions, in.		
	R. p. m.	C. f. m.	H. p.	R. p. m.	C. f. m.	H. p.			Length	Width	Height
0000	6770	376	.9	9450	538	2.5	7 1/2	23 1/2	10 1/4	9 3/4	12
00	5240	618	1.4	7320	874	4.1	9 1/2	31 1/2	13 1/2	12 3/4	15 1/2
0	4450	780	1.8	6210	1103	5.1	10 3/4	4 1/2	15 1/2	14 1/4	18 1/2
1	3900	900	2.1	5450	1251	5.9	12 1/2	47 1/2	18	16 1/2	20 1/2
2	3280	1075	2.5	4600	1480	7.0	14 1/2	53 1/2	21	18	24
3	2810	1500	3.4	3930	2085	9.8	17	61 1/2	24 1/4	20 3/4	28 1/2
4	2450	1615	3.9	3420	2260	10.6	19 1/2	78 1/2	28 1/2	25 3/4	33 1/2
5	2100	1990	4.6	2935	2800	13.2	22 3/4	87 3/4	34	29 3/4	39 1/2
6	1920	2555	5.7	2670	3600	16.8	25	101 1/4	39 1/4	34 1/4	45 3/4
7	1540	4225	10.0	2155	5900	27.9	31	12	45 3/4	41	51 1/2
8	1345	6215	14.7	1880	8700	41.0	35 1/2	137 1/2	52	46	59
9	1160	7240	17.0	1620	10000	47.5	41 1/4	16	60 1/2	51 1/2	69 3/4
10	1015	14770	34.0	1420	20600	96.8	47	18 1/2	70	60 3/4	80 1/2

Sturtevant Monogram Fans, Blowers and Exhausters.

The range of service of these units is midway between Sturtevant multivane fans and Sturtevant steel pressure blowers previously described.

The Monogram is distinctly a volume fan, handling air in greatly increased volume over the higher pressure types, while operating at lower pressures.

They will efficiently deliver large volumes of air at pressures of from 3 to 10 in. of water, but can be used for pressures as low as 1 or 2 in. and as high as 14 in.

Especially adapted for ventilating, for exhausting chemical fumes, for use with hot blast heater units, for drying systems and for supplying blast to forges and furnaces. In addition to these uses, the smaller sizes find a broad field of service in industrial work, being very largely adopted for dust collecting.

These units may be driven by belts from line shaft or from engine, motor or turbine, or may be driven direct connected to electric motor, steam engine or steam turbine.

See description of Sturtevant engines, turbines, and motors on page 1001.

Casing is of cast iron, cast in 2 sections and bolted together. Blast wheel is of the side plate type for all ordinary applications, but special wheels can be fitted to meet varying conditions. Bearings are ample in size, thoroughly lubricated and lined with Sturtevant white metal.

Monogram fans are built either as blowers or ex-hausters, and are regularly built with bottom horizontal discharge in all sizes and with up-blast discharge in sizes 3 to 10 inclusive. They can be built with down-blast or horizontal discharge as desired.

Monogram blowers are regularly built right hand, but can be built left hand if de-sired. Monogram exhausters are regu-larly built both hands.

Blowers may be equipped with adjustable bed with telescopic outlet. Sizes 4 to 10 are the only sizes regularly fitted with adjustable beds, but other sizes can be so fit-ted, if desired. Exhausters are not used with adjust-able beds.



STURTEVANT MONOGRAM EXHAUSTER

DATA, MONOGRAM EXHAUSTERS

Size	Capacities						Diam. wheel, in.	Outside diam. inlet, in.	Outside diam. outlet, in.	Extreme di- mensions, in.		
	R. p. m.	C. f. m.	H. p.	R. p. m.	C. f. m.	H. p.						
0000	4640	90	.08	6530	130	.23	6	3 3/8	2 3/4	9 5/8	8 1/8	10
00	3370	198	.16	4750	267	.49	8 1/4	4 7/8	4 1/8	14 3/8	12 3/8	14 1/4
0	2855	373	.33	4020	525	.91	9 3/4	5 3/4	4 3/4	17 3/8	14 3/8	16 3/8
1	2560	532	.46	3600	746	1.3	10 7/8	6 1/2	5 3/4	19 3/8	16 3/8	19 3/8
2	2270	775	.67	3200	1090	1.9	12 1/4	7 1/2	7 1/2	24 3/4	18 3/4	22 3/4
3	1885	1090	.97	2655	1537	2.7	14 3/4	9	9	28 3/4	21 3/4	26 3/4
4	1590	1502	1.3	2240	2113	3.8	17 1/2	10 1/2	10 1/2	32 3/4	24 3/4	31
5	1390	2090	1.8	1960	2950	5.2	20	12 1/4	12 1/4	37 3/8	28 3/8	36 1/4
6	1185	3356	2.9	1665	4735	8.4	23 1/2	15	14 3/4	43 3/4	32 3/4	41 3/4
7	1030	4757	4.3	1450	6700	11.8	27	16 3/8	16 3/8	50	38 1/4	50
8	900	6498	5.7	1265	9153	16.2	31	18 3/4	18 3/4	56 3/4	45 3/4	56 3/4
9	695	10113	8.9	980	14238	25.1	40	21 3/4	21 3/4	64 1/4	50 3/4	65 3/4
10	605	14690	12.9	850	20679	36.6	46	24 3/4	24 3/4	75	60 3/4	77 3/4

Sturtevant High Pressure Blowers.

Designed for delivering air or gas at pressure of from 1 to 5 lbs. per sq. in.

They are of the rotary or positive type and are especially adapted for furnishing blasts for cupolas, gas and oil burner furnaces, cement kilns, annealing and smelting furnaces, steel converters, puddling furnaces, forges using either coal, oil or gas, for agitating and aerating liquids, for cooling processes and for all work requiring blasts up to 5 lbs. per sq. in. Used as exhausters, they create the necessary vacuum for pneumatic conveying service, for the manufacture of coal gas and for many other applications.

One of the principal advantages of this design of blower is that the pulsations so common in many types of positive blowers are almost unnoticeable in the Sturtevant high pressure blower. This is especially valuable when the blower is to be used in the manufacture of gas or in producing blasts for use in gas or oil furnaces.

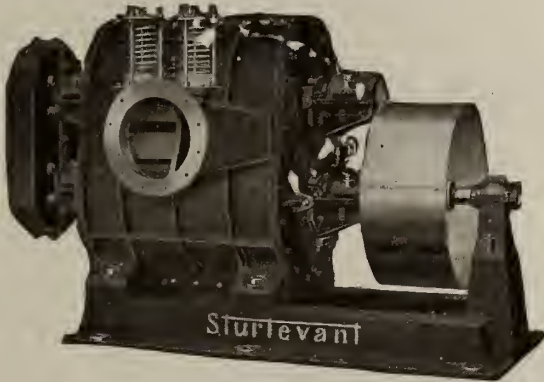
On either side of casing is an opening flanged and fitted for standard gas pipe fittings.

As the casing is symmetrical, rotors may be operated in either direction, and the openings in the casing are thereby used either as a discharge or inlet, depending upon the direction of rotation of the rotors.

The rotors never come in contact, and so ample is the clearance between the 2 rotors and between the rotors and casing that it is practically impossible to cause them to come in contact.

No internal lubrication is necessary, entirely eliminating the tendency present in some positive blowers to force the oil used in their internal lubrication through the pipes, causing trouble in many classes of work.

High grade construction and materials, accurate workmanship and simplicity of design makes this blower capable of continuous operation for long periods with little attention.



STURTEVANT HIGH PRESSURE BLOWER
With pulley and outboard bearing

Size	Capacities						Inside diam. inlet, in.	Inside diam. outlet, in.	Extreme dimensions, in.*		
	R. p. m.	C. f. m.	H. p. *	R. p. m.	C. f. m.	H. p.			Length	Width	Height
00	375	5	.2	800	25	.5	1 1/2	1 1/2	17	8 3/4	9 7/8
0	300	30	.5	700	85	1.3	2 1/2	2 1/2	26	13	13 3/4
1	250	70	1.3	600	200	3.0	3	3	31 3/4	16	18 3/4
2	300	170	2.6	500	300	4.4	4	4	38 3/4	20 1/2	22 3/4
3	250	230	3.4	475	480	7.4	4	4	48 1/2	23 1/2	26
4	300	425	5.5	450	650	8.6	6	6	58 1/2	25 1/2	28 3/4
5	260	575	7.2	450	1050	13.5	8	8	59	31 1/2	34
6	300	1020	12.3	425	1540	18.0	10	10	67 3/4	32	39
7	265	1500	17.0	410	2400	28.0	10	10	75	37	45
8	260	2300	26.0	370	3400	39.0	12	12	84	50 1/2	50 3/4
9	250	3300	37.0	350	4700	54.0	16	16	94	53	57 1/2
10	250	4600	51.0	320	6000	69.0	16	16	103 3/4	59 1/2	63 3/4
11	215	5800	65.0	300	8200	95.0	20	20	120 1/4	71 1/2	64
12	190	8000	90.0	255	11000	125.0	24	24	136 1/2	82	75
13	160	11000	125.0	220	15000	170.0	30	30	159 3/8	96 1/2	85

Sturtevant Slow Speed Planing Mill Exhausters (Design 2).

These exhausters are the latest type of convertible, slow speed, low power exhausters for planing mill work, being especially adapted for collecting and conveying shavings, sawdust, dust and all material that may be conveyed in a current of air.

Sturtevant planing mill exhausters will convey more material at a smaller expenditure of power than those of any other manufacture.

They are designed according to correct principles and embody the results of over 50 years' experience in the manufacture of fans.

They are exceptionally sturdy in appearance, rugged in construction and meet the demand for fans which can readily be changed to either hand or to any direction of discharge.

The cone on the pulley side of the housing and the inlet ring are of cast iron, secured to the side sheets by tap bolts threaded into annular steel rings on the inside of the housing side sheet and riveted to it. This construction clamps the side sheet securely to the supporting castings besides facilitating the interchangeability of discharge.

The roundabout corner angles are on the inside of the housing and bolted to roundabout sheet so that the bolts are readily accessible.

The blast wheel has eighteen arms made of steel tees cast in a solid iron hub. A steel back plate is used to stiffen the blades. This construction together with careful balancing of the parts insures a strong wheel free from objectionable vibrations.

The bearings are self-adjustable and self-lubricating, having a large oil reservoir with brush feed, and are lined with Sturtevant white metal, hammered in. In fact, these bearings are the same pattern which this company has found satisfactory for so many years in their standard steel plate planing mill exhausters.

The long experience of the Sturtevant engineers makes them particularly competent to design and install the most efficient conveying and dust collecting systems to meet all requirements.



DESIGN NO. 2. SLOW SPEED, LOW POWER PLANING MILL EXHAUSTER

DIMENSIONS AND WEIGHTS, STURTEVANT PLANING MILL EXHAUSTERS

Size	Outside dimensions				Size	Outside dimensions			
	Outside diam. inlet, in.	Outlet, in.	Pulley diam. face, in.	Weight, lbs.		Outside diam. inlet, in.	Outlet, in.	Pulley diam. face, in.	Weight, lbs.
SINGLE									
35	18 $\frac{3}{4}$	12 $\frac{3}{4}$ x 12	10 x 5 $\frac{1}{2}$	460	60	28 $\frac{7}{8}$	21 $\frac{5}{8}$ x 19 $\frac{1}{4}$	15 x 10 $\frac{1}{2}$	1567
40	20 $\frac{3}{4}$	14 $\frac{3}{4}$ x 12 $\frac{3}{4}$	11 x 5 $\frac{1}{2}$	678	70	33 $\frac{7}{8}$	25 $\frac{3}{8}$ x 21 $\frac{7}{8}$	16 x 11 $\frac{1}{4}$	2202
45	22 $\frac{3}{4}$	16 $\frac{3}{4}$ x 14 $\frac{3}{4}$	13 x 5 $\frac{1}{2}$	882	80	38 $\frac{7}{8}$	28 $\frac{3}{8}$ x 24 $\frac{7}{8}$	20 x 12 $\frac{1}{2}$	2605
50	24 $\frac{3}{4}$	18 $\frac{3}{4}$ x 16 $\frac{3}{4}$	13 x 8 $\frac{1}{4}$	1127	90	43 $\frac{7}{8}$	32 $\frac{3}{8}$ x 27 $\frac{7}{8}$	24 x 13 $\frac{1}{2}$	3100
55	26 $\frac{3}{4}$	19 $\frac{3}{8}$ x 17 $\frac{3}{4}$	15 x 8 $\frac{1}{4}$	1343	90	43 $\frac{7}{8}$	32 $\frac{3}{8}$ x 27 $\frac{7}{8}$	24 x 13 $\frac{1}{2}$	3100
DOUBLE									
35	18 $\frac{3}{4}$	12 $\frac{3}{4}$ x 12	11 x 7	838	60	28 $\frac{7}{8}$	21 $\frac{5}{8}$ x 19 $\frac{1}{4}$	20 x 12 $\frac{1}{2}$	2645
40	20 $\frac{3}{4}$	14 $\frac{3}{4}$ x 12 $\frac{3}{4}$	12 x 7 $\frac{1}{2}$	1185	70	33 $\frac{7}{8}$	25 $\frac{3}{8}$ x 21 $\frac{7}{8}$	24 x 13 $\frac{1}{2}$	3616
45	22 $\frac{3}{4}$	16 $\frac{3}{4}$ x 14 $\frac{3}{4}$	13 x 8	1436	80	38 $\frac{7}{8}$	28 $\frac{3}{8}$ x 24 $\frac{7}{8}$	26 x 14 $\frac{1}{2}$	4251
50	24 $\frac{3}{4}$	18 $\frac{3}{4}$ x 16 $\frac{3}{4}$	14 x 8 $\frac{1}{2}$	1868	90	43 $\frac{7}{8}$	32 $\frac{3}{8}$ x 27 $\frac{7}{8}$	30 x 16 $\frac{1}{2}$	4900
55	26 $\frac{3}{4}$	18 $\frac{3}{8}$ x 17 $\frac{3}{4}$	15 x 9	2277	90	43 $\frac{7}{8}$	32 $\frac{3}{8}$ x 27 $\frac{7}{8}$	30 x 16 $\frac{1}{2}$	4900

Sturtevant Heating System.

In the Sturtevant system of heating, air is forced by a fan across steam coils and is then conveyed through ducts to all parts of the building to be heated. This arrangement is usually known as the fan or hot blast system.

AIR WASHING—Where air washing is required, the Sturtevant air washer can be installed in the Sturtevant heating system as shown on page 999.

ADVANTAGES OF THE FAN SYSTEM OF HEATING—The chief advantage of the fan system of heating over steam pipe or radiator systems is its lower cost.

Other advantages are: greater flexibility; more readily controlled and regulated; less trouble to maintain; ventilates as well as heats; much less radiating surface required; humidity can be controlled; no undesirable steam piping to disfigure building.

ADAPTABILITY TO AVAILABLE SPACE—A distinctive advantage of Sturtevant heaters is that they can be installed in floor space of any dimensions and with ceiling of any height. The total lineal feet of 1-in. pipe necessary to heat any building can readily be arranged in a heater of dimensions that will be suitable for the room in question.

Types of Sturtevant Heaters and Their Uses.

LONDON HEATER—Used where it is desired to have perfect control over the temperature of hot air supplied, regardless of outside weather conditions. Adapted to public building work, schools, etc. Individually controlled valves are provided for every section.

RETURN BEND HEATER—This type provides for individual control of sections. It may be used for the same service as the other types, the chief difference being that it has a larger free area, and sections with greater surface are built in this type than in the other types.

MITRE TYPE HEATER—Provides for individual control of sections, and either steam or hot water may be used.

Very satisfactory for all conditions of service and, on account of its superior construction, is the most expensive Sturtevant heater made.

Arrangements on Hot Blast Apparatus.

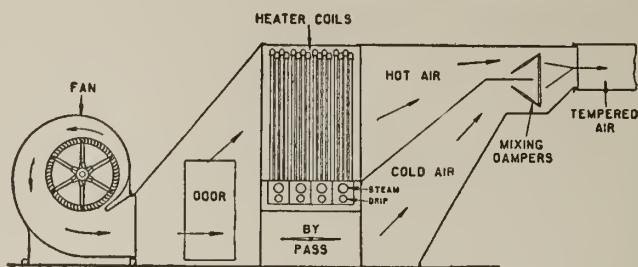
Sturtevant heaters may be installed in either "draw-through" or "blow-through" arrangement, depending upon the conditions of service.

In the former, air is drawn through the hot coils, passes through the fan and is forced through the distributing ducts. This is the usual arrangement where air of one temperature is required and is generally adopted in shop and factory heating.

Where air is required at more than one temperature, a "blow-through" rig is necessary. In this arrangement, air enters the fan first and is then blown through the heater. Dampers and a by-pass in the heater casing are so arranged that some or all of the air from the fan may be diverted around the heater and through a cold air duct (see illustration following).

A "draw-through" rig usually requires less space than a "blow-through" of the same capacity. The "draw-through" arrangement is shown in the air washer section on page 999.

Where one section is not large enough, double width, 2-way and 3-way heaters are installed.



BLOW-THROUGH HEATER WITH BY-PASS AND MIXING DAMPERS

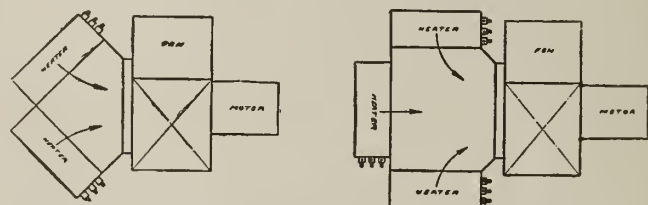
In some outfits, by-pass is above the coils

Piping and Bases of Sturtevant Heater Sections.

PIPING—All Sturtevant heater sections are made of an extra heavy 1-in. piping spaced on $2\frac{1}{8}$ - or $2\frac{3}{4}$ -in. centers.

BASES—The bases of the London and Mitre type sections are of cast iron, amply strong to withstand severe service. Being corrugated on the sides, the bases fit easily into one another and save floor space. The Sturtevant is the only heater made with a corrugated base.

The ends of the corrugated bases are so made that where a double width section is needed, 2 sections can be placed end to end and no extra space is left between the pipes of the 2 sections.



Two-way Heater Three-way Heater
SHOWING ARRANGEMENTS WHICH GIVE GREATER FREE AREA THAN CAN BE SECURED BY USING SINGLE WIDTH OR DOUBLE WIDTH HEATERS



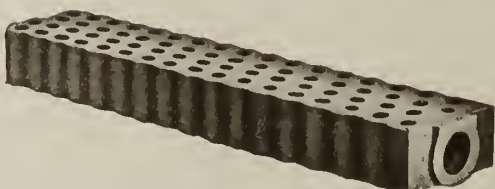
BASE OF LONDON HEATER

Hole in head accommodates through-bolt for binding sections together



BASE OF RETURN BEND HEATER

A, air vent; B, bleeder



DRIP BASE OF MITRE TYPE HEATER

Supply base is identical except that large tapping is in the back

The base of the return bend heater is of cast iron but is not corrugated. Each section is an individual unit and has supply and drip connections valved independently of the other sections.

SIZES—With the exception of the return bend heater, all bases for 1-in. pipe are made in 2 widths: 2 rows and 4 rows of pipes.

The half-width sections are generally used in connection with a number of 4-row sections, making an intermediate depth possible.

Length of bases will be found on page 996.

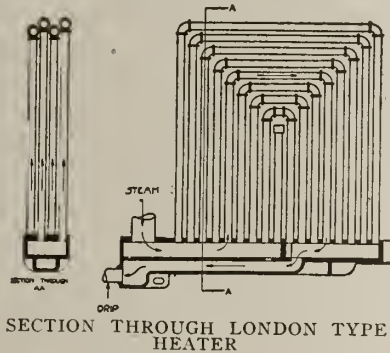
London Type Heaters.

These heaters are made with a steam supply in the top portion of the base that extends beyond the steel plate jacket that incloses the heater. The drip is tapped into the end of the extended portion of the base. With this arrangement each 2-row or 4-row section can be individually controlled.

The extended portion of the base permits tapping a supply connection large enough to permit the use of low pressure or exhaust steam without restricting the flow or causing the drop in pressure.

The drip is taken from a drainage pocket in the bottom of the section, thus complete drainage is assured.

The pipes are placed $2\frac{1}{8}$ in. apart, making a section with the free area about 5.5% of the heating surface.



How to Specify London Type Heaters.

There shall be furnished a pipe coil heater of the type, having lineal ft. of in. pipe and sq. ft. of free area. Heater shall be composed of 4-row sections and 2-row sections. All sections shall have a nominal length of ft., and nominal height of pipes shall be ft. in.

A sheet steel casing of No. gage shall be furnished, and this shall be suitably braced and stiffened.

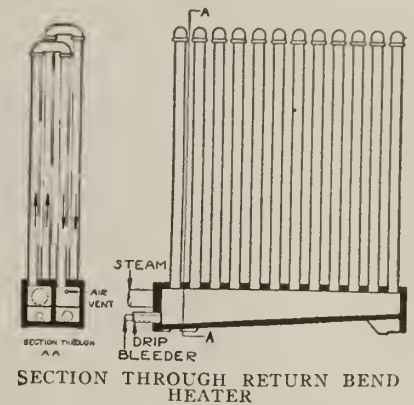
Return Bend Heaters.

The pipes in the return bend heaters are spaced $2\frac{3}{4}$ in. apart as compared to $2\frac{1}{8}$ in. spacing in the other Sturtevant heaters. This wider spacing results in a greater proportion of free area to total area, so that with the same air velocity and steam temperature a greater number of rows of pipes is required to result in the same temperature rise as in the other Sturtevant heaters. But with the same amount of heating surface, with air under given conditions and steam of given temperature, the same temperature rise in air will result in all Sturtevant heaters. The number of rows of pipes must not be confused with the amount of heating surface, as for equivalent size sections of the same number of rows there is less heating surface in the return bend type as compared to the other types.

The base of this heater is divided by a vertical partition, which separates the supply side from the drip side. As condensation takes place in the supply side as well as in the drip side, a separate drip connection called a bleeder is provided. And for best results, the bleeder connections should be led to a trap separated from the main return trap.

Each pair of vertical pipes is joined at the top with a malleable return-bend fitting. This construction is of superior design, inasmuch as it results in two less joints at the top of the pipe as compared to the method of joining the pipe by two separate elbows and a short nipple.

For sizes, dimensions, temperature rise curves, heating surfaces, free area, and designing notes, see pages 994-98.



How to Specify Return Bend Heaters.

There shall be furnished a pipe coil heater of the type, having lineal ft. of in. (1 or $1\frac{1}{4}$ in.) pipe and sq. ft. of free area. Heater shall be composed of 4-row sections and 2-row sections. All sections shall have a nominal length of ft., and nominal height of pipes shall be ft. in.

A sheet steel casing of No. gage shall be furnished, and this shall be suitably braced and stiffened.

Mitre Type Heaters.

In this type, there are 2 bases to each section. Vertical and horizontal pipes form a mitre. The steam (or hot water) is admitted to the vertical base and the water of condensation is drained from the horizontal base.

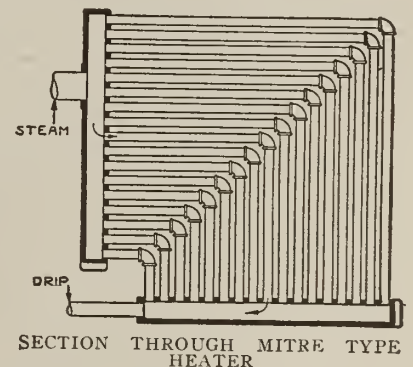
Mitre sections may be used with hot water as a heating medium because the flow of water is downward, due to the drop in temperature of the water.

When it is not advisable to depend on gravity circulation, a pump may be used to force the water through the coils.

The relative lengths of vertical and horizontal pipes vary greatly, and depend on the floor space and headroom available. If horizontal pipes are longer than 10 ft., a sheet steel diaphragm is used in the center of the pipes to keep them properly spaced and to prevent sagging.

Each Mitre section is controlled by individual supply and drip valves.

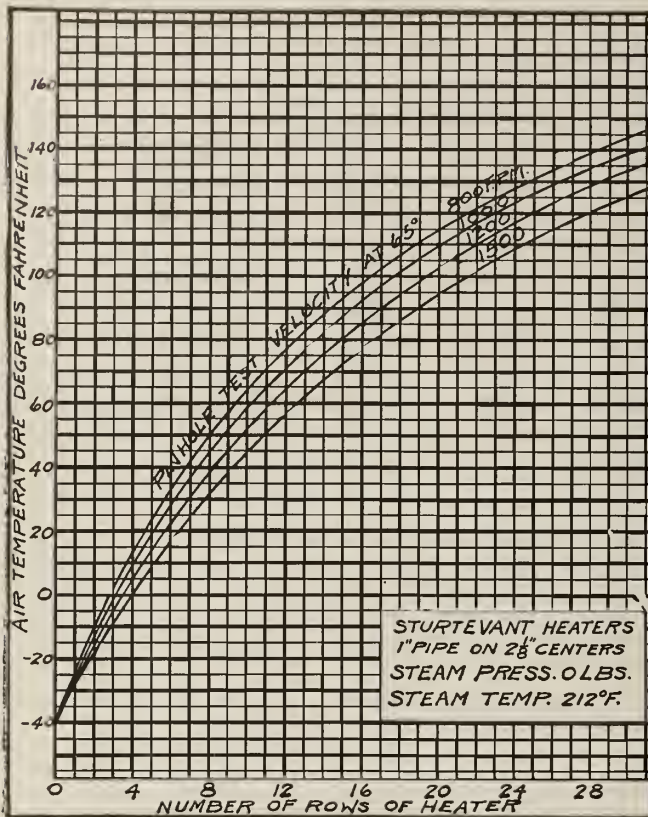
For sizes, dimensions, temperature rise curves, heating surfaces, free areas and designing notes, see pages 994-98.



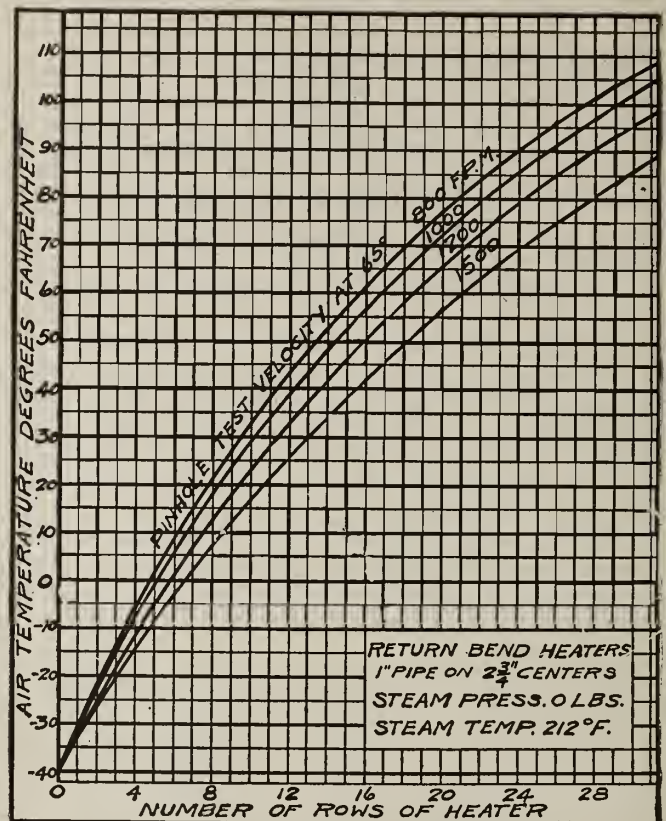
How to Specify Mitre Type Heaters.

There shall be furnished a pipe coil heater of the type, having lineal ft. of in. (1 or $1\frac{1}{4}$ in.) pipe and sq. ft. of free area. Heater shall be composed of 4-row sections and 2-row sections. All sections shall have a nominal length of ft., and nominal height of pipes shall be ft. in.

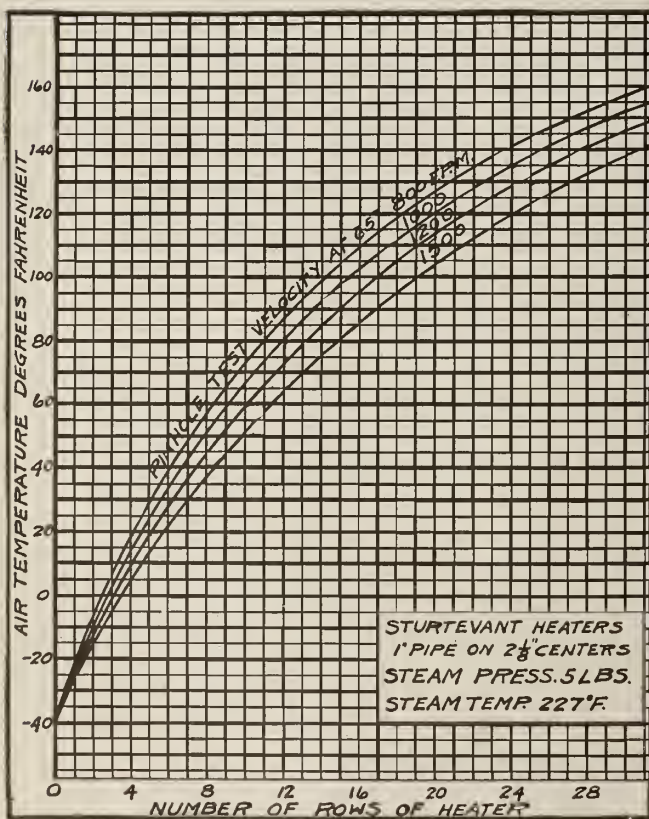
A sheet steel casing of No. gage shall be furnished, and this shall be suitably braced and stiffened.



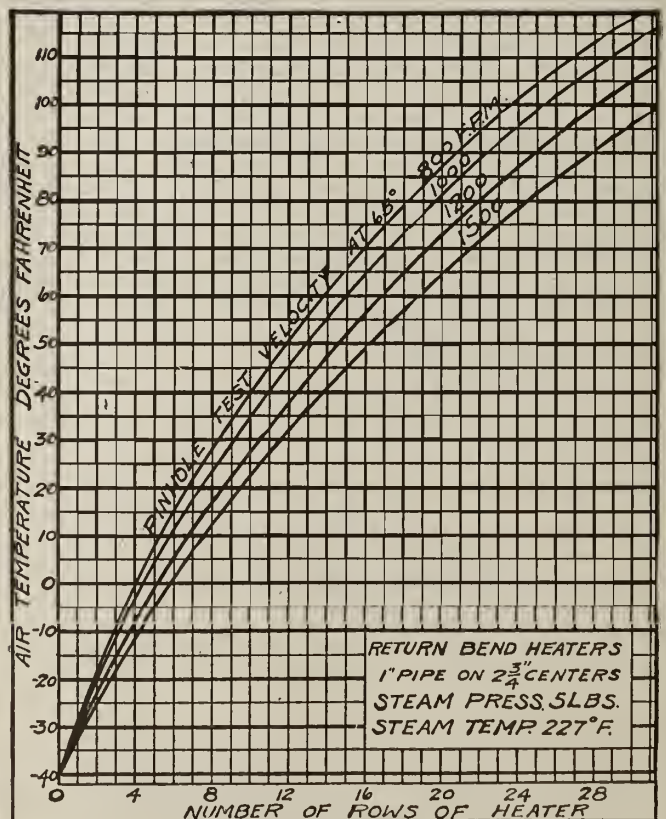
For London and Mitre Type Heaters
Latent heat, 966 B.t.u.



For Return Bend Heaters
Latent heat, 966 B.t.u.



For London and Mitre Type Heaters
Latent heat, 955 B.t.u.



For Return Bend Heaters
Latent heat, 955 B.t.u.

TEMPERATURE RISE CURVES

With given initial and final air temperatures, air velocity and steam pressure, first find the number of rows to give final temperature directly from chart. Next find the number of rows to heat air from minus 40 to actual initial temperature; the difference between these numbers will give the number of rows required. Given the number of rows, to find final temperature, first find number of rows to heat from minus 40 to initial temperature, and add to this the number of rows given, then find actual initial temperature with this number of rows

HEATING SURFACES, FREE AREAS AND DIMENSIONS OF LONDON HEATERS

Size of section		Free area for air passage in sq. ft.	4-row section		2-row section	
Nominal length of base	Nominal height of pipes		Heating surface, sq. ft.	Equivalent lineal ft. of 1-in. pipe	Heating surface, sq. ft.	Equivalent lineal ft. of 1-in. pipe
3 ft.	3 0	3.85	67	194	33	97
	3 6	4.52	79	230	40	115
	4 0	5.21	92	266	46	133
	4 6	5.76	102	296	51	148
	5 0	6.46	114	332	57	166
	5 6	7.12	127	368	63	184
4 ft.	6 0	7.67	137	398	69	199
	3 6	5.94	108	312	54	156
	4 0	6.85	124	360	62	180
	4 6	7.60	138	400	69	200
	5 0	8.46	155	450	78	225
	5 6	9.37	172	498	86	249
5 ft.	6 0	10.10	186	540	93	270
	6 6	11.01	202	588	101	294
	7 0	11.88	220	638	110	319
	4 0	8.50	156	454	78	227
	4 6	9.45	174	506	87	253
	5 0	10.51	196	568	98	284
6 ft.	5 6	11.68	216	628	108	314
	6 0	12.56	234	680	117	340
	6 6	13.65	256	742	128	371
	7 0	14.75	277	804	138	402
	7 6	15.75	294	854	147	427
	8 0	16.81	316	916	158	458
6 ft.	4 6	11.29	210	610	105	305
	5 0	12.60	236	684	118	342
	5 6	13.89	262	760	131	380
	6 0	14.96	383	822	142	411
	6 6	16.32	309	896	155	448
	7 0	17.64	334	970	167	485
6 ft.	7 6	18.75	356	1032	178	516
	8 0	20.07	382	1106	191	553
	8 6	21.18	403	1168	201	584
	9 0	22.50	428	1242	214	621

NOTE—Actual height of top of heater above floor is obtained by adding 12 in. to the nominal height of pipes. This allows for the base. Free area is approximately 5.5% of heating surface for 4-row sections.

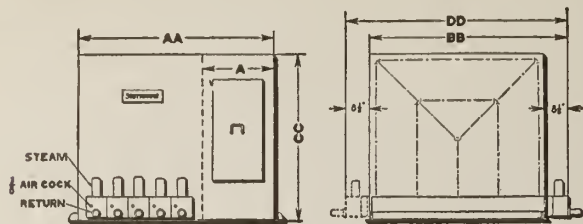
HEATING SURFACES, FREE AREAS AND DIMENSIONS OF MITRE TYPE HEATERS

Size of section				Free area for air passage in sq. ft.	4-row section		2-row section		
Nominal length of base	Nominal length of pipes		Nominal height of pipes		Heating surface, sq. ft.	Equivalent lineal ft. of 1-in. pipe	Heating surface, sq. ft.	Equivalent lineal ft. of 1-in. pipe	
	ft.	in.							ft.	in.
3 ft.	3	0	5	0	6.35	123	356	62	178
	3	6	5	6	7.01	135	392	68	196
	3	0	6	0	7.56	146	422	73	211
	4	0	6	0	7.67	148	428	74	214
	4	0	5	6	8.33	160	464	80	232
4 ft.	4	0	6	0	10.10	196	570	98	285
	4	0	7	0	11.84	230	668	115	334
	4	0	8	0	13.44	262	758	131	379
	5	0	6	0	11.84	230	668	115	334
5 ft.	5	0	7	0	14.76	290	842	145	421
	5	0	8	0	16.74	330	956	165	478
	5	0	9	0	18.75	368	1068	184	534
	5	0	10	0	20.73	408	1182	204	591
	6	0	7	0	16.91	333	966	166	483
6 ft.	6	0	8	0	20.00	398	1154	199	577
	6	0	9	0	22.43	445	1290	223	645
	6	0	10	0	24.82	492	1426	246	713
	6	0	11	0	27.40	543	1576	272	788
	6	0	12	0	29.80	590	1712	295	856

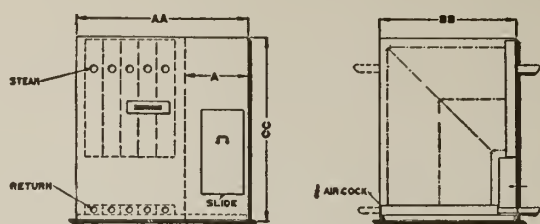
NOTE—On account of base, actual height is approximately 8½ in. greater than nominal height of pipes. Free area is approximately 5.2% of heating surface for 4-row sections.

HEATING SURFACES, FREE AREAS AND DIMENSIONS OF RETURN BEND HEATERS

Size of section					Size of section						
Nominal size and length of base	Nominal height of pipes		Heating surface, sq. ft.	Equivalent lineal ft. of 1-in. pipe	Free area for air passage in sq. ft.	Nominal size and length of base	Nominal height of pipes		Heating surface, sq. ft.	Equivalent lineal ft. of 1-in. pipe	Free area for air passage in sq. ft.
	ft.	in.					ft.	in.			
No. 12 2 ft. 11½ in.	2	9	48	139	4.80	No. 25 5 ft. 10½ in.	3	0	108	313	10.06
	3	0	52	151	5.19		3	3	117	338	10.82
	3	3	56	163	5.58		3	6	125	363	11.58
	3	6	61	175	5.97		3	9	134	388	12.34
	3	9	65	187	6.36		4	0	142	413	13.10
	4	0	69	199	6.75		4	3	151	438	13.82
	4	3	73	211	7.14		4	6	160	463	14.62
	4	6	77	223	7.53		4	9	168	488	15.38
	4	9	81	235	7.92		5	0	177	513	16.14
	5	0	85	247	8.31		5	3	186	538	16.90
	5	3	90	259	8.70		5	6	194	563	17.66
	5	6	94	271	9.09		5	9	203	588	18.42
	5	9	98	283	9.48		6	0	211	613	19.18
	6	0	102	296	9.87		6	6	229	663	20.70
	6	6	110	320	10.65		7	0	246	713	22.22
	7	0	119	345	11.43		7	6	263	763	23.74
No. 15 3 ft. 7¾ in.	8	0	127	369	11.91	8	0	280	813	25.26	
	8	6	138	399	12.85	8	6	298	863	26.78	
	7	6	148	429	13.79	9	0	315	913	28.30	
	7	6	158	459	14.73	10	0	349	1013	31.34	
	8	0	169	490	15.67	3	6	140	407	12.92	
	2	9	60	174	5.80	3	9	150	435	13.76	
	3	0	65	189	6.27	4	0	160	463	14.60	
	3	3	70	204	6.74	4	3	169	491	15.44	
	3	6	76	219	7.21	4	6	179	519	16.28	
	3	9	81	234	7.68	4	9	189	547	17.12	
	4	0	86	249	8.15	5	0	198	575	17.96	
	4	3	91	264	8.62	5	3	208	603	18.80	
	4	6	96	279	9.09	5	6	218	631	19.64	
	4	9	101	294	9.56	5	9	227	669	20.48	
	5	0	107	309	10.03	6	0	237	697	21.32	
	5	3	112	324	10.50	6	6	256	753	23.00	
5	6	117	339	10.97	7	0	276	809	24.68		
5	9	122	354	11.44	7	6	295	865	26.36		
6	0	127	369	11.91	8	0	314	921	28.04		
6	6	138	399	12.85	8	6	333	977	29.72		
7	0	148	429	13.79	9	0	353	1033	31.40		
7	6	158	459	14.73	10	0	391	1145	34.76		
8	0	169	490	15.67	11	0	429	1257	38.12		
No. 18 4 ft. 3¾ in.	2	9	72	209	6.93	4	0	177	512	16.17	
	3	0	78	227	7.49	4	3	187	543	17.12	
	3	3	85	245	8.05	4	6	198	574	18.07	
	3	6	91	263	8.61	4	9	209	605	19.02	
	3	9	97	281	9.17	5	0	219	636	19.97	
	4	0	103	299	9.73	5	3	230	667	20.92	
	4	3	109	317	10.29	5	6	241	698	21.87	
	4	6	116	335	10.85	5	9	252	729	22.82	
	4	9	122	353	11.41	6	0	263	760	23.77	
	5	0	128	371	11.97	6	6	284	822	25.67	
	5	3	134	389	12.53	7	0	305	884	27.57	
	5	6	140	407	13.09	7	6	326	946	29.47	
	5	9	147	425	13.65	8	0	348	1008	31.37	
	6	0	153	443	14.21	8	6	369	1070	33.27	
	6	6	165	479	15.33	9	0	391	1132	35.17	
	7	0	178	515	16.45	10	0	433	1256	38.97	
7	6	190	551	17.57	11	0	476	1380	42.77		
8	0	202	587	18.69	5	6	280	811	25.07		
8	6	215	623	19.81	5	9	292	845	26.15		
9	0	227	659	20.93	6	0	304	879	27.23		
No. 22 5 ft. 2½ in.	3	0	95	275	8.94	6	6	327	947	29.39	
	3	3	103	297	9.61	7	0	350	1015	31.55	
	3	6	110	319	10.28	7	6	373	1083	33.71	
	3	9	118	341	10.95	8	0	397	1151	35.87	
	4	0	125	363	11.62	8	6	420	1219	38.03	
	4	3	133	385	12.29	9	0	444	1287	40.19	
	4	6	141	407	13.96	10	0	491	1423	44.51	
	4	9	148	429	14.63	11	0	538	1559	48.83	
	5	0	156	451	15.30	12	0	585	1695	53.15	
	5	3	163	473	15.97	7	0	395	1145	34.83	
	5	6	171	495	16.64	7	6	423	1225	37.20	
	5	9	179	517	17.31	8	0	450	1305	39.57	
	6	0	186	539	17.98	8	6	478	1385	41.94	
	6	6	201	582	19.32	9	0	505	1465	44.31	
	7	0	216	626	20.66	10	0	560	1625	49.05	
	7	6	232	670	22.00	11	0	615	1785	53.79	
8	0	247	714	23.34	12	0	670	1945	58.53		
8	6	262	758	24.68	No. 40 9 ft. 4½ in.	9	0	505	1465	44.31	
9	0	277	802	26.02		10	0	560	1625	49.05	
10	0	307	890	28.70		11	0	615	1785	53.79	
						12	0	670	1945	58.53	



DIMENSIONS OF LONDON HEATERS



DIMENSIONS OF MITRE TYPE HEATERS

Size of Section		A*		AA	BB Single **	CC	DD Double §
Nominal length of base ft. in.	Nominal height of pipes, ft. in.	Single **	Double §				
3 ft.	3 0	21	24	$AA = 4\frac{1}{2}'' + A + 4.25N_2 + 7.75N_4$ N_2 = number of 2-row sections N_4 = number of 4-row sections	$46\frac{1}{4}$	48	$91\frac{3}{4}$
	3 6	21	24			54	
	4 0	21	24			60	
	4 6	21	24			66	
	5 0	21	24			72	
	5 6	21	24			78	
4 ft.	6 0	21	27			84	
	3 6	21	24		$58\frac{3}{4}$	54	$116\frac{3}{4}$
	4 0	21	24			60	
	4 6	21	27			66	
	5 0	21	27			72	
	5 6	24	27			78	
5 ft.	6 0	24	27			84	
	6 6	24	27			90	
	7 0	24	30			96	
	4 0	21	27		$71\frac{3}{4}$	60	$142\frac{1}{4}$
	4 6	24	27			66	
	5 0	24	27			72	
6 ft.	5 6	24	27			78	
	6 0	24	30			84	
	6 6	27	30			90	
	7 0	27	30			96	
	7 6	27	30			102	
	8 0	27	33			108	

Size of Section		A*		AA	BB Single **	CC
Nominal length of base ft. in.	Nominal height of pipes, ft. in.	Single **	Double §			
3 ft.	3 0	21	24	$AA = 7'' + A + 4.125N_2 + 7.75N_4$ N_2 = number of 2-row sections N_4 = number of 4-row sections	$45\frac{1}{4}$	$67\frac{1}{4}$
	3 6	21	27		45 $\frac{1}{4}$	73 $\frac{1}{2}$
	4 0	24	27		45 $\frac{1}{4}$	79 $\frac{1}{4}$
	4 6	24	27		58	115 $\frac{1}{2}$
	5 0	24	27		58	115 $\frac{1}{2}$
	5 6	24	27		58	115 $\frac{1}{2}$
4 ft.	6 0	27	30		58	115 $\frac{1}{2}$
	4 0	27	30		58	115 $\frac{1}{2}$
	4 6	27	30		58	115 $\frac{1}{2}$
	5 0	27	30		70 $\frac{3}{4}$	141
5 ft.	5 0	27	33		70 $\frac{3}{4}$	141
	5 6	30	33		70 $\frac{3}{4}$	141
	6 0	30	33		70 $\frac{3}{4}$	141
	5 0	33	36		70 $\frac{3}{4}$	141
	5 6	33	36		83 $\frac{1}{2}$	166 $\frac{1}{2}$
	6 0	33	36		83 $\frac{1}{2}$	166 $\frac{1}{2}$
6 ft.	6 0	33	36		83 $\frac{1}{2}$	166 $\frac{1}{2}$
	6 6	33	36		83 $\frac{1}{2}$	166 $\frac{1}{2}$
	6 0	36	39		83 $\frac{1}{2}$	166 $\frac{1}{2}$
	6 6	36	39		83 $\frac{1}{2}$	166 $\frac{1}{2}$
	6 0	39	39		83 $\frac{1}{2}$	166 $\frac{1}{2}$
	6 0	39	42		83 $\frac{1}{2}$	166 $\frac{1}{2}$

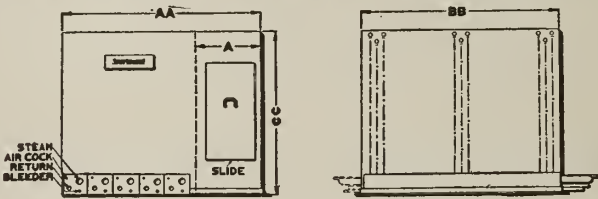


DIAGRAM OF RETURN BEND HEATERS

DIMENSIONS OF RETURN BEND HEATERS

Size of Section		A*		AA	BB Single **	CC	Size of Section		A*		AA	BB Single **	CC	Size of Section		A*		AA	BB Single **	CC
Nominal size and length of base ft. in.	Nominal height of pipes, ft. in.	Single **	Double §				Nominal size and length of base ft. in.	Nominal height of pipes, ft. in.	Single **	Double §				Nominal size and length of base ft. in.	Nominal height of pipes, ft. in.	Single **	Double §			
No. 12 2 ft. 11 $\frac{1}{2}$ in.	3 0	21	24	$AA = 4'' + A + 0.25N_4$ N_4 = number of 4-row sections	$35\frac{1}{4}$	$44\frac{5}{8}$	No. 18 4 ft. 3 $\frac{3}{4}$ in.	3 0	21	24	$AA = 4'' + A + 0.25N_4$ N_4 = number of 4-row sections	$51\frac{3}{4}$	$44\frac{5}{8}$	No. 25 5 ft. 10 $\frac{1}{2}$ in.	3 0	21	27	$AA = 4'' + A + 0.25N_4$ N_4 = number of 4-row sections	71	$45\frac{1}{8}$
	3 6	21	24			$50\frac{5}{8}$		3 6	21	24			$50\frac{5}{8}$		3 6	24	27			$51\frac{1}{8}$
	4 0	21	24			$56\frac{1}{8}$		4 0	21	24			$56\frac{1}{8}$		4 0	24	27			$57\frac{1}{8}$
	4 6	21	24			$62\frac{1}{8}$		4 6	21	24			$62\frac{1}{8}$		4 6	24	27			$63\frac{1}{8}$
	5 0	21	24			$68\frac{1}{8}$		5 0	24	27			$68\frac{1}{8}$		5 0	24	30			$69\frac{1}{8}$
	5 6	21	24			$74\frac{1}{8}$		5 6	24	27			$74\frac{1}{8}$		5 6	27	30			$75\frac{1}{8}$
	6 0	21	24			$80\frac{1}{8}$		6 0	24	27			$80\frac{1}{8}$		6 0	27	30			$81\frac{1}{8}$
	6 6	21	27			$86\frac{1}{8}$		6 6	24	30			$86\frac{1}{8}$		6 6	30	33			$87\frac{1}{8}$
	7 0	21	27			$92\frac{1}{8}$		7 0	24	30			$92\frac{1}{8}$		7 0	33	36			$93\frac{1}{8}$
	7 6	21	27			$98\frac{1}{8}$		7 6	27	30			$98\frac{1}{8}$		7 6	33	36			$99\frac{1}{8}$
	8 0	21	24			$104\frac{1}{8}$		8 0	27	30			$104\frac{1}{8}$		8 0	30	33			$105\frac{1}{8}$
	8 6	21	24			$110\frac{1}{8}$		8 6	27	30			$110\frac{1}{8}$		8 6	30	36			$111\frac{1}{8}$
No. 15 3 ft. 7 $\frac{3}{4}$ in.	3 0	21	24	$AA = 4'' + A + 0.25N_4$ N_4 = number of 4-row sections	$43\frac{1}{2}$	$44\frac{5}{8}$	No. 22 5 ft. 2 $\frac{1}{2}$ in.	3 0	21	24	$AA = 4'' + A + 0.25N_4$ N_4 = number of 4-row sections	$62\frac{3}{4}$	$45\frac{1}{8}$	No. 28 6 ft. 7 $\frac{1}{2}$ in.	3 0	21	27	$AA = 4'' + A + 0.25N_4$ N_4 = number of 4-row sections	$79\frac{1}{4}$	$45\frac{1}{8}$
	3 6	21	24			$50\frac{5}{8}$		3 6	21	24			$51\frac{1}{8}$		3 6	24	27			$51\frac{1}{8}$
	4 0	21	24			$56\frac{1}{8}$		4 0	24	27			$56\frac{1}{8}$		4 0	24	27			$57\frac{1}{8}$
	4 6	21	24			$62\frac{1}{8}$		4 6	24	27			$62\frac{1}{8}$		4 6	24	27			$63\frac{1}{8}$
	5 0	21	27			$68\frac{1}{8}$		5 0	24	27			$68\frac{1}{8}$		5 0	27	30			$69\frac{1}{8}$
	5 6	21	27			$74\frac{1}{8}$		5 6	24	30			$74\frac{1}{8}$		5 6	27	30			$75\frac{1}{8}$
	6 0	24	27			$80\frac{1}{8}$		6 0	27	30			$80\frac{1}{8}$		6 0	30	33			$81\frac{1}{8}$
	6 6	24	27			$86\frac{1}{8}$		6 6	27	30			$86\frac{1}{8}$		6 6	30	36			$87\frac{1}{8}$
	7 0	24	27			$92\frac{1}{8}$		7 0	27	30			$92\frac{1}{8}$		7 0	33	36			$93\frac{1}{8}$
	7 6	24	27			$98\frac{1}{8}$		7 6	27	30			$98\frac{1}{8}$		7 6	33	36			$99\frac{1}{8}$
	8 0	24	30			$104\frac{1}{8}$		8 0	30	33			$105\frac{1}{8}$		8 0	33	36			$106\frac{1}{8}$
	8 6	30	33			$110\frac{1}{8}$		8 6	33	36			$111\frac{1}{8}$		8 6	36	39			$112\frac{1}{8}$

*Dimension "A" is length of air space.
**"Single" means that heater consists of a single section. §"Double" means that heater is of double width, having 2 sections placed back-to-back.
Dotted lines at left of casing show location of additional headers and piping for double group heaters.

Data for Design and Calculation of Sturtevant Heat- ing Systems.

HEAT LOSSES—The reduction of temperature within buildings is due to (1) transmission of heat through roof, windows, walls, doors, floors, etc.; (2) direct leakage of hot air through cracks, open spaces, etc.

The material, thickness and method of construction of the walls, also exposure and relative amount of glass, determine the rapidity of heat loss.

Transmission Losses—To calculate the heat loss by transmission, it is customary to use the coefficients given in the table at the foot of this column. For example, when outside temperature is 20° and inside temperature is 70°, an 8-in. brick wall of 700 sq. ft. will have a heat loss by transmission of $458 \times (70^\circ - 20^\circ) \times 700 = 16,030$ B.t.u.

Leakage Losses—In the average building, the leakage loss amounts to one air change per hour; that is, in a building of 200,000 cu. ft. content, the leakage is 200,000 cu. ft. per hour. This varies with different types of buildings and with the grade of construction; thus this figure must be used with judgment and the designer must know from experience whether or not the building is better or worse than the average, and make allowance accordingly.

It should also be noted that in large buildings the air change is less frequent than in smaller buildings of the same construction, as the ratio of the wall space to the total cubic contents is considerably less. The leakage loss must be taken into consideration in buildings where ventilation is not provided, that is, where the fan draws its supply of air from the

rooms. If, however, the fan uses fresh air from the outside, no such allowance is necessary, as this is included in the heat required to warm the air used for ventilation.

Calculation of Heat Losses by Transmission—Assume an industrial building under the following conditions, and calculate heat loss by transmission in this building as shown in table below:

TABULATION OF HEAT LOSSES BY TRANSMISSION

SIZE OF BUILDING—100 by 200 by 50 ft.
MATERIAL—Brick and glass, the former averaging 20 in. thick.
EXPOSURE—Ends of building facing North and South.
ROOF—Flat, having 2-in. plank covered with 5-ply tar and gravel roofing. No exposure factor due to its flatness.
WINDOW OPENINGS—Front, 40% of total area; back, 30% of total area; 2 ends, each 35% of total area.
DOOR OPENINGS—Front and back, 100 sq. ft. each; ends, 200 sq. ft. each.
SKYLIGHT—20 by 100 ft.
BASEMENT—Unheated, entirely below ground level and with minimum temperature of 30°.
FLOORING—Double flooring used on first floor, forming basement ceiling.
LOWEST ENCOUNTERED OUTSIDE TEMPERATURE—20°.
AVERAGE INSIDE TEMPERATURE—70°.

Wall	Material and area	Loss in B.t.u. per hour, no allowance for exposure	Total loss, including allowance for exposure
East wall 10,000 sq. ft. Exposure factor 15%	20 in. brick = 5,900 sq. ft. Single window = 4,000 sq. ft. Doors (35% glass) = 100 sq. ft.	$5,900 \times 50^\circ \times .23 = 67,800$ $4,000 \times 50^\circ \times 1.215 = 243,000$ $100 \times 50^\circ \times .57^* = 2,850$ Total 313,650	$313,650 \times 1.15 = 360,000$
West wall 10,000 sq. ft. Exposure factor 25%	Same as east wall	Same as east wall	$313,650 \times 1.25 = 392,000$
North wall 5,000 sq. ft. Exposure factor 35%	20-in. brick = 3,050 sq. ft. Single window = 1,750 sq. ft. Doors (35% glass) = 200 sq. ft.	$3,050 \times 50^\circ \times .23 = 35,100$ $1,750 \times 50^\circ \times 1.215 = 106,000$ $200 \times 50^\circ \times .57 = 5,700$ Total 146,800	$146,800 \times 1.35 = 199,200$
South wall 5,000 sq. ft. Exposure factor 5%	Same as north wall	Same as north wall	$146,800 \times 1.05 = 153,500$
Roof 20,000 sq. ft. No exposure factor due to flat roof	5-ply tar and gravel roof on 2-in. plank = 17,000 sq. ft. Single skylight 20 x 150 = 3,000 sq. ft.	$17,000 \times 50^\circ \times .3 = 255,000$ $3,000 \times 50^\circ \times 1.215 = 182,000$ Total 437,000	= 437,000
Floor 20,000 sq. ft. Assume basement temperature 30° Total loss by	Double floor = 20,000 sq. ft. transmission.....	$20,000 \times 40^\circ \times .31 = 248,000$	= 248,000 = 1,788,700

B.T.U. TRANSMITTED THROUGH MATERIALS PER SQUARE FOOT OF EXPOSED SURFACE PER DEGREE DIFFERENCE OF TEMPERATURE BETWEEN INSIDE AND OUTSIDE AIR

Material	Coefficient	Material	Coefficient
Brick wall		Double floor with lath and plaster ceiling beneath	.18
4 in. thick	.66	Double floor without lath and plaster ceiling beneath	.31
8 in. thick	.46	Dirt floor—no covering	.23
12 in. thick	.32	Wood floor on dirt	.14
16 in. thick	.26	Galvanized iron siding	1.21
20 in. thick	.23	"Book Tile" roof	.80
24 in. thick	.19	Slate roof	.80
Concrete or stone		2-in. plank	.40
12 in. thick	.49	8-in. brick wall lined with 4-in. hollow terra cotta blocks—plastered inside	.22
16 in. thick	.43	12-in. brick wall lined with 4-in. hollow terra cotta blocks—plastered inside	.18
20 in. thick	.38	16-in. brick wall lined with 4-in. hollow terra cotta blocks—plastered inside	.16
24 in. thick	.35	4-in. terra cotta roof—plastered	.42
Single window or skylight†	1.215	8-in. terra cotta roof—plastered	.26
Double window or skylight† (independent sashes)	.57	12-in. terra cotta roof—plastered	.20
Door (close fitting and not often open)†	.57	5-ply tar and gravel roof on 4-in. re-enforced concrete slab	.64
Door, average (same as glass)	1.215		
Hy-Rib construction	1.0		
5-ply tar and gravel roofing on 3-in. plank	.30		
Frame walls, clapboard, paper, studding and plaster	.31		
Single wooden floor 1-in. thick with lath and plaster ceiling beneath	.27		

†In all cases measure the full opening for glass area or door area. To the values calculated from the constants as given above, add for north exposure 35%, south exposure 5%, east exposure 15%, west exposure 25%.

If the point of the compass is not known, 20% is added for each side instead of the above factors. If the roof is flat, or sloped only slightly, nothing is added for roof exposure.

If, however, it is quite steep, there is necessarily an increased heat loss due to exposure, and the factors above should be used for the roof as well. For a sawtooth roof, figure the two surfaces independently, using exposure factors in the same way as for walls.

†The 50° is the difference between inside temperature and lowest encountered outside temperature.

*In most cases doors are figured the same as glass.

Calculation of Heat Losses by Leakage—To the heat losses by transmission must be added the heat losses by leakage.

Assume the leakage in the building described above to be greater than average and equal to $1\frac{1}{2}$ air changes per hour.

This building has a total content of 1,000,000 cu. ft., the air leakage is $1\frac{1}{2}$ by 1,000,000 or 1,500,000 cu. ft. per hour, and this amount of air must be taken in at 20° and heated to 70° to replace the warm air lost by leakage.

The heat required to raise this air from 20° to 70° is found from the formula:

$$\text{B.t.u.} = \frac{\text{Cubic contents} \times \text{air changes} \times \text{temperature rise}}{55.2^*}$$

$$= \frac{1,000,000 \times 1\frac{1}{2} \times 50}{55.2} = 1,360,000 \text{ B.t.u. per hour}$$

These figures represent the heat loss due to leakage.

*1 B.t.u. will raise 55.2 cu. ft. of air 1° in temperature under standard conditions or will raise 1 cu. ft. 55.2° Fahr. In commercial work, either 55 or 56 is used in the above formula.

Total Heat Losses—The total heat losses for the building described above are 3,040,000 B.t.u. This amount of heat must be transmitted to the air supplied to the building.

RECOMMENDED VELOCITIES THROUGH HEATERS—In an industrial installation, the apparatus is designed to supply the necessary heat with as slight cost as possible; whereas in public building work, noise must be considered.

This latter is often the controlling factor and greatly affects the velocities used.

See following table for recommended velocities.

RECOMMENDED VELOCITIES THROUGH HEATERS

Number of 4-row sections deep	Public buildings, schools, office buildings, etc., velocity in ft. per min.	Factories, shops and industrial buildings, velocity in ft. per min.
1 to 3	1200	1500*
4 to 6	1000	1200
7 or more	800†	1200

*In factory work, velocities through the heater sometimes run as high as 1800, but this is done only under unusual conditions or where space limitations preclude the possibility of a heater of adequate size. It should be noted that high velocities greatly increase the power required to drive the fan and militate against an efficient system.

†Under special conditions, the velocities in public building work may run as low as 600 ft. per min. In drying work, where very high temperatures are sometimes necessary, extremely low velocities—even 300 ft. per min.—and deep heaters are installed.

DESIGN OF DISTRIBUTING SYSTEM—Piping—A well designed piping system should be laid out on a basis of equal friction loss per foot, and the following table is calculated on this basis. With this table it is possible to figure the sizes of pipe necessary when two or more pipes meet, or when a main splits into two or more branches.

*EQUALIZATION OF PIPES

Diam. in.	1 in.	2 in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.	14 in.	16 in.	18 in.	20 in.	24 in.
2	5.7	1														
3	15.6	2.8	1													
4	32.0	5.7	2.1	1												
5	55.9	9.9	3.6	1.7	1											
6	88.2	15.6	5.7	2.8	1.6	1										
7	130	22.9	8.3	4.1	2.3	1.5	1									
8	181	32.0	11.7	5.7	3.2	2.1	1.4	1								
9	243	43.0	15.6	7.6	4.3	2.8	1.9	1.3	1							
10	316	55.9	20.3	9.9	5.7	3.6	2.4	1.7	1.3	1						
11	401	70.9	25.7	12.5	7.2	4.6	3.1	2.2	1.7	1.3	1					
12	499	88.2	32.0	15.6	8.9	5.7	3.8	2.8	2.1	1.6	1.2	1				
13	609	108	39.1	19.0	10.9	7.1	4.7	3.4	2.5	1.9	1.2	1				
14	733	130	47.0	22.9	13.1	8.3	5.7	4.1	3.0	2.3	1.5	1.1	1			
15	871	154	55.9	27.2	15.6	9.9	6.7	4.8	3.6	2.8	1.7	1.2	1			
16		181	65.7	32.0	18.3	11.7	7.9	5.7	4.2	3.2	2.1	1.4	1.1	1		
17		211	76.4	37.2	21.3	13.5	9.2	6.6	4.9	3.8	2.4	1.6	1.2	1.1	1	
18		243	88.2	43.0	24.6	15.6	10.6	7.6	5.7	4.3	2.8	1.9	1.3	1.1	1.1	1
19		278	101	49.1	28.1	17.8	12.1	8.7	6.5	5.0	3.2	2.1	1.5	1.1	1.1	1.1
20		316	115	55.9	32.0	20.3	13.8	9.9	7.4	5.7	3.6	2.4	1.7	1.3	1.3	1.3
22		401	146	70.9	40.6	25.7	17.5	12.5	9.3	7.2	4.6	3.1	2.2	1.7	1.7	1.7
24		499	181	88.2	50.5	32.0	21.8	15.6	11.6	8.9	5.7	3.8	2.8	2.1	1.6	1.6
26		609	221	108	61.7	39.1	26.6	19.0	14.2	10.9	7.1	4.7	3.4	2.5	1.9	1.9
28		733	266	130	74.2	47.0	32.0	22.9	17.1	13.1	8.3	5.7	4.1	3.0	2.3	2.3
30		871	316	154	88.2	55.9	38.0	27.2	20.3	15.6	9.9	6.7	4.8	3.6	2.8	2.8
36			199	243	130	88.2	60.0	43.0	32.0	24.6	15.6	10.6	7.6	5.7	4.3	4.3
42				357	205	130	88.2	63.2	47.0	32.0	21.8	15.6	10.6	7.6	5.7	5.7
48				499	286	181	123	88.2	62.7	47.0	32.0	21.8	15.6	10.6	7.6	7.6
54				670	383	243	165	118	88.2	67.0	43.0	29.2	20.9	15.6	12.0	12.0
60				871	499	316	215	154	115	88.2	65.7	43.0	29.2	20.9	15.6	15.6

*This table gives the number of pipes of smaller size equal to one larger pipe. Thus one 10-in. pipe has the same air carrying capacity as 20.3 3-in. pipes for equal friction loss per lineal foot of pipe.

Size of Main Ducts and Velocities—In factory work, the air velocity in the main duct varies from 1500 to 2500 ft. per minute and averages about 2000 ft. This velocity decreases gradually until the air reaches the risers. In public building work, the velocities in main duct range from 1000 to 1500 ft. and average about 1200 ft. The velocities in any connection leading to a riser must be intermediate between that leaving the fan and that existing in the riser.

Knowing the volume of air handled and assuming the velocity, the cross-sectional area of the main ducts is secured from the formula:

Cubic feet of air passing through ducts per minute

Area= Velocity in feet per minute

Velocities in Vertical Flues—In public buildings, the usual velocities in risers leading to registers are from 400 to 800 ft. per minute. The larger the riser, the greater is the allowable velocity. The figures in the accompanying table will serve as a rough guide.

Velocities Through Registers—In public buildings, the factors of noise and drafts render it advisable to restrict velocities through net clear area of registers to not more than 500 ft. per minute; 325 and 500 ft. are usually considered the limiting values. The desirable velocity depends on the type of room and the location of the register, also the larger the register the higher is the velocity that it is safe to use. In most cases, an approximate velocity is assumed, and from this the size of the register is figured. This size may not conform to standard size registers, and the nearest should therefore be chosen. The range of velocities allows a considerable leeway, so that a register can be chosen to suit the structural requirements of the building. Floor registers are not recommended; but if used, velocities of from 175 to 275 ft. per minute should be adopted.

VELOCITIES THROUGH REGISTERS

Cu. ft. per min. of air supplied to room	Under 500	525 to 950	1000 to 1800	1850 to 2500
Velocity through net area of registers, ft. per min.	325 to 375	375 to 410	410 to 450	450 to 500

TO FIND SIZE OF MAIN STEAM CONNECTION AND RETURN PIPE—Determine the total amount of heat units necessary per hour to raise the air volume under consideration from its initial temperature entering the heater to its final temperature leaving the heater from the number of heat units required; find the number of pounds of steam necessary to supply the required amount of heat by dividing the heat units by latent heat of evaporation per pound of steam at the steam pressure used. The resulting figure will be the pounds of steam required and condensed per hour.

By consulting the table below, the proper size steam and drip main can be chosen with the pounds of steam known with gauge pressures of 0, 5 and 80 lbs.

For other steam pressures, interpolation with sufficient accuracy can be made to determine the size mains required.

SIZES OF STEAM PIPES FOR STURTEVANT HEATERS IN INCHES

Lbs. steam condensed per hour	Steam Pressure						Lbs. steam condensed per hour	Steam Pressure					
	0 lbs.		5 lbs.		80 lbs.			0 lbs.		5 lbs.		80 lbs.	
	Supply	Return	Supply	Return	Supply	Return		Supply	Return	Supply	Return	Supply	Return
50	1.5	1.00	1.25	1.00	1.00	0.75	3000	7	3.5	6	3.0	3.5	2.0
100	2.0	1.25	1.5	1.00	1.00	0.75	3250	7	3.5	6	3.0	3.5	2.0
150	2.5	1.5	2.0	1.25	1.25	1.00							
200	2.5	1.5	2.0	1.25	1.25	1.00	3500	8	4.0	6	3.0	3.5	2.0
							3750	8	4.0	6	3.0	3.5	2.0
250	3.0	2.0	2.5	1.5	1.25	1.00	4000	8	4.0	7	3.5	4.0	2.0
300	3.0	2.0	2.5	1.5	1.25	1.00	4250	8	4.0	7	3.5	4.0	2.0
350	3.0	2.0	2.5	1.5	1.5	1.00							
400	3.5	2.0	3.0	2.0	2.0	1.25	4500	8	4.0	7	3.5	4.0	2.0
							4750	8	4.0	7	3.5	4.0	2.0
450	3.5	2.0	3.0	2.0	2.0	1.25	5000	9	4.5	7	3.5	4.0	2.0
500	3.5	2.0	3.0	2.0	2.0	1.25	5250	9	4.5	7	3.5	4.0	2.0
600	4.0	2.0	3.0	2.0	2.0	1.25							
700	4.0	2.0	3.5	2.0	2.0	1.25	5500	9	4.5	7	3.5	4.0	2.0
							5750	9	4.5	7	3.5	4.0	2.0
800	4.5	2.5	3.5	2.0	2.0	1.25	6000	9	4.5	7	3.5	4.5	2.5
900	4.5	2.5	3.5	2.0	2.5	1.5	7000	10	5	8	4.0	4.5	2.5
1000	4.5	2.5	4.0	2.0	2.5	1.5							
1250	5	2.5	4.0	2.0	2.5	1.5	8000	10	5	8	4.0	4.5	2.5
							9000	10	5	9	4.5	5	2.5
1500	6	3.0	4.5	2.5	2.5	1.5	10000	12	6	9	4.5	5	2.5
1750	6	3.0	4.5	2.5	3.0	2.0	11000	12	6	9	4.5	6	3
2000	6	3.0	5	2.5	3.0	2.0							
2250	6	3.0	5	2.5	3.0	2.0	12000	12	6	10	5	6	3
							13000	12	6	10	5	6	3
2500	7	3.5	6	3.0	3.0	2.0	14000	12	6	10	5	6	3
2750	7	3.5	6	3.0	3.5	2.0							

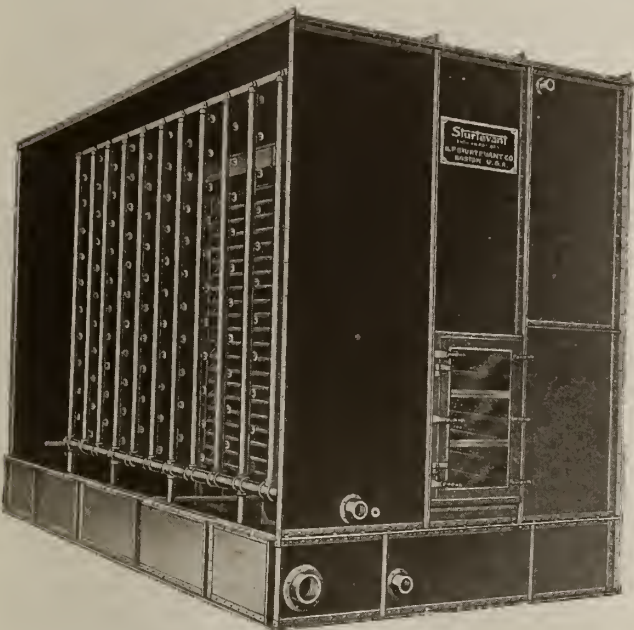
Sturtevant Air Washers.

TYPES—There are three standardized types of Sturtevant air washers:

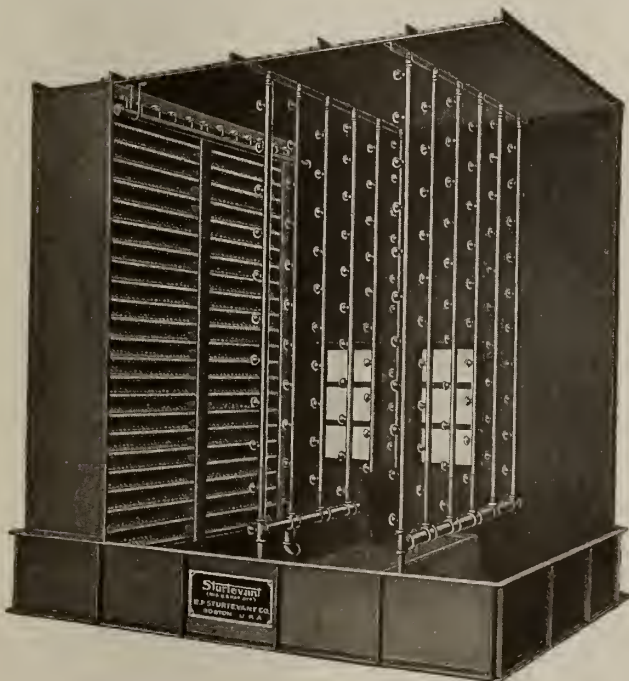
Type H—An efficient apparatus designed for all general work in washing, purifying and humidifying. This is the type recommended.

Type C—For more severe service than Type H, and will give the maximum cooling that is possible with re-circulated water; that is, it cools to practically the wet bulb temperature. This type is of similar design to Type H, but has an additional group of nozzles and a spray chamber 2 ft. longer.

Type S—Suited for all average air washing requirements in simple ventilating systems. Recommended where low cost is the primary consideration.



STURTEVANT TYPE H AIR WASHER



STURTEVANT TYPE C AIR WASHER WITH SIDE AND BAFFLES REMOVED

Note auxiliary spray pipe and method of attaching risers at top

Sturtevant Type H Air Washer.

Adapted for a very wide range of work. In comparison with competitive apparatus, it has the following advantages:

Tank constructed of No. 14-gage iron, thus it is heavier than that of most other makes. Has more than twice the strainer area of any other washer made and has ten times the area of some. Strainer area is hundreds of times greater than area of pump suction. No washer has its strainer designed for such easy removal for cleaning.

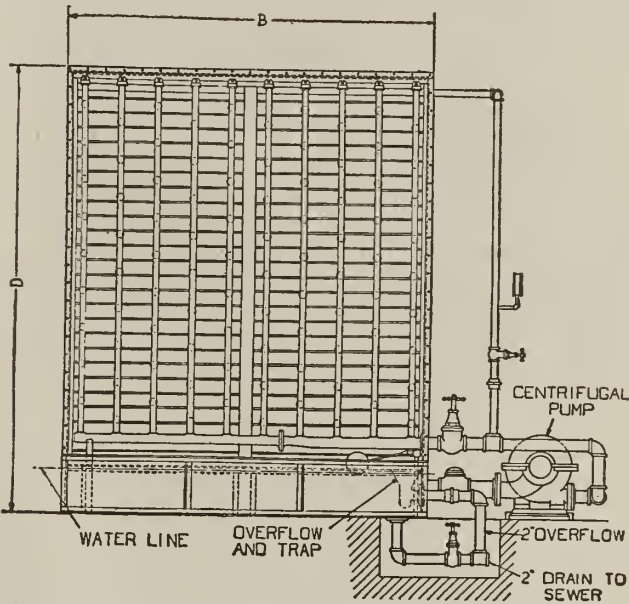
No other washer has as many spray nozzles for a given capacity. In the Sturtevant, there is one nozzle for every 325 cu. ft. of air, exclusive of the auxiliary nozzles washing the eliminators.

No other washer is furnished with trap in overflow. No other washer supplies as much as 5 gals. of water per minute for each foot of width of the eliminator plates for auxiliary washing.

No other washer is furnished with louvers where air enters. These louvers, or diffuser plates, eliminate eddy currents and prevent mist getting outside the spray chamber.

CLEANING EFFICIENCY—Sturtevant air washers have a guaranteed cleaning efficiency of 98%.

Type H will increase the relative humidity of the air and will cool 85% of the wet bulb temperature. Type C will cool to 100% of the wet bulb depression.

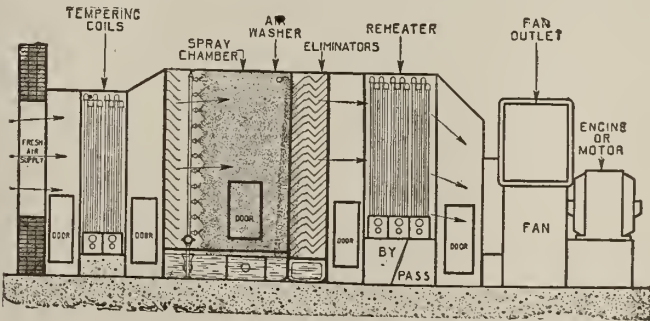


SIDE ELEVATION OF STURTEVANT TYPE H AIR WASHER

Dimensions B and D are given in third and fourth columns of table on following page. If pump is placed as indicated above, the additional width required for the pump and piping is as follows:

Pump discharge, in..... 1½ 2 2½ 3 4 5
Minimum additional width, ft. and in.... 2-6 3-0 3-6 4-0 4-6 5-0

The size of pump necessary for any size of air washer is given in column 5 of table on following page.



TYPICAL STURTEVANT HEATING, VENTILATING AND AIR CONDITIONING SYSTEM

How to Specify Air Washers.

GENERAL—There shall be furnished a by size air washer. Width of the washer shall be ft. in. by a height ft. in. The length of the washer in direction of flow of air shall be 7 ft.

The air washer shall have a capacity of cu. ft. of air per minute at a velocity of ft. per minute.

TANK—The tank shall be constructed of galvanized steel firmly braced and riveted to a rigid frame of galvanized angle irons. The plates of the tank shall be of No. 14-gage, the angle irons shall be $1\frac{1}{2}$ by $\frac{3}{8}$ in., and shall be spaced not more than 3 ft. apart. The top framing angles are to be punched 5 in. on centers for $\frac{3}{8}$ -in. bolts, to secure the casing of the spray chamber to the tank. All rivet heads and seams shall be soldered over to make the tank watertight. The tank shall be fitted with a conical shaped overflow and trap which shall carry away the surplus water. The trap shall be provided, to prevent the admission of sewer gas from the drain to the spray chamber.

CASING—The casing of the washer shall be made of No. 18 galvanized steel thoroughly braced with $1\frac{1}{2}$ by $1\frac{1}{2}$ by $\frac{3}{8}$ -in. galvanized angle irons, spaced not more than 3 ft. on centers. The seams and rivet heads are to be soldered so as to make the casing watertight. The casing shall be fitted with an 18 by 30-in. hinged door for access to spray chamber. This door shall consist of a rigid cast iron frame fitted with 3 glass panels. The door shall be hung on heavy hinges and shall clamp against a heavy rubber gasket inserted in the frame that carries the door. To make the door watertight, it shall be provided with 6 latches operating with a cam motion. The frame shall be arranged to collect any water that may drip from the door, and return same to tank, should the door be left unclamped.

ELIMINATORS—There shall be provided eliminator plates to remove the entrained moisture from the air after it has passed through the spray chamber. These eliminators shall be of the horizontal cut-lip type, arranged in tiers of not more than 5-ft. widths. The plates shall be not lighter than No. 22-gage steel and shall be galvanized after they have been cut and formed to shape. The plates are to be so arranged that a large part of the surface will become a washing surface for the removal of dust that impinges upon them. The eliminators shall consist of one group in the direction of the flow of air and be so arranged that the passageway between two plates shall be continuous.

SPRAY DEVICE—The spray device shall consist of a horizontal header placed across the bottom of the spray chamber and fitted with vertical risers so placed as to bring the spray nozzles, secured to the risers, in a plane parallel to and at a distance of 48 in. in front of the eliminators. The upper ends of the risers shall be capped with a special cap that will permit fastening to a galvanized angle iron across the top of the spray chamber, thus holding the risers securely in line. There shall be not less than one atomizing nozzle for each 325 cu. ft. of air washed per

minute. The nozzles shall be constructed entirely of bronze and shall have large waterways to prevent clogging of the nozzles by sediment carried in the water. The nozzle openings shall be not less than $\frac{3}{8}$ in. in diameter, and shall discharge not more than $1\frac{1}{4}$ gal. per minute with 19-lb. pressure per sq. in. All piping and fittings shall be heavily galvanized. For washers of 8 ft. height and under, 1-in. risers shall be used; for washers over 8 ft. in height, $1\frac{1}{4}$ -in. risers shall be used.

In addition to the atomizing nozzles, there shall be furnished a spray pipe across the top of the spray chamber adjacent to the eliminator plates. These nozzles shall be of the rain-spray type, shall be placed 6 in. on centers and shall have capacity to wash each foot of width of the eliminators with not less than 5 gal. of water per minute.

STRAINER—The straining device shall consist of a compartment extending the full width of the tank and shall be fitted with fine mesh copper wire screens arranged for easy removal for cleaning. There shall be 2 sq. ft. of strainer area for each foot in width of the tank. The top of the compartment shall be closed with hinged doors to prevent dirt washed from the air falling into it.

DIFFUSER PLATES—Across the front of the spray chamber shall be placed a series of louverlike diffuser plates to eliminate eddy currents and to prevent back splash of the spray washer. The washer shall be so designed that when the fan is not in operation, the spray water will be entirely retained within the spray chamber when the pump is running.

PUMP AND MOTOR—For re-circulating the spray water, there shall be furnished centrifugal pump of the double suction, split casing type. The pump to be furnished with a bronze impeller, bronze covered steel shaft and bronze bushings. The bearings shall be of the ring oiling type. Heavy cast iron base shall be furnished, upon which to mount the pump and motor. An oil groove shall extend completely around the cast iron base. The pump will be driven by the motor through an insulated flexible coupling.

The motor shall be of ... horsepower, capacity at ... r.p.m., and designed to operate on current of the following characteristics:

ACCESSORIES—Where necessary, a suitable starter will be furnished with the motor. A 5-in. diameter pressure gage, with white dial and black figures reading to 30 lbs., shall be furnished with the washer. A bronze float for maintaining constant water level in the tank will be furnished with the washer. The casing shall be fitted with a waterproof marine type fixture ready to receive the electric bulb to be furnished by others.

NOTE—Pipe connections will be fitted to the washers for connecting the pump suction and discharge to the strainer compartment and to the spray headers, respectively. The contractor is to furnish between the washer and pump, galvanized piping in accordance with the washer manufacturer's drawings.

DATA, STURTEVANT AIR WASHERS, TYPE H (ATOMIZING TYPE 7 FT. LONG)

Capacity, cu. ft. per min.	Size, ft.		Total width, ft.	Total height, ft.	Pump discharge, in.	Gals. per min.	H.p. motor	R.p.m. pump	Capacity, cu. ft. per min.	Size, ft.		Total width, ft.	Total height, ft.	Pump discharge, in.	Gals. per min.	H.p. motor	R.p.m. pump	
	Width	Height								Width	Height							
																		ft.	in.	ft.	in.
3600—4500	3 x 3	3	3 3/8	4	1 1/8	11 1/2	38	2	1750	28800—36000	9 x 8	9	9 3/8	9	1 1/8	212	7 1/2	1150
4800—6000	3 x 4	3	3 3/8	5	1 1/8	11 1/2	46	3	1750	32400—40500	9 x 9	9	9 3/8	10	1 1/8	233	7 1/2	1150
6000—7500	3 x 5	3	3 3/8	6	1 1/8	11 1/2	53	3	1750	36000—45000	9 x 10	9	9 3/8	11	1 1/8	253	7 1/2	1150
7200—9000	3 x 6	3	3 3/8	7	1 1/8	11 1/2	61	3	1750									
										32000—40000	10 x 8	10	9 3/8	9	1 1/8	233	7 1/2	1150
6400—8000	4 x 4	4	4 3/8	5	1 1/8	1 1/2	58	3	1750	36000—45000	10 x 9	10	9 3/8	10	1 1/8	255	7 1/2	1150
8000—10000	4 x 5	4	4 3/8	6	1 1/8	1 1/2	68	3	1750	40000—50000	10 x 10	10	9 3/8	11	1 1/8	278	7 1/2	1150
9600—12000	4 x 6	4	4 3/8	7	1 1/8	2	77	3	1750									
11200—14000	4 x 7	4	4 3/8	8	1 1/8	2	87	3	1750	35200—44000	11 x 8	11	9 3/8	9	1 1/8	253	7 1/2	1150
										39600—49500	11 x 9	11	9 3/8	10	1 1/8	278	7 1/2	1150
										44000—55000	11 x 10	11	9 3/8	11	1 1/8	302	10	1150
8000—10000	5 x 4	5	5 3/8	5	1 1/8	1 1/2	71	3	1750									
10000—12500	5 x 5	5	5 3/8	6	1 1/8	2	83	3	1750	38400—48000	12 x 8	12	9 3/8	9	1 1/8	265	7 1/2	1150
12000—15000	5 x 6	5	5 3/8	7	1 1/8	2	94	3	1750	43200—54000	12 x 9	12	9 3/8	10	1 1/8	290	10	1150
14000—17500	5 x 7	5	5 3/8	8	1 1/8	2	105	3	1750	48000—60000	12 x 10	12	9 3/8	11	1 1/8	315	10	1150
16000—20000	5 x 8	5	5 3/8	9	1 1/8	2	116	3	1750									
18000—22500	5 x 9	5	5 3/8	10	1 1/8	2 1/2	128	3	1750									
										41600—52000	13 x 8	13	9 3/8	9	1 1/8	298	10	1150
12000—15000	6 x 5	6	6 3/8	6	1 1/8	2	97	5	1750	46800—58500	13 x 9	13	9 3/8	10	1 1/8	328	10	1150
14400—18000	6 x 6	6	6 3/8	7	1 1/8	2	110	5	1750	52000—65000	13 x 10	13	9 3/8	11	1 1/8	358	10	1150
16800—21000	6 x 7	6	6 3/8	8	1 1/8	2 1/2	124	5	1750									
19200—24000	6 x 8	6	6 3/8	9	1 1/8	2 1/2	136	5	1750	44800—56000	14 x 8	14	9 3/8	9	1 1/8	318	10	1150
21600—27000	6 x 9	6	6 3/8	10	1 1/8	2 1/2	150	5	1750	50400—63000	14 x 9	14	9 3/8	10	1 1/8	350	10	1150
24000—30000	6 x 10	6	6 3/8	11	1 1/8	2 1/2	162	5	1750	56000—70000	14 x 10	14	9 3/8	11	1 1/8	382	10	1150
16800—21000	7 x 6	7	7 3/8	7	1 1/8	2 1/2	127	5	1750	48000—60000	15 x 8	15	9 3/8	9	1 1/8	338	10	1150
19600—24500	7 x 7	7	7 3/8	8	1 1/8	2 1/2	142	5	1750	54000—67500	15 x 9	15	9 3/8	10	1 1/8	372	10	1150
22400—28000	7 x 8	7	7 3/8	9	1 1/8	2 1/2	157	5	1750	60000—75000	15 x 10	15	9 3/8	11	1 1/8	406	15	1150
25200—31500	7 x 9	7	7 3/8	10	1 1/8	2 1/2	172	7 1/2	1750									
28000—35000	7 x 10	7	7 3/8	11	1 1/8	3	187	7 1/2	1150	51200—64000	16 x 8	16	9 3/8	9	1 1/8	358	10	1150
										57600—72000	16 x 9	16	9 3/8	10	1 1/8	394	10	1150
										64000—80000	16 x 10	16	9 3/8	11	1 1/8	428	15	1150
19200—24000	8 x 6	8	8 3/8	7	1 1/8	2 1/2	154	5	1750									
22400—28000	8 x 7	8	8 3/8	8	1 1/8	3	173	7 1/2	1150	54400—68000	17 x 8	17	9 3/8	9	1 1/8	377	10	1150
25600—32000	8 x 8	8	8 3/8	9	1 1/8	3	192	7 1/2	1150	61200—76500	17 x 9	17	9 3/8	10	1 1/8	414	15	1150
28800—36000	8 x 9	8	8 3/8	10	1 1/8	3	211	7 1/2	1150	68000—85000	17 x 10	17	9 3/8	11	1 1/8	452	15	1150
32000—40000	8 x 10	8	8 3/8	11	1 1/8	3	229	7 1/2	1150									

Continued on next page

Sturtevant Steam Engines.

Vertical engines, VS-7 and VS-8 types, are furnished for use as independent engines and for driving fans, blowers, exhausters and generators direct connected.

They are of the simple, single valve type and may be operated as automatic or throttling engines.

These two types differ only in their oiling arrangements. The VS-7 type has a gravity system and the VS-8 has forced lubrication.



STURTEVANT VERTICAL ENGINE

DATA, VS-7 AND VS-8 ENGINES
HIGH AND MEDIUM PRESSURE

Size	Max. r. p. m.	Horsepowers at varying steam pressures									
		60	70	80	90	100	110	120	130	140	150
4x5	500	4.0	5.0	5.5	6.5	7.5	8.5	9.5	10.0	11.0	12.0
5x5		6.0	7.5	9.0	10.5	12.0	13.0	14.5	16.0	17.5	18.5
6x5		9.5	11.5	13.5	15.0	17.0	19.0	21.0	23.0		
7x5		13.0	15.5	18.0	21.0	23.5					
5x6	475	7.5	9.0	10.5	12.0	13.5	15.0	16.5	18.0	19.5	21.0
6x6		11.0	13.0	15.5	17.5	20.0	22.5	24.5	26.5	29.0	31.0
7x6		14.5	17.5	20.5	24.0	27.0	30.0	33.0	36.0		
8x6		19.5	23.5	27.0	31.0	35.0					
6x7	425	11.5	13.5	16.0	18.0	20.5	23.0	25.0	27.0	29.5	32.0
7x7		15.5	18.5	21.5	25.0	28.0	31.0	34.0	37.5	40.5	44.0
8x7		20.5	24.5	28.5	33.0	37.0	41.5	45.5	50.0		
9x7		26.0	31.0	36.0	41.5	46.6					
7x8	400	16.5	19.5	23.0	26.5	30.0	33.0	36.0	39.5	42.5	46.0
8x8		22.0	26.5	31.0	35.0	39.5	44.0	48.5	53.0	57.5	62.0
9x8		27.5	33.5	39.0	44.5	50.0	55.5	61.0	66.5		
10x8		34.5	41.0	48.0	55.0	62.0					
8x9	375	23.0	27.5	32.0	36.5	41.0	46.0	50.5	55.0	59.5	65.0
9x9		29.0	35.0	41.0	47.0	53.0	59.0	64.5	70.0	76.0	82.0
10x9		36.0	43.5	51.0	58.0	65.0	72.5	80.0	88.0		
11x9		43.5	52.0	61.0	70.0	79.0					
9x10	350	30.0	36.0	42.5	48.5	54.0	60.5	66.0	72.5	78.5	84.5
10x10		37.5	45.0	52.5	60.0	68.0	75.5	83.0	91.0	99.0	106.0
11x10		45.0	54.0	63.5	73.0	82.0	91.0	100.0	109.0		
12x10		54.0	65.0	76.0	87.0	98.0					
10x12	300	38.0	46.0	54.0	62.0	70.5	78.5	85.0	93.0	100.0	108.0
11x12		46.5	55.0	64.5	73.5	82.0	91.5	101.0	110.0	120.0	129.0
12x12		56.0	70.0	78.0	90.0	101.0	112.0	123.0	135.0	145.0	156.0
13x12		65.0	78.0	92.0	105.0	118.0	131.0	143.0	153.0		
14x12		75.0	90.0	105.0	120.0	136.0	151.0				
16x12	300	30	40	50	60	70	80				
		28.0	49.5	73.0	94.0	118.0	138.0				

LOW PRESSURE

Size	Max. r.p.m.	Horsepowers at varying steam pressures							
		15	20	25	30	35	40	50	60
8x5	400	2.0	3.0	5.0	7.0	8.5	10.5	14.5	18.0
12x6	375	4.5	8.5	12.5	17.0	21.5	26.0		
14x7	350	8.5	14.0	21.0	26.0	33.0	40.0		
18x8	300	14.0	21.5	30.0	39.0				

Sturtevant Steam Turbines.

Simple and durable construction makes the Sturtevant steam turbine a reliable source of power for driving fans, blowers, centrifugal pumps and electric generators.

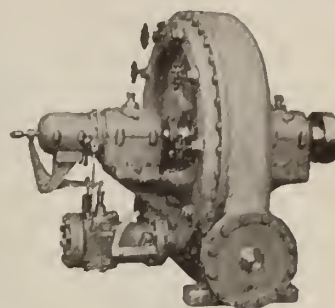
Type 6 is of the single stage, multi-velocity type, and its operation is such as to give high efficiency

DATA, TYPE 6 STEAM TURBINES

Size	R. p. m.	H. p.	Over all dimensions, in.			Maximum pipe sizes, in.		Diam. rotor, in.
			Length	Width	Height	Steam	Exhaust	
A-6	1000	1	37½	23½	22	1½	4	12
	4000							
B-6	1200	5	42½	30¾	28¾	2	6	18
	3600							
C-6	1200	10	52½	38¾	36¾	3	8	24
	3200							
D-6	1200	25	56¾	45½	43½	3½	8	30
	2800							
E-6	8000	50	60¾	51½	49½	4	10	36
	2400							

and permit of moderate rotative speeds. Hand valves are used for shutting off the nozzles, and the speed is regulated by a centrifugal throttling governor placed on the end of the shaft.

Internal lubrication is unnecessary, therefore the exhaust steam is free from oil.



STURTEVANT STEAM TURBINE, TYPE 6

Sturtevant Electric Motors.

TYPE D—Type D motors are designed primarily for use as a general purpose motor. The field frame is of cast iron. All sizes are provided with commutating poles. Sizes 100 to 103, inclusive, have 2 poles; sizes 1 to 9, inclusive, have 4 poles. They can be arranged for either floor, wall or ceiling mounting.

TYPE C—Type C motors are designed to meet the demand for a slow speed motor for direct connection to fan apparatus and the like.

The smaller sizes are of the end shield type, and the larger are all of the pedestal type

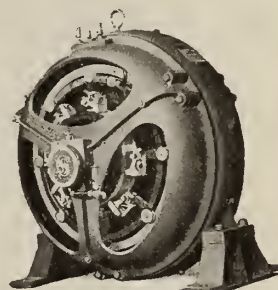
They are built in standard voltages and in capacities from 1 to 800 h.p.

OTHER TYPES—Type TF turbo motor for direct connection to high speed centrifugal fan and centrifugal pumps. Built in sizes 5 to 100 h.p.; speeds up to 4,000 r.p.m.

Type MP-4 built in larger sizes up to 125 h.p. at medium speeds.



STURTEVANT TYPE D MOTOR WITH COMMUTATING POLES



STURTEVANT TYPE C MOTOR WITH COMMUTATING POLES

DATA, TYPE D MOTORS, STANDARD STOCK RATINGS

Frame Size	Full load ratings						Max. allow. speed with weak shunt field	Shipping weight, lbs.
	115-volt		230-volt		550-volt			
	H. p.	R. p. m.	H. p.	R. p. m.	H. p.	R. p. m.		
100	1	1750	1	1750	1	1750	2000	135
101	2	1750	2	1750	2	1750	2000	250
102	3	1750	3	1750	3	1750	2000	300
103	5	1750	5	1750	5	1750	2000	400
1	7½	1750	7½	1750	7½	1750	2000	475
2	10	1750	10	1750	10	1750	2000	600
100	¾	1150	¾	1150	¾	1150	1700	135
101	1	1150	1	1150	1	1150	1700	250
102	2	1150	2	1150	2	1150	1700	300
103	3	1150	3	1150	3	1150	1700	400
1	5	1150	5	1150	5	1150	1700	475
2	7½	1150	7½	1150	....	....	1700	600
3	10	1150	10	1150	7½	1150	1700	800
4	15	1150	15	1150	10	1150	1700	980
5	20	1150	20	1150	15	1150	....	1250
6	..	....	25	1150	20	1150	....	1850
7	..	....	30	1150	..	....	....	2250
8	..	....	40	1150	..	....	....	2650
9	..	....	50	1150	..	....	....	3400
5	15	850	15	850	..	...	1100	1250
6	20	800	20	800	15	850	1100	1850
7	25	850	25	850	20	800	1100	2250
8	30	850	30	850	30	850	1100	2650
9	40	...	40	800	40	800	1100	3400

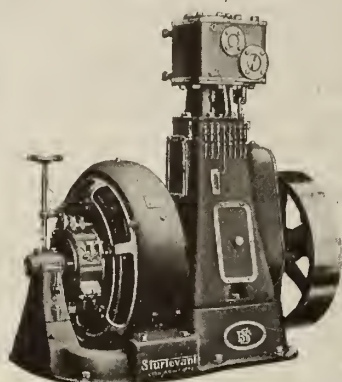
Sturtevant Generating Sets.

VS-7 AND VS-8 STEAM ENGINE SETS—Compact and self-contained units especially adapted for isolated power plants and for auxiliaries in large plants.

Generators are of the 8-pole type, capable of carrying a 50% overload momentarily without shifting brushes and without destructive sparking and a 25% overload for 2 hours without sparking or undue heating.

Both types are identical, except that the VS-7 has gravity lubrication and the VS-8 has forced lubrication.

Speed regulation is within 1½%, making the sets particularly desirable for lighting purposes.



STURTEVANT VERTICAL STEAM ENGINE GENERATING SET

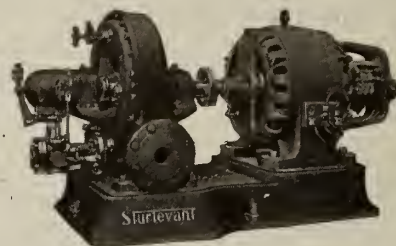
DATA, STEAM ENGINE GENERATING SETS

Kw.	Generator type	Engine size	Pipes, in.		Steam pressure, lbs.	R. p. m.	Net weight, lbs.		
			Steam	Exhaust			Set	Engine and ext. base	Generator
7½	7½ M P 6	4 x 5	1½	1½	175		2700	1350	
		5 x 5	1½	1½	120		2700	1350	
		6 x 5	1½	2	90		2725	1375	
		7 x 5	1½	2	60		2750	1400	1350
10	10 M P 6	5 x 6	1½	2	120		3675	1900	
		6 x 6	1½	2	90		3675	1900	
		7 x 6	2	2½	70		3700	1925	
		8 x 6	2	2½	50		3725	1950	1775
12½	12½ M P 6	5 x 6	1½	2	150		3775	1900	
		6 x 6	1½	2	110		3775	1900	
		7 x 6	2	2½	90		3800	1925	
		8 x 6	2	2½	60		3825	1950	1875
15	15 M P 6	6 x 7	2	2½	120		5175	2650	
		7 x 7	2	2½	90		5175	2650	
		8 x 7	2½	3	75		5250	2725	
		9 x 7	2½	3	60		5325	2800	2525
17½	17½ M P 6	6 x 7	2	2½	150		5275	2650	
		7 x 7	2	2½	110		5275	2650	
		8 x 7	2½	3	90		5350	2725	
		9 x 7	2½	3	70		5425	2800	2625
20	7 C	7 x 8	2½	3	120		6175	3475	
		8 x 8	2½	3	90		6175	3475	
		9 x 8	3	3½	75		6275	3575	
		10 x 8	3	3½	60		6375	3675	2700
22½	8 C	7 x 8	2½	3	130		6200	3475	
		8 x 8	2½	3	110		6200	3475	
		9 x 8	3	3½	90		6300	3575	
		10 x 8	3	3½	70		6400	3675	2725
25	9 C	7 x 8	2½	3	150		6225	3475	
		8 x 8	2½	3	110		6225	3475	
		9 x 8	3	3½	90		6325	3575	
		10 x 8	3	3½	70		6425	3675	2750
30	10 C	8 x 9	3	3½	130		6900	4100	
		9 x 9	3	3½	100		6900	4100	
		10 x 9	3	3½	80		7025	4225	
		11 x 9	3	3½	60		7150	4350	2800
35	12½ C	8 x 9	3	3½	150		7100	4100	
		9 x 9	3	3½	120		7100	4100	
		10 x 9	3	3½	90		7225	4225	
		11 x 9	3	3½	70		7350	4350	3000
40	15 C	9 x 10	3	3½	130		9125	5125	
		10 x 10	3	3½	110		9125	5125	
		11 x 10	3	3½	90		9275	5275	
		12 x 10	3½	4	75		9425	5425	4000
50	24 C	9 x 10	3	3½	150		11375	5125	
		10 x 10	3	3½	125		11375	5125	
		11 x 10	3	3½	105		11525	5275	
		12 x 10	3½	4	90		11675	5425	6250
60	24 C	10 x 12	3	3½	140		15100	8650	
		11 x 12	3½	4	120		15100	8650	
		12 x 12	4	4½	100		15100	8650	
		13 x 12	4	4½	90		15300	8850	
75	34 C	14 x 12	5	6	80		15300	8850	
		16 x 12	5	6	60		15500	9050	6450
		10 x 12	3	3½	170		16550	9050	
		11 x 12	3½	4	150		16550	9050	
100	50 C	12 x 12	4	4½	130		16550	9050	
		13 x 12	4	4½	110		16750	9250	
		14 x 12	5	6	100		16750	9250	
		16 x 12	5	6	80		16950	9450	7500
		10 x 12	3	3½	210		17700	9200	
		11 x 12	3½	4	180		17700	9200	
		12 x 12	4	4½	150		17700	9200	
		13 x 12	4	4½	130		17900	9400	8500
		14 x 12	5	6	110		17900	9400	
		16 x 12	5	6	80		18100	9600	

TURBO GENERATING SETS—These sets make desirable power and lighting units. When mounted on cast iron subbase, their compactness recommends them where space is an important item to be considered. Absence of vibration due to perfect balance makes a foundation other than a subbase unnecessary.

Absence of oil in the exhaust steam makes it possible to utilize the exhaust in the heating system. An efficient regulating device makes it possible to maintain a constant voltage and impossible for the turbine to overspeed. Individual nozzle shut-off valves are a source of great steam economy when operating under fractional loads.

Sturtevant steam turbines (described on preceding page) can be furnished separately and can be directly connected to standard makes of electric generators.



STURTEVANT TURBO GENERATING SET

*DATA, D. C. 2-WIRE TURBO GENERATING SETS

Kw.	Type turbine	Steam pressure, lbs.	Diameter pipes, in.		R. p. m.	Overall dimen., in.			Net weight, lbs.
			Steam	Exhaust		Length	Width	Height	
5	A6	75 to 250	1½	2	4000	66¼	30	30	1300
7½	A6	75 to 250	1½	2½	3600	71	30	30	1575
10	A6	75 to 250	2	3	3600	71	30	30	1775
	B6	75 to 250	2	3	3600	74¾	31¾	34¾	2225
15	A6	75 to 250	2	4	3600	73¾	30	34	2225
	B6	75 to 250	2	4	3600	76¾	36	36¼	2700
25	B6	75 to 250	2½	4	3600	82½	36	36¼	2900
	C6	75 to 250	2½	4	3600	89½	43¾	44½	3425
35	B6	75 to 250	3	5	2800	94½	36	37¼	3525
	C6	75 to 250	3	5	2800	101½	41¾	45¼	4075
50	C6	100 to 250	3	5	2800	101½	41¾	45¼	4130
	D6	75 to 250	4	6	2800	110¼	48½	52	5130
75	D6	100 to 250	4	8	2200	124	48½	52¾	6450
	E6	75 to 250	5	8	2200	134½	60	61½	7250
100	D6	150 to 250	5	8	2200	130	48½	52¾	6925
	E6	100 to 250	5	8	2200	140	60	61½	7725

*D.C. 3-wire, 125 and 250 volts can be furnished in sizes from 35 to 100 k.w. to comply with operating conditions, also A.C. 2 and 3 phase, all cycles, in sizes from 50 to 150 k.v.a.

Sturtevant Gear Transmissions.

Built primarily for turbo blower outfits. Their chief duty is to enable both turbine and blower to run at their most efficient speed, resulting in the remarkable saving in power and lower steam consumption.

Gears have double helical (herringbone) stub teeth, giving maximum strength and perfect rolling contact without end thrust. They are accurately cut and do not require filing, fitting or running in. Tooth pres-



STURTEVANT GEAR TRANSMISSION

DATA, GEAR TRANSMISSIONS

Pitch	Ratio (Max.)	Centers, in.	Weights		
			4-in. face	6-in. face	8-in. face
8	8.08	8½	1200	1300	1400
to 10	12.33	12½	1600	1700	1800
10	16.58	16½	2000	2100	2200
6	5.78	8½	.....	.....	1500
to 8	9.00	12½	.....	.....	1900
8	12.20	16½	.....	.....	2300
5	4.66	8½	.....	.....	1600
to 7	7.34	12½	.....	.....	2000
7	10.00	16½	.....	.....	2400

sure is very light, consequently the life of the gears is unusually long.

Quiet operation is secured by means of fine pitch and wide face. Bearings are long and shafts large, giving minimum bearing pressure.

Complete transmission, including gears, oil pump and bearings is contained in lower casing. Upper casing serves as a cover to keep oil in and dust out. Small door in upper casing permits inspection while in operation.

Sturtevant Turbo Undergrate Blowers.

Compact, self-contained units designed to secure the advantages of mechanical forced draft without the expense of the larger systems.

They consist of a specially designed built-up propeller fan, with rolled aluminum blades securely riveted into a bronze hub and mounted upon the shaft of a Sturtevant steam turbine. The rotor is a solid forging of the best open hearth steel, with buckets milled into the rim. Nozzles and reversing buckets consist of one solid bronze casting, reversing buckets being milled in the solid metal.

Bearings are bronze sleeves lubricated by ring oilers, which are continually supplied with oil from a reservoir with capacity large enough to make frequent filling unnecessary. Bearing casing and supporting arm are cast integrally with the turbine casings, making an exceptionally rigid unit.



TURBO UNDERGRATE BLOWER

CAPACITIES, DESIGN 3 TURBO UNDERGRATE BLOWERS

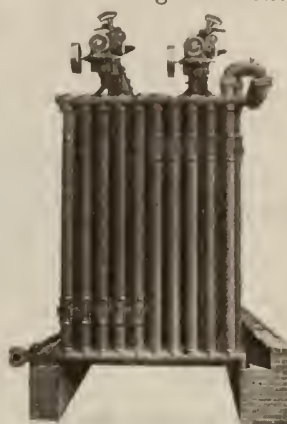
Draft or static pressure in inches of water	No. 14 Blower		No. 18 Blower		No. 22 Blower		No. 26 Blower	
	R. p. m.	Cu. ft. air supplied per min.	R. p. m.	Cu. ft. air supplied per min.	R. p. m.	Cu. ft. air supplied per min.	R. p. m.	Cu. ft. air supplied per min.
1/2"	2200	1850	2050	3300	1525	3770	1175	6400
	2750	2600	2500	4350	1925	5300	1625	10500
	3300	3250	3150	5850	2500	7400	2050	13700
	3850	4000	3850	7250	3050	9400	2500	17000
	4400	4600	4300	8200	3850	12000	2950	20200
3/4"	2200	1550	2050	2900	1525	3150	1175	5300
	2750	2350	2500	4050	1925	4800	1625	9450
	3300	3100	3150	5600	2500	7050	2050	13000
	3850	3800	3850	7100	3050	9070	2500	16600
	4400	4450	4300	8050	3850	11800	2950	19900
1"	2200	1250	2050	2500	1525	2500	1175	4250
	2750	2100	2500	3700	1925	4300	1625	8650
	3300	2900	3150	5300	2500	6700	2050	12400
	3850	3600	3850	6900	3050	8800	2500	16000
	4400	4350	4300	7900	3850	11600	2950	19600
1 1/4"	2750	1850	2050	2050	1525	1850	1175	3100
	3000	2300	2500	3400	1925	3800	1625	7900
	3550	3100	3150	5100	2500	6300	2050	11900
	4100	3850	3850	6700	3050	8500	2500	15600
	4400	4200	4300	7700	3850	11300	2950	19100
1 1/2"	2750	1600	2500	3000	1925	3250	1625	7000
	3000	2050	2950	4250	2500	5900	1925	9900
	3550	2900	3400	5400	3050	8200	2225	12600
	4100	3650	3850	6450	3450	9650	2650	16400
	4400	4050	4300	7500	3850	11100	2950	18800
1 3/4"	2750	1350	2500	2700	1925	2750	1625	6310
	3000	1850	2950	4000	2500	5500	1925	9350
	3550	2700	3400	5150	3050	7900	2225	12100
	4100	3500	3850	6250	3450	9400	2650	16000
	4400	3900	4300	7300	3850	10900	2950	18400
2"	2750	1100	2500	2350	1925	2250	1625	5500
	3000	1600	2950	3700	2500	5100	1925	8650
	3550	2500	3400	4900	3050	7550	2225	11500
	4100	3350	3850	6000	3450	9100	2650	15400
	4400	3700	4300	7100	3850	10600	2950	17900
2 1/2"	3000	1120	2500	1650	1925	1160	1625	3860
	3300	1630	2950	3100	2500	4300	1925	7250
	3550	2100	3400	4420	3050	7000	2225	10400
	4100	3000	3850	5600	3450	8600	2650	14500
	4400	3450	4300	6720	3850	10100	2950	17100
3"	3300	1210	2700	1780	2500	3450	1625	2250
	3550	1700	2950	2500	2850	5400	1925	5900
	3850	2200	3400	3900	3050	6300	2225	9150
	4100	2650	3850	5150	3450	8050	2650	13600
	4400	3080	4300	6300	3850	9600	2950	16300

Sturtevant Fuel Economizers.

Sturtevant fuel economizers effect large fuel savings, increase the capacity of boilers, prolong their life, purify the feed water and reduce the smoke nuisance. When used in connection with the Sturtevant system of mechanical draft, increased savings may be secured through the burning of the cheapest grades of fuel.

The construction of the Sturtevant economizer is extremely simple.

Consult the Sturtevant engineers for a satisfactory solution of economizer problems.



STURTEVANT FUEL ECONOMIZER

SIZES, STANDARD ECONOMIZERS

Height over gearing, 12 ft. 6 in. Height over section, 10 ft. 2 1/4 in.

Machine No.	No. pipes	No. sections	No. pipes in section	External heating surface, sq. ft.	Capacity, lbs. of water	General dimensions			
						Length, ft., in.	Width with standard back side dampers ft., in.	Area between tubes, sq. in.	
								Without side dampers	With one side damper
								ft., in.	sq. in.
11	100	20	5	1248	6300	12-1	4-9	19.40	26.05
12	120	24	5	1499	7560	14-6	"	"	"
13	140	28	5	1747	8820	16-11	"	"	"
14	160	32	5	1997	10080	19-4	"	"	"
19	120	20	6	1496	7560	12-1	5-5	22.00	29.30
20	144	24	6	1795	9072	14-6	"	"	"
21	168	28	6	2094	10584	16-11	"	"	"
22	192	32	6	2393	12096	19-4	"	"	"
23	216	36	6	2692	13608	21-9	"	"	"
28	140	20	7	1743	8820	12-1	6-1	24.70	31.95
29	168	24	7	2092	10584	14-6	"	"	"
30	196	28	7	2440	12348	16-11	"	"	"
31	224	32	7	2789	14112	19-4	"	"	"
32	252	36	7	3137	15876	21-9	"	"	"
40	192	24	8	2388	12096	14-6	6-9	27.35	34.60
41	224	28	8	2786	14112	16-11	"	"	"
42	256	32	8	3185	16128	19-4	"	"	"
43	288	36	8	3583	18144	21-9	"	"	"
44	320	40	8	3981	20160	24-2	"	"	"
53	288	32	9	3580	18144	19-4	7-5	30.00	37.25
54	324	36	9	4027	20412	21-9	"	"	"
55	360	40	9	4475	22680	24-2	"	"	"
56	396	44	9	4922	24948	26-7	"	"	"
57	432	48	9	5370	27216	29-0	"	"	"
64	280	28	10	3478	17640	16-11	8-1	32.65	39.90
65	320	32	10	3974	20160	19-4	"	"	"
66	360	36	10	4471	22680	21-9	"	"	"
67	400	40	10	4968	25200	24-2	"	"	"
68	440	44	10	5465	27720	26-7	"	"	"
69	480	48	10	5962	30240	29-0	"	"	"
70	520	52	10	6458	32760	31-5	"	"	"
78	528	48	11	6554	33268	29-0	8-9	35.30	42.55
79	572	52	11	7101	36045	31-5	"	"	"
80	616	56	11	7646	38811	33-10	"	"	"
81	660	60	11	8193	41588	36-3	"	"	"
82	704	64	11	8739	44359	38-8	"	"	"
91	720	60	12	8933	45371	36-3	9-5	37.95	45.20
92	768	64	12	9529	48398	38-8	"	"	"
93	816	68	12	10125	51425	41-1	"	"	"
94	864	72	12	10721	54452	43-6	"	"	"
95	912	76	12	11317	57479	45-11	"	"	"
96	960	80	12	11913	60506	48-4	"	"	"
97	1008	84	12	12489	63432	50-9	"	"	"
98	1056	88	12	13065	66357	53-2	"	"	"

Sturtevant Drying Systems.

The drying department of this company is in a position to provide drying equipment for various kinds of industrial work. The experts comprising this department have an intimate knowledge of the materials most generally requiring drying, and their services are at the disposal of those desiring to install systems for drying paper, brick and clay products, leather, varnish, paint, fish, fruits, chemical powders, milk, malt, glue, lumber, etc.

All drying requirements and conditions are known by the Sturtevant engineers and can be obtained precisely by Sturtevant dryers. Submit dryer problems to this company for a satisfactory solution.

L. J. WING MFG. CO.

Air Handling and Power Plant Equipment

354-360 West 13th Street

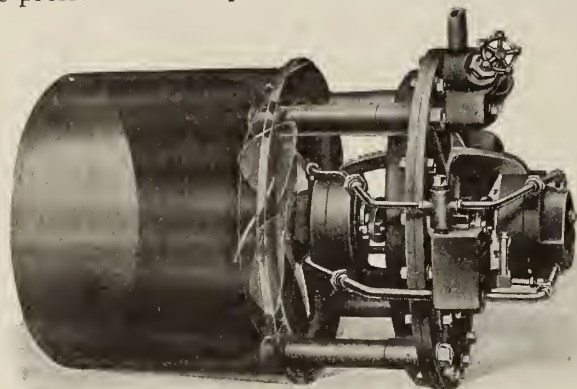
NEW YORK, N. Y.

Products.

WING TURBINE and ELECTRIC BLOWERS for mechanical draft; "WING-SCRUPLEX" and "DISC" FANS for ventilation; "WYDAWAKE" DAMPER REGULATORS. "WING-SCRUPLEX" UNIT HEATERS; "HYPRESS" PRESSURE BLOWERS and VACUUM PUMPS, SMALL STEAM TURBINES.

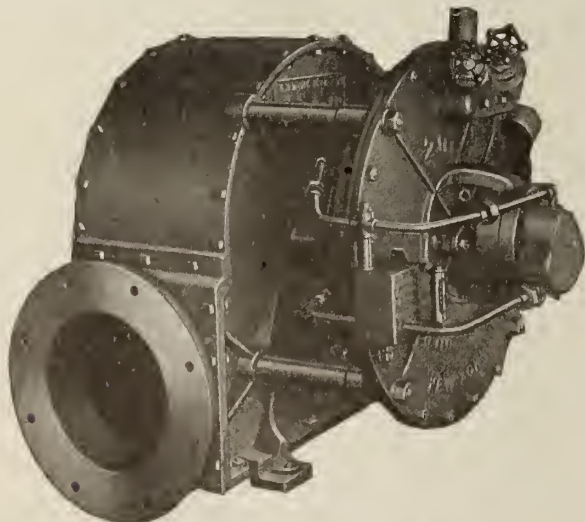
Wing Turbine Blower.

CAPACITIES—Wing turbine blowers are made in sizes from 12 to 25 in. Volume capacities range up to 17,000 to 20,000 cu. ft. per minute, depending upon the pressure. Static pressures range up to 5 in.



WING PROPELLER TYPE TURBINE BLOWER

APPLICATIONS—Wing turbine blowers were originally designed for forced draft in hand fired boilers; but with their improvement and development, their use has been extended to stoker installations. For drying and ventilating, too, they have proved exceptionally fitted, for by the simple addition of a heater, turning the exhaust of the turbine into the heating coils, this propeller type blower becomes a complete drying unit. Such a unit takes up only a *fraction* of the space occupied by a centrifugal blower.



WING CENTRIFUGAL TURBINE BLOWER

For such applications as require higher pressure than that given by an open type or propeller fan, the Wing centrifugal turbine blower is built. This small, simple outfit possesses the advantage of greatly smaller upkeep than the engine driven type. The whole outfit takes up little space and delivers high volumes of air against high static pressures.

Wing "Wydawake" Damper Regulator.

The "Wydawake" damper regulator is sensitive and accurate in operation. Consists of only 3 principal parts. Used to operate both dampers and blower valves.

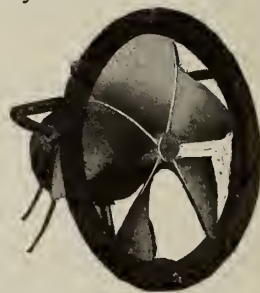
Wing "Hypress" Pressure Blowers and Vacuum Pumps.

"Hypress" blowers are efficient and absolutely positive in operation, built up of only four parts. "Hypress" blowers put up pressures to 10 lbs.

The "Wing-Scruplex" Fan.

The remarkable record made by this fan is due to its highly efficient operation against resistances offered by ductwork, etc. This fan delivers its air straight forward, in a column of practically the same diameter as the fan itself, and at practically uniform velocity over its entire area; thereby eliminating eddy current losses.

The propeller is a solid aluminum casting in the smaller sizes and of pressed steel in the larger sizes. Motors are fully enclosed and dustproof. Made in all sizes, 12 in. to 12 ft. in diameter, and are built for either motor or pulley drive.



"WING-SCRUPLEX" FAN

The "Wing-Scruplex" Exhauster.

This unit combines all the advantages of the "Scruplex" fan with certain advantages of the enclosed or steel plate fan. The motor of the "Scruplex" exhauster is entirely outside the current of air or vapor being handled by the fan. The motor thereby keeps clean and is easy of access. The unit is of small dimensions, capable of exhausting very large volumes of air.



"WING-SCRUPLEX" EXHAUSTER

The "Wing-Scruplex" Unit Heater.

This unit is a combination of the "Scruplex" fan and a heater. The apparatus is so arranged as to direct the heated air downward to assure a warm layer of air at the floor level and, at the same time, to keep the air in a room circulating. Several units may be used in one room, each placed where the heat is most needed. Ideal for large open shops, foundries, steel mills, etc.

Wing Steam Turbine.

For driving centrifugal pumps, etc., requiring up to 25 h. p. Wing turbines are simple, compact, economical driving units, low in cost.

CARRIER AIR CONDITIONING COMPANY OF AMERICA

BUFFALO, N. Y.

Products.

AIR WASHERS.

Humidifiers, Dehumidifiers, Generator Coolers.

Carrier Air Washers.

Air washers insure pure, clean air by removing all dust with a finely divided water spray. Operated in connection with heating installations a lower temperature may be used, because of the increase in comfort due to proper humidity.



INTERIOR VIEW OF CARRIER AIR WASHER

Carrier Air Washers consist of three important elements: first, the Spray System; second, the Eliminators; and third, the Dew-point Control. Each of these is of extreme importance in insuring the proper control of a perfect heating system.

Carrier Spray System.

A fine spray is essential for the intimate intermingling of the water and the air. The Carrier Spray Nozzle is very simple and highly effective. The atomizing effect does not depend upon the size of the nozzle opening, but upon the interior design of the nozzle itself; hence, large openings can be used, which positively prevent clogging. With water pressure as low as 15 lbs. an extremely fine spray is produced.



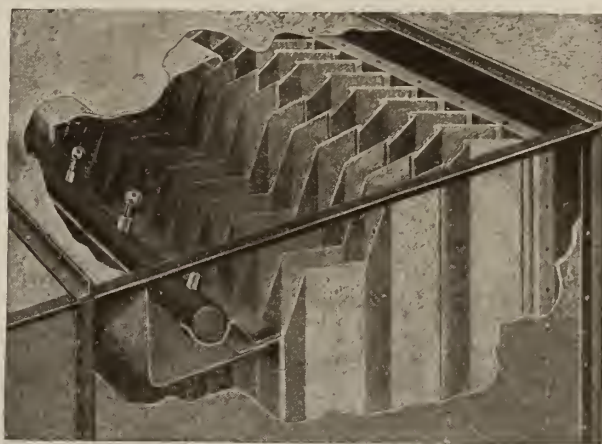
AIR WASHER SPRAY IN OPERATION



SPRAY NOZZLE

Eliminators.

The eliminators of the Carrier Air Washer consist of a series of zigzag, vertical, continuous surfaces, against which the moisture laden air is thrown in its passage through the washer. The free moisture and dirt adhere to the plates and is washed into the settling tank by the continuous spray from the flooding nozzles.



PART OF CASING REMOVED SHOWING ELIMINATORS IN POSITION



FIVE PAILS OF DIRT WASHED FROM AIR DURING ONE WEEK'S OPERATION OF AIR WASHER

Dew-point Control.

The Carrier Dew-point control insures the delivery of air into buildings with just the proper amount of moisture, without variation, during the heating season.

Catalogue.

Carrier Catalogue No. 13 gives complete data and information.

ATMOSPHERIC CONDITIONING CORPORATION

Specialists in Air Conditioning Equipment

443 Chestnut Street
PHILADELPHIA, PA.

Products.

EQUIPMENT for Maintaining Artificial Atmospheric Conditions in Industrial Plants; HUMIDIFYING, DEHUMIDIFYING, DRYING, COOLING APPARATUS and AIR CONDITIONING APPARATUS for Generator and Transformer Ventilation.

Webster Air Conditioning Apparatus for Generator and Transformer Ventilation.

The construction of the Webster air conditioning apparatus for cleansing and cooling the air for turbo-generator and transformer ventilation is arranged to permit the air to pass through a spray chamber in which water is finely atomized, producing an extremely intimate contact between the air and the water.

Under certain conditions and in some localities, the prime object in installing such an apparatus is for the removal of dust, dirt, oily particles and foreign matter generally from the air, the thought of cooling being secondary.

For use in such cases the Webster Type "G-W" apparatus will fully meet the requirements; the length of apparatus, quantity of water circulated and cost of installation will be somewhat less than that for the Webster Type "G-C" equipment, which is designed to secure the greatest cooling effect possible with recirculated water, reducing the temperature of the air passing to the entering wet bulb temperature.

The Webster apparatus includes as its initial feature a spray chamber containing a series of Webster spiral mist nozzles for atomizing the spray water.

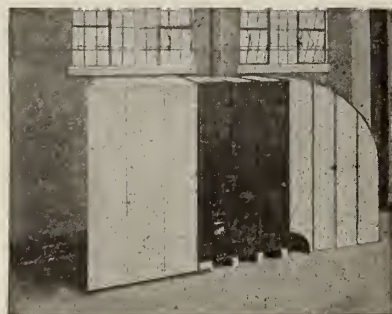
These nozzles are arranged uniformly over the entire spray chamber, there being but one group in the "G-W"



type of apparatus, the quantity of water handled being sufficient to remove 98% of all foreign matter contained in the entering air, and capable of cooling this air 70% of the wet bulb depression.

In the Webster Type "G-C" apparatus the spray chamber piping consists of two banks of sprays, one discharging the water in the direction of the air flow, the other discharging against the air flow. This construction insures a very intimate contact between the air and water, resulting in the air being reduced to the saturation point, at the same time giving a 98% cleansing effect.

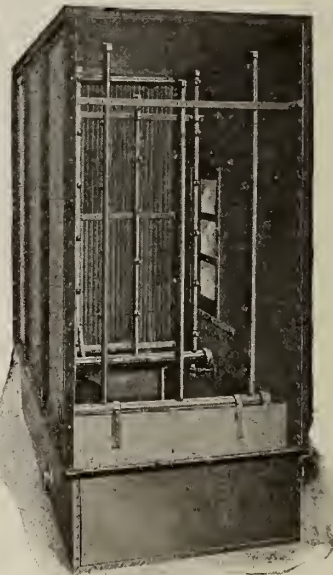
The Type "G-W" (400 series) is 7 ft. long, while the Type "G-C" (500 series) is 9 ft. long and each is made in various dimensions and capacities to meet any local space condition.



50,000 C.F.M. WEBSTER APPARATUS
INSTALLED IN POWER
PLANT BELOW

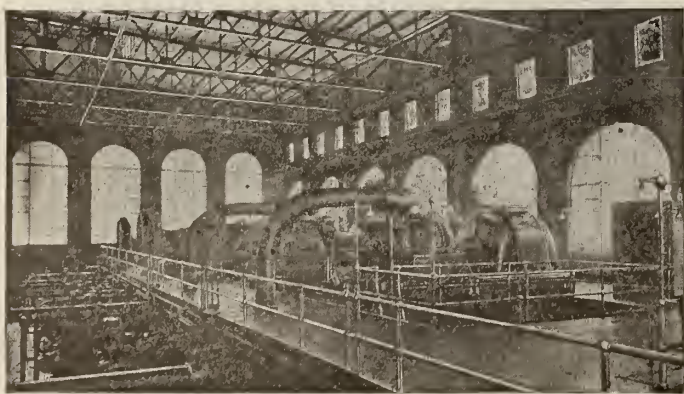


SPRAY CHAMBER VIEW OF
WEBSTER APPARATUS



WEBSTER TYPE "G-C"
APPARATUS

WEBSTER SPIRAL MIST NOZZLE—Nozzle shown in illustration is designed to produce the proper atomi-



INTERIOR VIEW OF GENERATOR ROOM, MUNICIPAL POWER
PLANT, JACKSONVILLE, FLA.

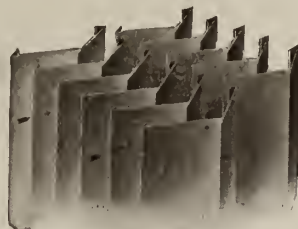
SCOFIELD ENGINEERING Co., Construction Engineers, Philadelphia, Pa.
5 Turbo-generators provided with cool, clean air through Webster apparatus



THE WEBSTER SPIRAL MIST NOZZLE (PATENTED)

zation of spray water at a pressure of 17 lbs. per sq. in. The mist nozzles are made entirely of brass and have a discharge orifice of $\frac{3}{16}$ in. in diameter. The large water opening makes the mist nozzle practically non-cloggable.

ELIMINATOR—For eliminating the free moisture from the air after it has been subjected to the sprays, a series of vertical baffles are provided and may be constructed of galvanized steel, ingot iron or copper as desired. The front and rear sections of the eliminator are staggered so that the air streams will be split in passing through the same. The construction of the eliminators is such that all entrained moisture is removed from the air being discharged to generator or transformer.



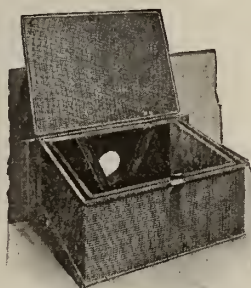
SECTIONAL VIEW OF USUAL FORM OF WEBSTER ELIMINATOR

TANK—It extends under the entire apparatus and is provided with the necessary flanges for fresh water, overflow, drain, suction connections, etc. The tank is usually made 15 in. in depth, which allows ample space for the collection of dust, dirt and foreign matter removed from the entering air. The tank should be cleaned and flushed out daily.

STRAINER—The strainer furnished for sheet metal tank is of the double brass box type with hinged lid and a removable inner basket having a free area 15 times that of the pump suction. The entire strainer is removable for cleansing and inspection. For concrete tanks, the strainer furnished is of the cylindrical type having the same free area through the inner basket.

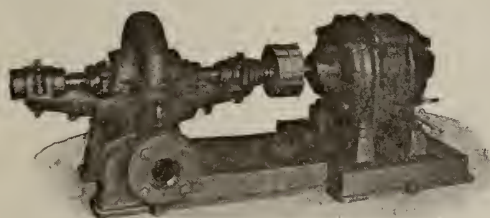


DOUBLE CYLINDRICAL BRASS STRAINER



DOUBLE BOX BRASS STRAINER

CENTRIFUGAL PUMP—Of the double suction type having horizontally split shell which allows access to the interior parts of the pump without disturbing the pipe connections. The pump is provided with flexible coupling direct connected to motor, both mounted on cast iron base.



DOUBLE SUCTION CENTRIFUGAL PUMP DIRECT CONNECTED TO ELECTRIC MOTOR

APPLICATION—Each installation must be designed for the particular space available and conditions encountered.

Maintenance of Artificial Atmospheric Conditions.

Special apparatus for maintaining artificial atmospheric conditions in industrial plants, where humidifying, dehumidifying, cooling, drying, etc., are involved, is the chief product of the company. The company's engineers are constantly engaged in the investigation of conditions and the design of apparatus for correcting troubles in plants where atmospheric control is essential.

The nature of the problem influences the type and construction of each equipment, which may require apparatus using recirculated water in the simpler forms or may make the use of deep well water necessary. This type of apparatus may be of either the single or double stage type, the latter especially desirable where the quantity of well water is limited.

Where greater cooling effect is necessary and the results to be secured warrant this expense, apparatus can be furnished in connection with which refrigerating equipment is provided.

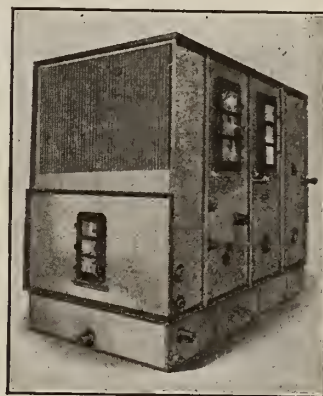
The Webster system of automatic humidity control makes possible the regulation of temperature within 1° Fahr. either way and the control of the relative humidity within 2% of the point for which it is set.

The company's engineers are available at all times for investigation of conditions and consultation regarding the adaptability of Webster apparatus.

No contract ever undertaken where just the results the buyer wishes can not be accomplished.

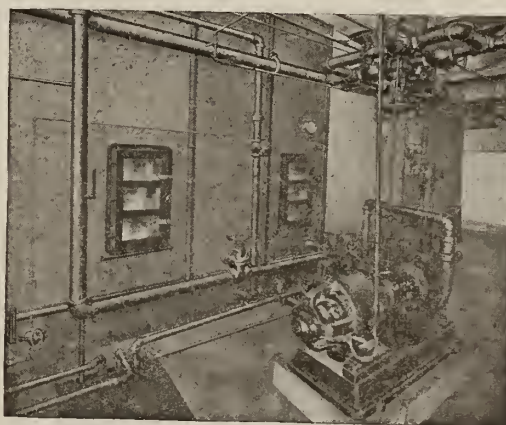


Showing Spray Chamber Side



Showing Eliminator Side

WEBSTER DEHUMIDIFIERS OF THE REFRIGERATION TYPE



WEBSTER HUMIDIFIERS EQUIPPED WITH THE WEBSTER SYSTEM OF HUMIDITY CONTROL

CARRIER ENGINEERING CORPORATION

Consulting, Designing and Contracting Engineers; Air Conditioning and Drying
Specialists in Manufactured Weather

39 Cortlandt Street
NEW YORK, N. Y.

BRANCH OFFICES

BUFFALO, N. Y., Prudential Building
BOSTON, MASS., 176 Federal Street

PHILADELPHIA, PA., Land Title Building
CHICAGO, ILL., Transportation Building

Products and Services.

CONSULTATION, DESIGNS, CONSTRUCTION, EQUIPMENT and INSTALLATION, complete or in part, of plants for the purpose of Humidifying, Dehumidifying, Cooling, Air Washing, Automatic Temperature and Humidity Regulation.



Experience and Co-operative Service.

More than a thousand Carrier installations are manufacturing more than 400,000,000 lbs. of made-to-order weather every working day; in more than 200 distinctly different American industries, all the way from chewing gum to aeroplanes.

Carrier service is founded upon the experience gained in serving this remarkable clientele.

Wherever weather—dry, moist, hot or cold—affects the process or the labor, Carrier apparatus, designed and installed by Carrier engineers, can be efficiently employed to manufacture the kind of weather required.

Manufactured weather is improving efficiency, standardizing routine, increasing production, and making "Every day a good day" in all of the following industries, besides many others (space permits the mention of only one firm name, selected at random, in each industry).

Literature.

Any of the following publications will be gladly furnished on request:

"Weather, and The Story Of How It Is Manufactured," a 64-page bound book telling, non-technically, the fairy story of manufactured weather.

- Bulletin 100, Humidifying Apparatus.
- Bulletin 101, Dehumidifying Apparatus.
- Bulletin 102, Humidity and Temperature Regulating Devices.
- Bulletin 103, Manufactured Weather in The Textile Mill.
- Bulletin 109, The Harrison Automatic Dryer.
- Bulletin 200, The Theory and Practice of Drying With Conditioned Air.

A Few Firms and Industries We Have Served.

Aeroplanes—U. S. Naval Aircraft Factory, Philadelphia, Pa.
Alpacas—Farr Alpaca Co., Holyoke, Mass.
Ammonium Nitrate—Atlas Powder Co., Perryville, Md.
Arsenals—U. S. Government, Rock Island, Ill.
Artificial Silk—Viscose Co., Marcus Hook, Pa.
Asbestos—H. W. Johns-Manville Co., Manville, N. J.
Asphalt—Barber Asphalt Co., Maurer, N. J.
Automobile Tire Fabrics—Brighton Mills, Passaic, N. J.
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Bakery—Gordon-Pagle Co., Detroit, Mich.
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Bathrooms—Trenton Pottery Co., Trenton, N. J.
Bond Papers—Crocker-McElwain Co., Holyoke, Mass.
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Candy—W. F. Schrafft & Sons Corp., Boston, Mass.
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Capsules—Eli Lilly Co., Indianapolis, Ind.
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Ceramics—General Electric Co., Schenectady, N. Y.
Chewing Gum—Beechnut Packing Co., Canajoharie, N. Y.

Chicle—American Chicle Co., Long Island City, L. I., N. Y.
Chocolate—Hershey Chocolate Co., Hershey, Pa.
Cigarettes—Tobacco Products Corp., New York, N. Y.
Cigars—Tobacco Products Corp., New York, N. Y.
Citric Acid—Chas. Pfizer Co., New York, N. Y.
Clubs—Royal Automobile Club, London, England
Coffee Substitute—Kellogg Corn Flakes Co., Battle Creek, Mich.
Cord Tire Fabrics—Winnsboro Mills, Winnsboro, S. C.
Cotton Goods—Riverside and Dan River Mills, Danville, Va.
Crude Rubber—Hartford Rubber Co., Hartford, Conn.
Dry Plates—Defender Photo Supply Co., Rochester, N. Y.
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Knit Goods—Mercury Mills, Windsor, Ont.
Knitting Yarns—S. B. & B. W. Fleisher Bros., Philadelphia, Pa.
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Conditioning—U. S. Appraisal Co., New York, N. Y.
Electrical—General Electric Co., Schenectady, N. Y.
Explosives—E. I. duPont de Nemours & Co., Wilmington, Del.
Pathological—Rockefeller Institute of Research, New York, N. Y.
Steel—Bethlehem Steel Co., So. Bethlehem, Pa.
U. S. Bureau of Standards, Washington, D. C.
Leather Drying—International Shoe Co., St. Louis, Mo.
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Pottery—Standard Sanitary Mfg. Co., Kokomo, Ind.
Powder—E. I. duPont de Nemours & Co., Wilmington, Del.
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Rifles—Winchester Repeating Arms Co., New Haven, Conn.
Rubber—Morgan & Wright, Detroit, Mich.
Sanitariums—Battle Creek Sanitarium, Battle Creek, Mich.
Serums—Great Western Serum Co., Chicago, Ill.
Shoe Strings—Narrow Fabric Co., Reading, Pa.
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Silk Throwing—Klots Throwing Co., New York, N. Y.
Soap—Procter & Gamble, Ivorydale, Ohio
Spun Silk—Champlain Silk Co., Whitehall, N. Y.
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Underwear—Northwestern Knitting Mill, Minneapolis, Minn.
Velvets—Cheney Bros., South Manchester, Conn.
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Wireless Station—Tuckerton Radio Station, Tuckerton, N. J.
Worsted Yarns—Passaic Worsted Spinning Co., Passaic, N. J.
Yeast—Corby Co., Langdon, D. C.

W. L. FLEISHER & CO., INC.

Consulting and Contracting Industrial Engineers for Air Conditioning and Drying

31 Union Square West
NEW YORK, N. Y.

Sales inquiries direct to home office, or the 22 branch offices of the B. F. Sturtevant Co., in principal cities of the United States

Products.

AIR CONDITIONING SYSTEMS: Humidifying, Dehumidifying, Heating, Ventilating.

DRYERS for SOLIDS: Tray, Tunnel, Progressive.

DRYERS for LIQUIDS: Spray type.

Service.

W. L. FLEISHER & Co., INC., employs a staff of chemical and mechanical engineers solely for the purpose of working on problems which arise in the preparation and use of materials such as:

Chemicals	Paints	Wool	Fruits
Drugs	Soaps	Fibers	Milk
Dyes	Silk	Lumber	Meats
Varnishes	Cotton	Leather	Candy

Laboratories, equipped with experimental and model humidifiers, dehumidifiers, washers for the clim-



Air Conditioning.

The humidifying, dehumidifying, heating and cooling systems installed by W. L. FLEISHER & Co., INC., maintain constant atmospheric conditions inside the factory by means of patented devices. They insure an uninterrupted production in spite of adverse winter or summer weather.

Installations are made only after exhaustive tests both in the laboratory and at the factory, and are guaranteed to "deliver the climate" ideal for the specific purpose.

This company carries the problem through from preliminary investigation to the completed installation and turns the equipment over in operating condition with guarantees demonstrated.

They offer the ideal combination—Fleisher Service and Sturtevant Apparatus.

Dryers for Solids.

Like the air conditioning systems, the dryers of this company are built to fit the particular problem, and no recommendation is made until after scientific experiments have determined the proper solution.

Building made-to-order equipments enables W. L. FLEISHER & Co., INC., to furnish tray, tunnel, or progressive types of highest mechanical and thermal efficiency, each fitted to the particular problem.

Results are guaranteed.

Dryers for Liquids.

The spray dryers of this company are of the continuous operating type, delivering the product in powder or granulated form. They are inherently simple, fireproof, economical to operate, require no skilled attendance and do not affect the most delicate products.

The spray dryers not only offer their inherent advantages, but their use usually eliminates from the manufacturing process many troublesome and expensive steps, such as filtering, cake drying, grinding and screening.

A commercial scale laboratory is at the service of prospective purchasers for making tests of factory size.



AIR CONDITIONING IN A CANDY FACTORY

ination of dust and gases, shelf dryers and spray dryers, are at the service of engineers and contractors.

This company handles each problem from preliminary laboratory work through design to complete installation of the system as an individual problem. Standard apparatus used, any part of which can be easily renewed.



TYPICAL DEHUMIDIFYING INSTALLATION



CHEMICAL DRYER

PARKS-CRAMER COMPANY

SUCCESSORS TO THE G. M. PARKS CO., AND STUART W. CRAMER

Manufacturers of Humidifying Apparatus
FITCHBURG, MASS.

BRANCH OFFICES

BOSTON, MASS., 1102 Old South Building

CHARLOTTE, N. C.

Products.

AIR CONDITIONING EQUIPMENTS; TURBO-HUMIDIFYING SYSTEM; TURBO OIL SPRAYER; AIR WASHERS; HUMIDIFIERS; COOLERS; AUTOMATIC HUMIDITY AND TEMPERATURE REGULATORS; HYGROMETERS; PSYCHROMETERS; DIAPHRAGM VALVES; COMPRESSED AIR CLEANING DEVICES.

For the Merrill Process of Industrial Heating, see page 962.

Air Conditioning Equipments.

The requirements of the various industries being so different, it early developed that no one particular system could meet all possible conditions; and, to properly meet the general demands, it became necessary to develop a number of types of equipment, and the matter now merely resolves itself into what system is best adapted to the particular problem presented.

Sometimes it is merely desirable to humidify, sometimes to air-wash or to heat, but more frequently to combine either two or more of these features in the same plant and at the same time to automatically control both the temperature and humidity.

With these requirements in mind, the following types of air conditioning equipment have been developed, which by themselves, or in combination with each other, meet most completely the individual requirements of all forms of industry.

(A) Central station outfits for ventilating, cooling, heating, air cleansing, humidifying, or dehumidifying.

(B) Fan driven air conditioners, both of the inside and of the wall ventilating type.



(C) Improved accessible spray humidifiers.

(D) Forced draft multiple bank atomizers.

(E) Humidity and temperature control equipment.

(F) Recording and indicating apparatus: valves, accessories, etc.

Diaphragm Humidity and Temperature Regulator.

The essential features of this instrument are the metal diaphragms, which contain a highly volatile fluid, expanding and contracting with changes in temperature.

These movements are positive, and of such magnitude that they can be used without multiplication to open and close valves, and thereby produce a most simple and effective machine for this purpose.

In this machine the spray method of maintaining the wet bulb temperature without rags or wicks is used, and this part of the device needs no attention.



DIAPHRAGM HUMIDITY AND TEMPERATURE REGULATOR

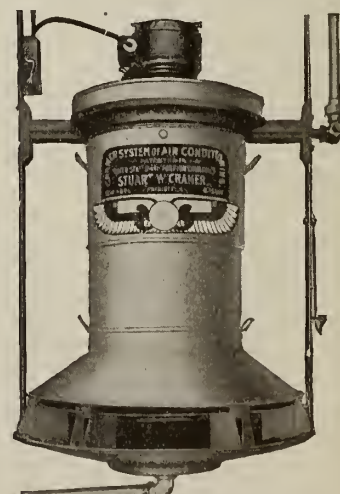
Copper Fan Air Conditioners.

This air conditioner produces, with approximately the same power expenditure, enormously increased results, both in air handling and water evaporative capacity.

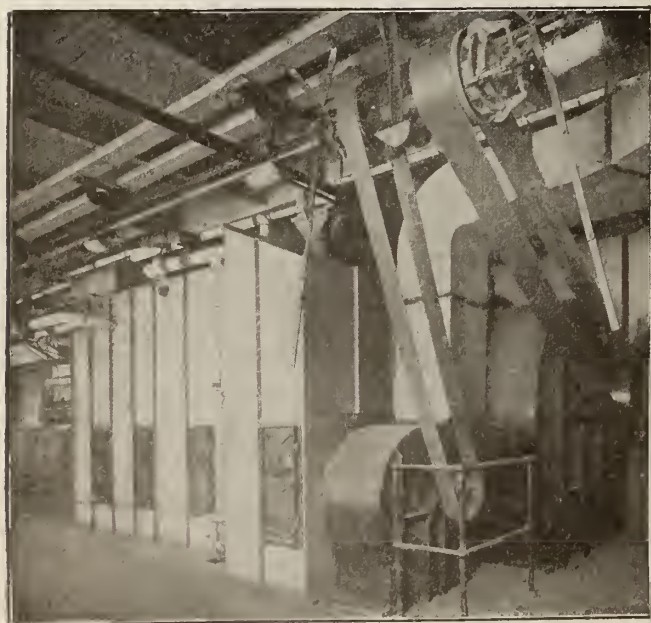
It is the only really successful fan humidifier made. The only one that does not blow out drops of water, and that has an instantly accessible interior, with perforated copper pan strainer, and a fan motor removable without bothering with bolts or screws.

To take the fan off, merely lift it off. It can not fall off, as it is secured in a heavy iron ring while in a running position.

The design of inside cover is such that the spray is discharged in a flat horizontal plane, and not drawn back into fan at the top, resulting in local circulation and wet spots around each head.



"HIGH DUTY" COPPER FAN AIR CONDITIONER



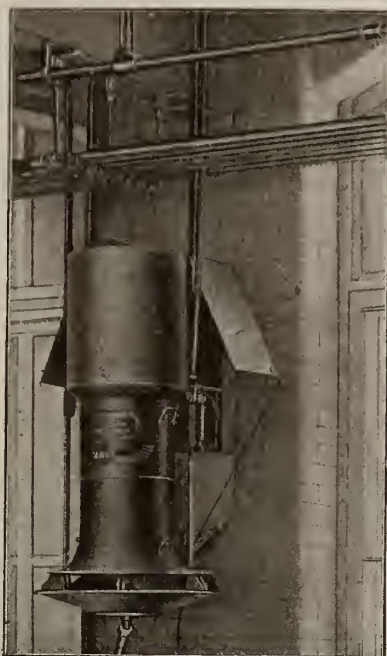
CENTRAL STATION EQUIPPED WITH DOUBLE FAN

The smooth outside surface presents no unusual humps to be filled with floating lint, and its size is small compared with its evaporative and air handling capacity.

Ventilating Fan Air Conditioners.

This type of equipment lends itself admirably to ventilating purposes, and is usually arranged with a thimble in the pilaster, or a direct duct connection to the transom on either side, so that part or all of the air drawn through the fan can be brought from out of doors.

This head will handle 60,000 cu. ft. of air per hour, and in warm weather reduces it to the wet bulb temperature; while in winter, if hot water is used, as is ordinarily the case, warm tempered air is introduced.



VENTILATING FAN AIR CONDITIONER

Turbo-humidifying System.

The Turbo-humidifying system imparts additional humidity or moisture to the air in factories or other buildings.

Air under pressure is supplied through a main pipe to the several branch lines in which the heads are located. Parallel with these branch air lines are water lines. These are run dead level.

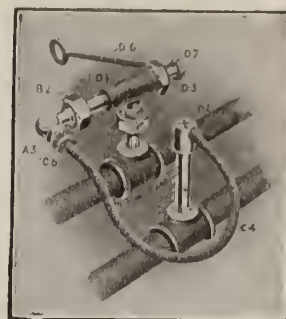
Water is supplied through a covered, float controlled tank. This tank is equipped with overflow pipe, draw-off pipe, filter, etc., and is covered to keep out dust and lint. The supply tank is a special one, but is about the size of that furnished with any complete toilet room set.

One of the tanks will supply from 60 to 70 heads, but in large rooms the best practice is to divide the system into 2, 3 or 4 separate sections. Tanks may be located in toilet rooms, or other convenient, accessible places. The water line, controlled by overflow pipe is located 1½ in. below the center line of the head.

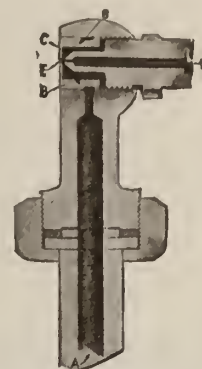
It is absolutely impossible for water to overflow from the heads on floors, machinery, stock, etc., for when the air is shut off there is no power to lift the water up to and into the head; when the water is shut off the air has no water to lift, hence no damage either way.

TURBO-HUMIDIFIER HEAD—Air is supplied at the required pressure at the orifice, A; passes through the tangential orifices in the bushing, B-B; produces a vacuum at the end of the water nozzle, E, and by so doing, draws water through the tube, D.

The centrifugal motion imparted to the air by the turbo principle actually pulverizes the water in the chamber, C, before it is delivered to the atmosphere. The importance of this centrifugal action is noted, since it spreads the vapor and distributes it before condensation can occur.



DETAIL OF PIPING AND INSTALLATION OF TURBO HEAD



CROSS SECTION OF TURBO HEAD

The water inlet to the head is connected to the riser nipple, C-1, in the water branch pipe by means of a non-corrosive, flexible, metallic tube, C-4, which being provided with union connections, B-2, C-6, makes all parts readily accessible and adjustments easy. Two unions, one vertical and the other horizontal, make it possible to point the jet in any direction.

The turbo valve or cock, D-1, is so located that any head may be shut down without interfering with the others. Simply shutting off the air shuts down the head.

Compressed Air Cleaning.

The next most profitable use of compressed air from the Turbo-humidifier system applies directly to the manufacturing departments through its utilization in cleaning the mill and its machinery.

A hose specially designed for this service and a special cleaning nozzle with operating lever is supplied.

The use of compressed air is the easiest and most economical method of cleaning mill machinery. Write for complete details of this service.

Turbo Oil Sprayer.

The Turbo sprayer was designed to meet special spraying problems where a penetrating spray is necessary. Perhaps its most frequent application is the conditioning of wool, worsted, cotton and jute.

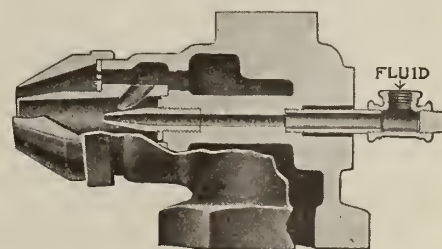
The capacity of the sprayers will vary with the quality of the wool and the percentages of raw wool or waste stock which are being treated. The needle valves which control the supply to each sprayer are adjustable for very close regulation.

The fluid is delivered through a small fluid tip and is atomized by the Turbo principle.

Various sizes of fluid tips and air nozzles supplied and interchanged to produce the desired quality of spray and distribution for particular conditions.

The positive rotary impeller type pump is particularly well adapted for this purpose. Extremely durable under all conditions. Special strainers, installed in fluid supply tank, are used to protect pumps from foreign matter.

Inquiries for equipments for special purposes will receive the prompt attention of Parks-Cramer engineers.



TURBO OIL SPRAYER UNIT

HERSH & BROTHER

SUCCESSORS TO BICALKY FAN CO.

GENERAL OFFICES AND FACTORY

ALLENTOWN, PA.

BUFFALO, N. Y., 951 Niagara Street

PHILADELPHIA, PA., Perry Building

Products.

Manufacturers of AIR WASHERS, BIMULTI FANS, STEEL PLATE FANS, ROOF FAN VENTILATORS.

Blowers, Exhaust Fans, Dust Collectors, and Mushroom Ventilators.

Services.

With engineering data unusually complete, we stand ready at all times to assist engineers in the study of their problems. What may seem a complicated problem may be reduced to a simple proposition through the experience of the HERSH & BROTHER engineering department.

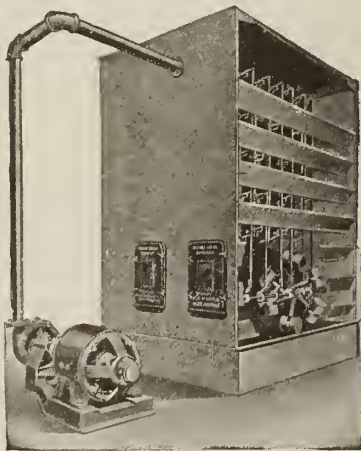
Do not hesitate to ask for information.

Bi-cal-ky Air Washer.

This machine is designed for cleansing and cooling air by passing it through a mist-filled chamber. A series of spray heads placed in a vertical plane across the chamber produce the mist.

The construction and mechanical manipulation of this air washer is such that the mist from the spray heads remains intact while flushing. This is of the greatest importance for the reason that it offers no weak spot in the mist sheets during the flushing operations to permit of any foreign matter passing through the air washer.

AUTOMATIC FLUSHING—A rigid shaft is placed across the air washer above the sump. This runs freely and is rotated by means of buckets filled with falling waste water from the spray heads. Cams are arranged on this shaft, under each vertical row of spray heads, so as to operate a series of tee iron rods connected with the different rows of heads. When released



BICAL-KY AIR WASHER

by the cams these rods fall and produce a hammer blow on the center rods of the spray heads, causing a rush of water through the nozzles, which dislodges any dirt that may have accumulated in hindrance to a perfect mist spray. The cams are set so as to drop one tee at a time, which in turn flushes this vertical row of spray heads.

Planing Mill Exhaust Fan.

This type is constructed especially for shaving exhaust systems in planing mills. The patented wheel construction gives unusual strength and prevents racking.



The absence of rivets on the face of the blade insures an unusually long life to the wheel as the rivets otherwise are worn by the abrasive action of the material handled. The construction of the wheel also permits the handling of long, stringy materials without clogging. This type is also constructed as a double fan.

Bimulti Type Fan.

The Bimulti fan is particularly designed for use in heating and ventilating systems in public and industrial buildings, where large volumes of air are to be handled at comparatively low pressures. The patented wheel construction is unique among fans combining as it does the desirable features of the older steel plate fan with the large capacity, efficient and quiet operation of the multiblade type.



BIMULTI FAN WHEEL

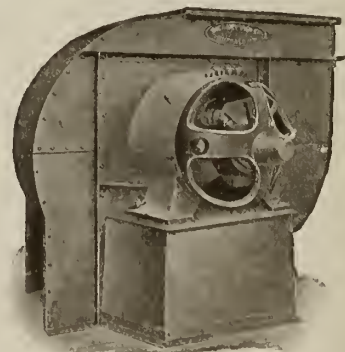
The unusual strength and ruggedness of construction are readily apparent from an examination of the blades running at a tangent from the central hub of the wheel. These blades are formed of two heavy bent plates riveted together at the center to form bracing angles on the back of the blade and are so placed with reference to the hub as to give the greatest strength in the direction of rotation.

Write for catalogue giving capacity tables, horsepower and characteristic curves.

Steel Plate Type Fan.

The particular advantage of this type is its adaptability for all purposes. The pressure characteristics adapt it particularly to forced and induced suction of pressure systems where the pressure involved is greater than $1\frac{1}{2}$ to 2 oz. Under such conditions this type is preferable to the Bimulti.

The efficiency of the wheel is not affected by high pressures as is the case to a certain extent in the multiblade wheel.



STEEL PLATE FAN DIRECT CONNECTED TO MOTOR
With inquiry, state electrical current available

THE ARCTIC ICE MACHINE COMPANY

CANTON, OHIO

AGENCIES

NEW ORLEANS, LA., O. J. MORRIS, 851 Carondelet Street
NEW YORK, N. Y., F. M. ADAY, Suite 368, 50 Church Street
DES MOINES, IOWA, C. L. PERCIVAL Co.
BOSTON, MASS., WALWORTH-ENGLISH-FLETT Co., 100 Pearl Street
PHILADELPHIA, PA., STANDARD CONSTRUCTION ENGINEERING & SUPPLY Co., 1752 North 29th Street

MINNEAPOLIS, MINN., L. A. POLLARD, 442 Metropolitan Bank Building
LOS ANGELES, CAL., WM. F. SPRING, Hellman Building
CIENFUEGOS, CUBA, SR. JUAN JOSE HERNANDEZ, Apartado 536
PENANG, STRAIT SETTLEMENTS, HEIM & Co.
MOSCOW, RUSSIA, LOUIS PLUSCZCZEWSKI, 10 Tshistye Proody
LUCKNOW, INDIA, NEWFUL KISHORE PRESS

Products.

Manufacturers of ICE MAKING and REFRIGERATING PLANTS, for every purpose from 1-ton capacity upwards, and suitable for connection to any kind of power.

Drop Forged Steel Ammonia Fittings, for high pressure work.

Ice Plant Supplies, for every purpose.

Cold Drinking Water Plants, for large industrial institutions.

Chemical Reclamation Plants, for reclaiming benzol and other volatile liquids in gaseous form for re-use; Chemical Precipitating Plants, where certain soluble chemicals are precipitated into solids at low temperatures.

Oil Cooling Systems, for use in connection with large steel heat treating plants or any other purpose.

Roll Cooling Systems, for the rubber industry.

Large Water Cooling Systems, where the temperature is brought down lower than it can be done by cooling towers, or spray ponds.

Gas Condensers, atmospheric, double pipe, submerged and tube types; Solution and Gas Coolers, in styles best adapted to the particular use.

Insulating Material, for every condition.

Heat Exchangers, in all styles: atmospheric, double pipe, submerged, shell and tube.

Pipe Work and Fittings, for every use and pressure.

Arctic Pownall Raw Water System (The Ultimate Plant).

This is the most efficient and up to date ice making plant built in the world. It will produce better ice at less cost than any other.

POWER COST—The current consumption runs from 40 to 55 kw. hours per ton of ice produced, and the current usually costs from $\frac{3}{4}\phi$ to $1\frac{1}{4}\phi$ per kw. hour.

This covers everything, including lights and pumping of water.

LABOR—Less than one-half as many men on a shift as required by other type of plant. Only one man required on the tank.

OVERHEAD EXPENSE—Greatly reduced. Insurance is lower. Less chance for fire. Depreciation and repairs greatly reduced on account of modern construction.

UPKEEP—Very little, as the wear on motor drive is practically nothing.

CALCIUM LOSS—Virtually eliminated.

The Arctic Junior Line.

Made in sizes from 1 to 25 tons daily refrigerating capacity and can be driven by any kind of power. It is simple and sturdy, requiring a minimum of attention as it is of the splash oiling type.

All points of wear are fitted with replaceable bushings.

Particularly suited to hotels, apartment houses, small water cooling plants, commissary departments, meat markets and dairies.

Can be fitted to operate automatically.

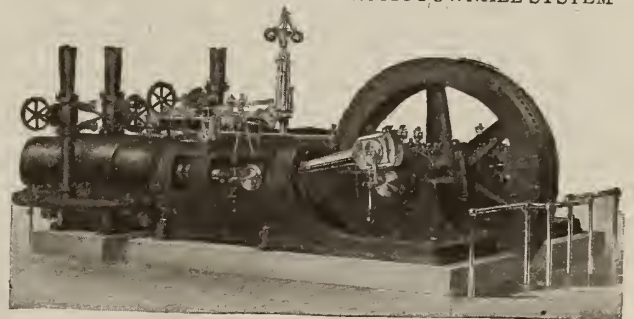
Co-operative Service.

THE ARCTIC ICE MACHINE COMPANY specializes in adapting refrigeration to industrial requirements.

The experience of this organization is at the command of all customers. If in doubt as to the requirements, this company will investigate and guarantee results, advising the most efficient method of removing heat or transferring it from one substance to another.



BLOCK OF "QUALITY ICE" PRODUCED BY ARCTIC POWNALL SYSTEM



ARCTIC HORIZONTAL, DOUBLE-SINGLE ACTING COMPRESSOR
Suitable for large installations and adapted for driving by any kind of power



SMALL ASSEMBLED REFRIGERATING PLANT

THE AUTOMATIC REFRIGERATING COMPANY

Automatically Controlled Refrigerating and Ice Making Plants

MAIN OFFICE AND WORKS
HARTFORD, CONN.

BRANCH OFFICES

ATLANTA, GA., 1123 Candler Building
CLEVELAND, OHIO, 1020 Citizens Building
SEATTLE, WASH., 1709 L. C. Smith Building
NEW YORK, N. Y., 50 East 42nd Street
CHICAGO, ILL., 537 Monadnock Block
ROCHESTER, N. Y., 405 Chamber of Commerce Building

BOSTON, MASS., 659 John Hancock Building
SAN FRANCISCO, CAL., 58 Sutter Street, Holbrook Building
LOS ANGELES, CAL., 228 Union Oil Building
WASHINGTON, D. C., 537 Munsey Building
NEW ORLEANS, LA., 616 Hibernia Bank Building
HONOLULU, T. of H., Fourth and Queen Streets

AGENCIES

HOUSTON, TEX., TENNANT-LOVEGROVE Co., Union National Bank Building

BALTIMORE, MD., AUMEN MACHINERY Co., 107 East Lombard Street

Products.

Manufacturers of complete AUTOMATICALLY CONTROLLED AMMONIA COMPRESSION REFRIGERATING and ICE MAKING PLANTS, including Compressors, Condensers, Coils, Piping and Traps, and Automatic Controlling and Safety Devices for Refrigerating Plants.

Advantages and Scope of Utility.

Chief among the numberless and varied uses of refrigerating and ice making plants are their advantageous application to industrial needs. Automatic refrigerating equipment, designed for large industrial establishments, is eminently adapted for drinking water, in factory, restaurants and commissary departments. It is also extensively utilized in special mechanical processes such as tempering and solidifying work.

An Automatic plant can be located anywhere in a building without reference to the location of the engine room. It will cool from 10 to 15 refrigerators at different temperatures on the one direct expansion system.

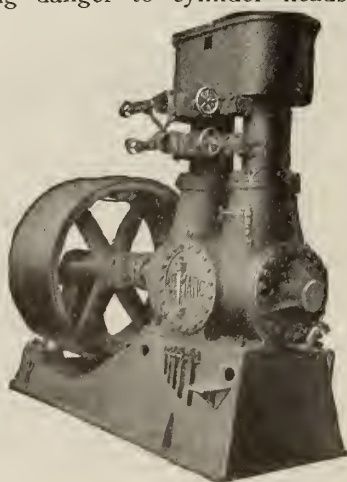
Brine installations are handled with equal facility where conditions warrant that type of plant.

Automatic Refrigerating Plants.

These plants (fully patented) are designed to provide mechanical refrigeration without the necessity of an operating engineer. Automatic devices absolutely control starting and stopping of machine as temperature in boxes rises above, or falls below, predetermined points, and also control feed of ammonia to expansion coils, and feed of water to condenser. Safety devices immediately stop plant in case of trouble with water or electric power service.

Compressors.

They are of the vertical 2-cylinder, single acting, enclosed type; built to accurate dimensions with parts interchangeable. They are provided with patent "safety heads," preventing danger to cylinder heads from non-gaseous substances getting into cylinder. Cylinders and pistons are especially designed to prevent objectionable oil pumping into expansion piping. Single units have from $\frac{1}{2}$ ton to 32 tons refrigerating capacity per 24 hours. The construction is particularly rugged, and all parts are thoroughly tested. Fitting and assembling carefully done by skilled mechanics insure dependable service and longevity.



AMMONIA COMPRESSOR

Automatic Control.

The control equipment is mechanically correct and of rugged construction, therefore thoroughly dependable. It includes a specially designed switchboard, which has automatic safety devices that shut the machine down and cut off all power in the event of trouble in the electric service, preventing danger of damage to motor.

Thermostat.

The thermostat automatically controls the starting and stopping of the machine so as to maintain any desired temperature within a degree or two of a predetermined point, preventing consumption of power except when the temperature requires it. As it is used with the Automatic electric control panel, there is no arcing or pitting of the contact points.

Automatic Expansion Valve.

Automatically controls the feed of ammonia to the expansion coils, thus maintaining the most economical pressure for the expansion of the liquid ammonia in the coils. It is easily adjusted, and functions perfectly.

Automatic Water Regulator.

Automatically controls the flow of water to the condenser, and automatically adjusts the water use to the requirements of the plant. The action of the water valve is powerful and positive, and water waste is eliminated.

Automatic High Pressure Safety Cut-off.

This device automatically stops the machine should the head pressure approach the danger point, due to failure of water supply or any other cause. It puts the plant in operation again when the cause of the high pressure is eliminated.

Condensers.

These are of the double pipe type, with water and ammonia flowing in opposite directions. Atmospheric condensers are used where conditions make them more desirable.

Coils.

Coils are continuously welded, or with screwed or flanged return bends, whichever type is best adapted to the specific installation. All screwed joints are thoroughly "sweated" and tested under high pressure.

Repair Parts.

All parts of Automatic plants are subjected to rigid tests and are interchangeable. A complete stock is always carried, insuring prompt shipment.

Co-operative Services.

The engineering department of this company will gladly co-operate with engineers and architects in the solution of special problems affecting mechanical refrigeration. This service, including preparation of drawings and data, is at the disposal of clients and entails no obligation.

CARBONDALE MACHINE CO.

Manufacturers of Refrigerating and Ice Making Machinery
CARBONDALE, PA.

BRANCH OFFICES

NEW YORK, 50 Church Street
BALTIMORE, 304 Continental Building
PHILADELPHIA, 1009 Harrison Building

LOUISVILLE, 217 Norton Building
CHICAGO, 1325 Manhattan Building

NEW ORLEANS, 904 Title Guarantee Building
PITTSBURGH, 1122 Alleghany Avenue
BUFFALO, 380 Ellicott Square Building

Products and Services.

REFRIGERATING and ICE MAKING MACHINERY which includes: Absorption Refrigerating Machinery, Compression Refrigerating Machinery using Worthington Feather Valve Compressors, Ice Making Plants, Ammonia Economizers, Paraffin Wax Machinery, consisting of Distillate Chilling Machines, Hydraulic Filter Presses, Pumping Equipment, Sweating Pans, Steam and Aqua Ammonia Pumps, Brine Coolers, Gland and Ammonia Fittings, etc.

We are prepared to design, furnish and install complete Ice Making, Refrigerating, and Paraffin Wax Plants.

Advantages of Absorption Refrigerating Machines.

(1) Can run by exhaust steam. (2) No heavy moving parts. (3) Noiseless. (4) No heavy foundations. (5) Very little attention required. (6) Adapted for any floor space or headroom. (7) Most economical, with low cost of maintenance.

Types of Absorption Machines.

The type of machine is determined by local conditions. These are, first, the atmospheric type, which is adapted to warm or muddy water; second, double pipe type, which is used in engine rooms where water conditions are favorable, and, on account of having straight pipes, is very accessible for repairs and cleaning; third, shell and coil type, adapted for water which is not corrosive.

Ice Making.

Central stations, gas plants and steam users with a source of exhaust steam can operate a Carbondale ice machine to advantage. If a complete plant is desired with boiler equipment, the evaporator system is recommended and the fuel consumption is guaranteed.

Refrigeration.

Where exhaust steam machines are not wanted for ice making purposes, but for refrigerating uses alone, in hotels, clubs, department stores, hospitals, offices, etc., the condensed steam from the generator is trapped to a hot well and then used for boiler feed.

In connection with a large refrigerating machine installation, an ammonia economizer is recommended. This has two functions: First, it serves as a reducing still for strengthening the charge of an absorption machine by the distillation of strong aqua ammonia, while the machine is in operation; second, it is used as a purge absorber to reduce the ammonia loss incidental to purging the main absorber of air and foul gases.

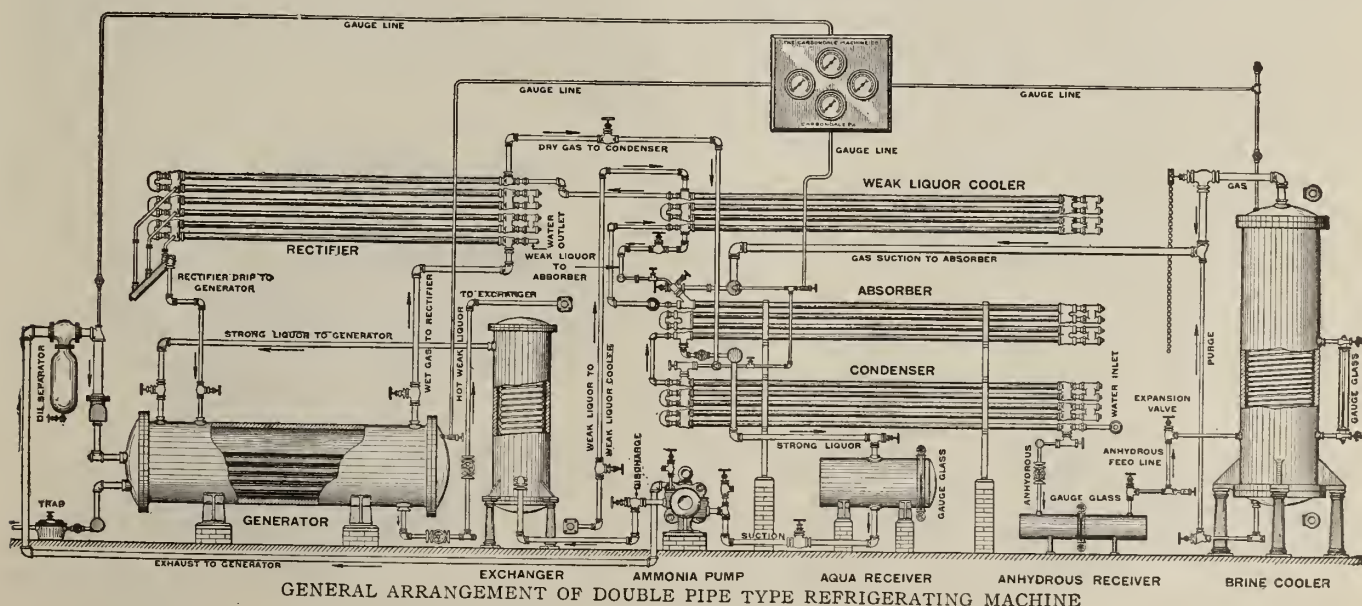
Paraffin Wax Plants.

All apparatus in connection with paraffin wax plants can be designed and supplied by this company. The absorption machine is used on account of adaptability for low temperatures. Plans and specifications furnished to cover desired equipment. Patented wax distillate chilling machines used for both medium cold test neutral oils and zero cold test oils.

Many successful installations can be referred to, or shown.

Installation.

Machines are designed for the service required. All installations carefully planned, with a view of giving operator best economy possible. Special attention given to water connections; when water is under pressure, outlet water can be used for other purposes within building. Particular attention directed to brine circulation. Estimates and preliminary drawings furnished. Catalogue sent upon request. Existing refrigerating and ice making plants remodeled.



CONTINENTAL MACHINERY COMPANY

Manufacturers of Refrigerating Machines

1101 Security Building, 189 West Madison Street
CHICAGO, ILL.

PHILADELPHIA, PA. BRANCH OFFICES DETROIT, MICH.
ST. LOUIS, MO. BALTIMORE, MD. MINNEAPOLIS, MINN.

Products.

"CONTINENTAL" REFRIGERATION: Raw Water Ice Plants, and Accessories, including Ammonia Fittings, Compressors, Refrigerating Equipment.

Scope of Use.

Abatoirs, meat markets, poultry freezing, dairy plants, creameries, marine refrigeration, fur cold storage, skating rinks, drying, confectioners, air conditioning, oil refining, hotels, restaurants, fruit storage, hospitals and morgues, mining operations, mushroom growing, bottling plants, steel tempering, fruit precooling, fish freezing.

"Continental" Ammonia Compressors.

The "Continental" ammonia compressors, following automobile and gas engine design that has proved so satisfactory, are of the multiple cylinder type, being made with 1, 2 and 3 cylinders. Standard sizes range from 1½ to 50 tons refrigerating capacity. For any plant within this range the company can furnish a machine with just the right capacity, neither too small nor too large.

SAFETY HEAD—In case a charge of liquid has been drawn into the cylinders, the safety head opens as well as the discharge valve; thus effectively clearing the cylinders of liquid with no danger to the cylinder heads proper. *Safety is the "Continental" way.*

CLEARANCE—Due to the adjustment for clearance in the crosshead, the "Continental" compressor, with the safety head and single acting construction, is run with less clearance than any other machine now made with *maximum volumetric efficiency* as a result.

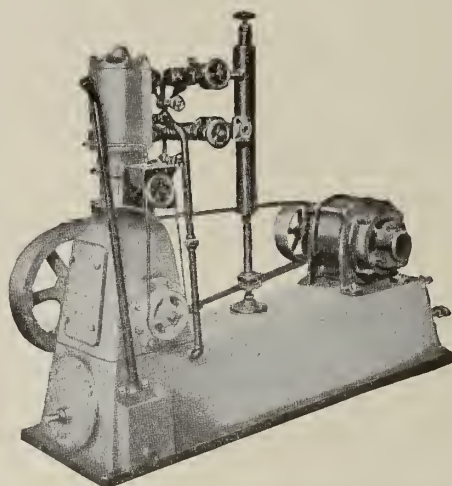
VALVES—The valves are flat discs of vanadium steel, light, quick acting, noiseless, absolutely tight and safe. The valves can not fall into the cylinder and wreck the machine. The valve seats are of hardened steel, and with the vanadium discs, enduring, permanent and always dependable.

BEARINGS—All bearing bushings are die cast and can be adjusted to take up wear or easily replaced. Every bearing is so carefully fitted that a "Continental" is absolutely noiseless in operation.

CRANK SHAFT—The crank shafts are steel forgings very liberally proportioned, giving ample strength and insuring continuous service.

LUBRICATION—The lubricating system on a "Continental" compressor is ideal. All parts run in a bath of oil, reducing friction losses to the absolute minimum and increasing the life of parts to a maximum. Even the space around the spring in stuffing box is kept constantly filled with oil by the force feed lubricator. The oil in crank case surrounds the working parts there.

ACCESSIBILITY—Ammonia does not surround the working parts of a "Continental," so they are always



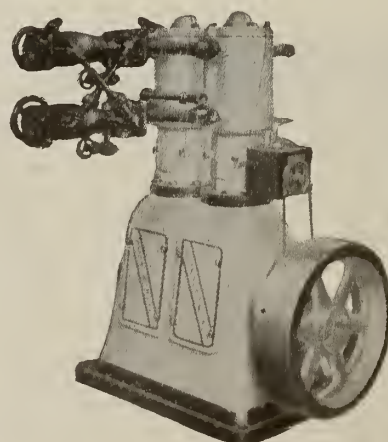
"CONTINENTAL" SELF-CONTAINED "HIGH SIDE"

easily accessible for inspection or adjustment. Is it not reasonable to assume that a machine constructed thus, will receive better care and last longer than one so built that the owner must pump out ammonia, break several gastight joints, and then work with hands and face exposed to burning ammonia fumes? To inspect the cylinder, piston and valves it is only necessary to take off the cylinder head. There are no pipe connections or water heads to be taken down first.

Engineering Service.

On the CONTINENTAL MACHINERY COMPANY's staff are engineers with years of refrigeration experience.

The service of these specialists is available without charge. Acquaint this staff with the conditions and complete information, with cost of plant installed, will be furnished.



"CONTINENTAL" TWO-CYLINDER COMPRESSOR

ESTABLISHED 1880

HENRY VOGT MACHINE CO.

Manufacturers of Ice and Refrigerating Machinery

LOUISVILLE, KY.

Products.

ICE and REFRIGERATING MACHINERY, EXHAUST STEAM AMMONIA GENERATORS, AQUA AMMONIA PUMPS, and DROP FORGED VALVES and FITTINGS.

Oil Refinery Equipment, Paraffin Wax Presses, Distillate Wax Chilling Machines for cold test oils, Steam and Crude Stills, Filter Presses, Agitators, Condenser Boxes, Welded Vessels.

For Boilers and Boiler Casings, see page 660.

Refrigeration.

Thirty-nine years of effort in the design and construction of the Vogt absorption machine has brought forth the present economical and efficient exhaust steam unit. By an exhaust steam unit is meant a refrigerating machine capable of developing its rated capacity through the use of steam that has already performed useful work.

A further economy is effected by combining the exhaust steam refrigerating machine with any mill, light or power plant, the refrigeration or ice so produced being a by-product. When it is understood that the operation of such a machine is possible without the introduction of any complicated parts, our correctness of design is thoroughly established.

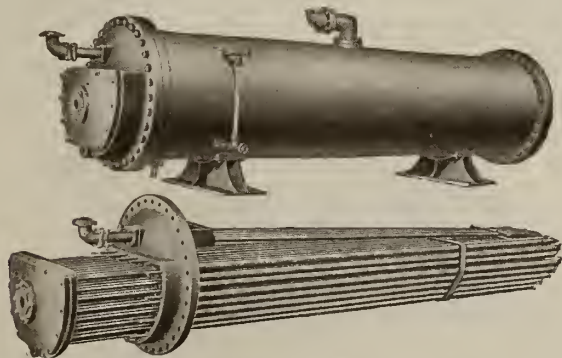
The workmanship and materials used in the Vogt machines are the very best; the Vogt drop forged valves and fittings being one of the superior features.

Vogt Exhaust Steam Ammonia Generator (Patented).

Designed to operate on lowest possible steam pressure.

The shell and heads are made of semisteel, this metal being the most durable in contact with hot ammonia.

The coil is made of straight extra heavy wrought iron pipe, and each pipe is closed at one end. The steam is delivered through an inside pipe at the closed end and travels only one time the length of the generator. This



VOGT EXHAUST STEAM AMMONIA GENERATOR (PATENTED)

SWEET'S CATALOGUE

eliminates the friction and enables operation at minimum pressure.

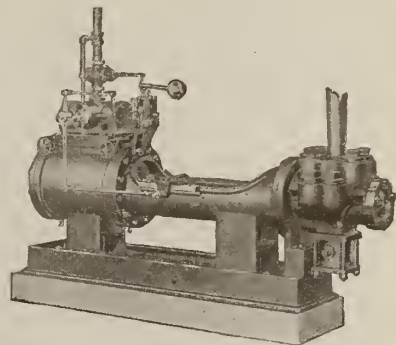
Other special features are: *no* return bends; *no* bent pipes; *no* exposed heating surface; *no* stuffing boxes on steam coils; *no* threaded joints inside of shell.

Vogt Aqua Ammonia Pump.

The Vogt aqua ammonia pump is designed to handle strong aqua ammonia. The steam cylinder is equipped with balanced piston type valve, governed by an auxiliary valve that is mechanically operated. The steam consumption is considerably low for this type pump, and the speed is automatically controlled at any desired number of strokes by means of a Mason regulator. The ammonia cylinder is provided with an extra long stuffing box and water chamber.

The ammonia piston rod is made of special steel and connected with coupling to the steam piston rod so it can be easily removed when necessary.

The pump is mounted on a heavy base.



VOGT AQUA AMMONIA PUMP

Drop Forged Valves and Fittings.

The purchase of low grade valves and fittings is false economy. The one consideration that should govern the choice of valves and fittings is their permanent value—not their first cost factor. The purchaser, who overlooks this wide difference between value and price, overlooks the inevitable losses through leaks and breakage which are invariably in excess of the money originally saved.

Vogt forged valves and fittings are in daily service, frequently subjected to intense pressures which no other fitting but a Vogt could withstand. They are especially adapted for high pressures of air, steam, gas, ammonia, water and oil. For the manufacture of chemicals, of explosives, of hydraulic equipment; for the factory, the mill and the mine, these fittings are no experiment—they are a daily necessity.

With a record of excellent service and a guarantee of satisfaction, Vogt forged valves and fittings are a logical selection—there can be no reason for not specifying them.



DROP FORGED VALVE AND FITTINGS

ESTABLISHED 1867

THE VILTER MANUFACTURING CO.

Ice Making and Refrigerating Machinery, Compressors and Engines

1002 Clinton Street
MILWAUKEE, WIS.

BRANCH OFFICES

NEW YORK, 220 Broadway
PHILADELPHIA, 1619 Chestnut Street
PITTSBURGH, 314 Curry Building
CHICAGO, 731 Monadnock Building
SEATTLE, 1015 Alaska Building
ST. LOUIS, 2723 Bennett Court
ATLANTA, GA., 112 South Gordon Street

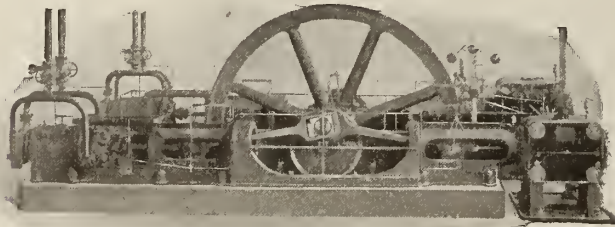
KANSAS CITY, 324 Finance Building
HOUSTON, 519 Beatty Building
LOS ANGELES, 2650 Santa Fe Avenue
(Office and Warehouse)
SALT LAKE CITY, 28 West Broadway
(Office and Warehouse)
HAVANA, CUBA, O'Reilly 9
WELLINGTON, NEW ZEALAND

Products.

VILTER ICE MAKING and REFRIGERATING MACHINERY; AMMONIA COMPRESSORS; PATENTED IMPROVED LOW TEMPERATURE COMPRESSION SYSTEM; POPPET VALVE ENGINES; ROLLING MILL CORLISS ENGINES.

Vilter Duplex Ammonia Compressor.

A duplex steam driven unit, with horizontal double acting ammonia compressors and direct connected to cross compound Corliss engine. Compressor equipped with multiple valve heads, giving maximum area. Stuffing box of the double packed type, with oil seal and pressure release.

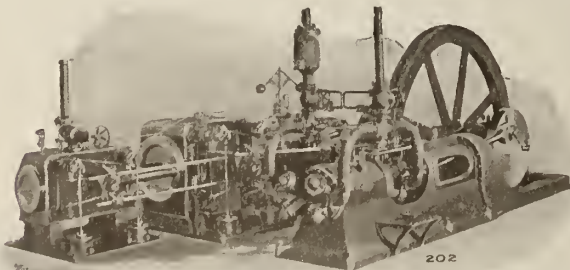


VILTER DUPLEX DOUBLE ACTING CROSS COMPOUND MACHINE

Vilter Single Ammonia Compressors.

This type also built with the Vilter poppet valve high pressure steam cylinder, for high steam pressures and superheat. The duplex type is built in sizes from 125 to 800 tons daily refrigerating capacity.

A single heavy duty steam driven unit, direct connected to tandem compound Corliss engine. The design is wonderfully free from complication, and the construction is such as will insure long life, satisfactory service and freedom from trouble. The heavy duty frame is

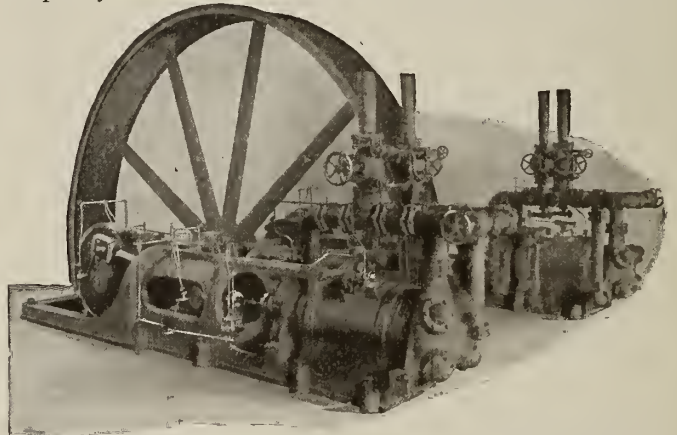


COMPRESSOR DIRECT CONNECTED TO VILTER TANDEM COMPOUND HEAVY DUTY CORLISS ENGINE

designed on straight line principles, of massive construction. The tandem compound engine driven type is built in sizes from 50 to 375 tons daily refrigerating capacity.

Compressor Arrangement for Belt Drive.

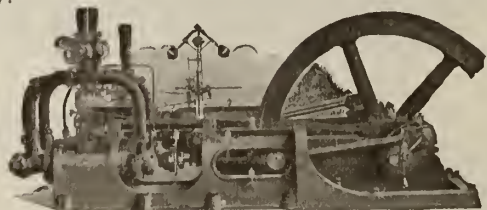
The belt driven machines are furnished in either single or duplex units, and either belt wheels or wheels grooved for rope can be supplied. These units may be driven by any kind of power, such as electric motor, gas or oil engines, etc. Single units are built in sizes from 7½ to 400 tons daily refrigerating capacity; duplex units, in sizes from 15 to 800 tons daily refrigerating capacity.



ROPE DRIVEN DUPLEX COMPRESSOR ROLLING MILL FRAMES

Rolling Mill Type Compressor.

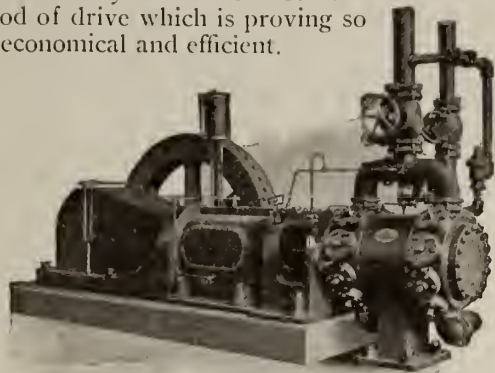
The rolling mill frame machine is built along very heavy lines for all conditions of service. It is used with only slight modifications in all sizes of compressors. Its very appearance gives assurance and proof of its strength and reliability. All parts of the base rest upon the foundation, thus giving a uniform distribution of the load and insuring maximum stability and rigidity.



ROLLING MILL TYPE COMPRESSOR

Vilter Horizontal High Speed Ammonia Compressor.

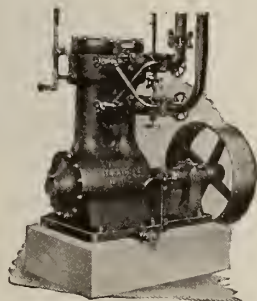
Vilter horizontal high speed ammonia compressors are simple in design, rugged in appearance and in the character of service they give. They are specially designed for direct connection to the newest types of high speed prime movers, and particularly adapted for direct connection to synchronous motors—a method of drive which is proving so highly economical and efficient.



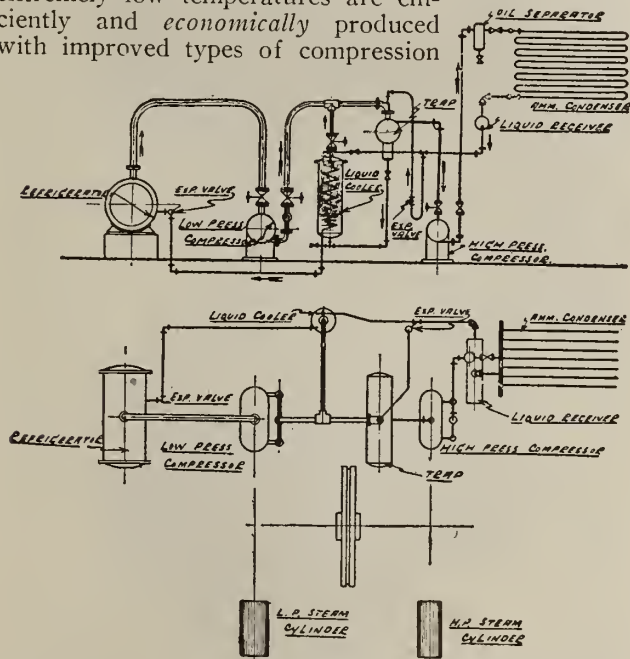
VILTER HORIZONTAL HIGH SPEED AMMONIA COMPRESSOR

Vilter Twin Cylinder Ammonia Compressor.

A vertical compressor, specially designed for users of comparatively small quantities of refrigeration. The design unites the base, main bearing and crank case in a single massive casting, cylindrical sections being used throughout, giving simplicity, symmetry and strength, with a very low center of gravity and perfect alignment. Made in sizes from 1 to 20 tons daily refrigerating capacity.

VILTER VERTICAL AMMONIA COMPRESSOR
Small capacity**Vilter Low Temperature Compression System.**

A system manufactured under D. I. Davis patents; extremely low temperatures are efficiently and economically produced with improved types of compression



DIAGRAMMATICAL ARRANGEMENT OF LOW TEMPERATURE SYSTEM

Showing plan and elevation of the low temperature compression system

SWEET'S CATALOGUE

refrigerating machinery superior to the standard compression machine—the latter costs more and its operation is accompanied with several disadvantageous results.

These economic, detrimental features are overcome in this system by the following methods:

(1) Multistage compression, which increases volumetric efficiency and reduces the power required for operating the compressors.

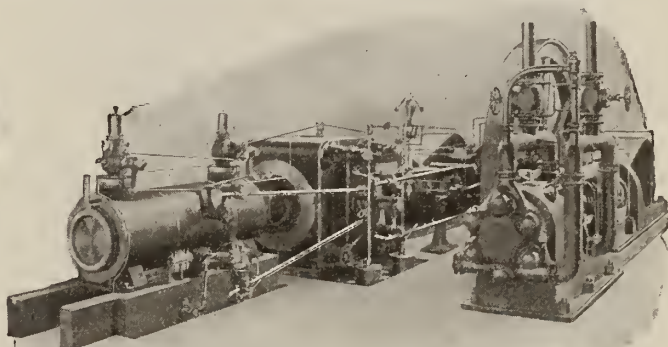
(2) Cooling the liquid before entering the low temperature refrigerator, thus reducing amount of gas handled by low pressure compressor and the power per ton of refrigeration—because the work of cooling is handled by one high pressure cylinder.

(3) Proper traps, etc.

Vilter Tandem Compound Poppet Valve Engine.

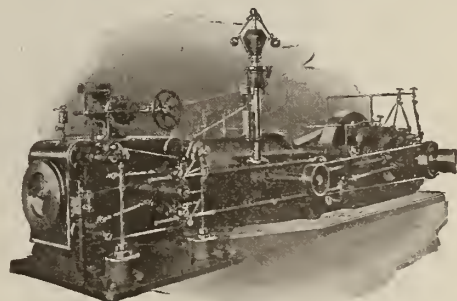
Vilter tandem compound engine with poppet high pressure and Corliss low pressure cylinder direct connected to rolling mill compressor frame. The most economical combination known, using high pressure superheated steam.

The latest design of Vilter poppet valve engine embodies the very latest developments to accomplish low steam consumption and simple operation.

VILTER TANDEM COMPOUND ENGINE
Having poppet valve high pressure and Corliss low pressure cylinders, direct connected to rolling mill type compressor**Vilter Rolling Mill Type Simple Corliss Engine.**

The rolling mill frame Corliss engine is of exceptionally massive construction throughout; and is adapted to any class of service from the steady belted load to direct connected electrical service, in which the engine is subjected to heavy and extremely variable loads.

It is built for high steam pressures, and high rotative speeds, and may be used with superheated steam up to 100° Fahr. superheat. The valve gear is of the high speed type, and all valves are double ported. Built in all sizes, either simple, tandem, compound or cross compound.



VILTER ROLLING MILL TYPE SIMPLE CORLISS ENGINE

YORK MANUFACTURING CO.

Ice Making and Refrigerating Machinery

MAIN OFFICE AND WORKS

YORK, PA.

BRANCH OFFICES

BOSTON, MASS., 88 Broad Street
 BROOKLYN, N. Y., Columbia and Warren Streets
 PHILADELPHIA, PA., 2222 Arch Street
 PITTSBURGH, PA., 47 Terminal Way, S.S.
 ATLANTA, GA., 116-118 Central Avenue
 ST. LOUIS, MO., 117-119 South 11th Street
 TORONTO, CAN., CANADIAN ICE MACHINE Co., Villiers and Muniton Streets

CHICAGO, ILL., 26-28 North Clinton Street
 HOUSTON, TEX., Franklin Avenue and Louisiana Street
 LOS ANGELES, CAL., 308 Boyd Street
 SAN FRANCISCO, CAL., 832 Folsom Street
 SEATTLE, WASH., 508 Terry Avenue, North

Products.

ICE MAKING and REFRIGERATING MACHINERY which includes Compression Refrigerating Machines (Ammonia and Carbon Dioxide), Absorption Refrigerating Machines, Ice Making Plants, Refrigerating Plants, Ammonia Valves, Ammonia Fittings, Ammonia Condensers, Brine Coolers, Aqua Ammonia Pumps, Ice Cans, and all parts needed to equip a complete ice making or refrigerating plant.

Description.

We make, in our own factory, all the machinery and apparatus used in ice making and for general refrigeration, both compression and absorption systems.

Sizes.

The enclosed machine is built in sizes from $\frac{1}{4}$ ton refrigerating capacity upward; the vertical single acting machines from 20 to 600 tons; the horizontal double acting machines from 10 to 600 tons—either belt or steam driven type. Absorption plants of any capacity required by the trade.

Application.

York machines can be used wherever ice making or refrigeration is required, the style of machine being determined, to a great extent, by local conditions.

The enclosed machine is particularly adapted for residences, apartment houses, small hotels, creameries, ice cream factories, etc.

Valves and Fittings.

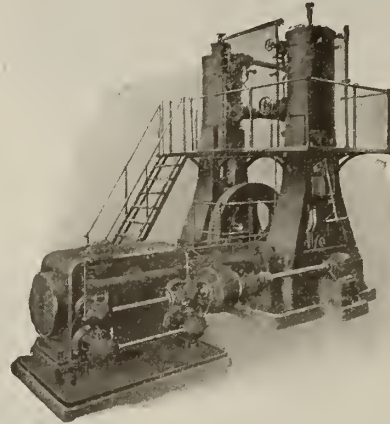
York ammonia valves and fittings are guaranteed to give satisfaction under all usual working pressures.

Service.

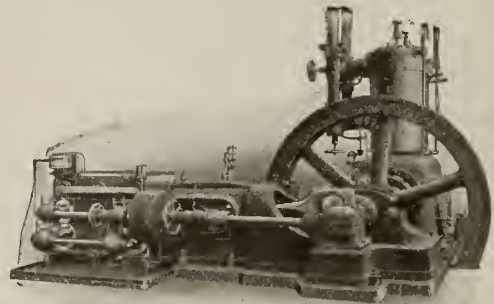
All our agencies carry in stock a complete line of ammonia valves and fittings; also a line of enclosed machines.

What a service department is to the owner of an automobile, the York Sales Organization is to the user of ice making and refrigerating machinery.

Both *quality* and *service* can be secured by patronizing the York Organization.



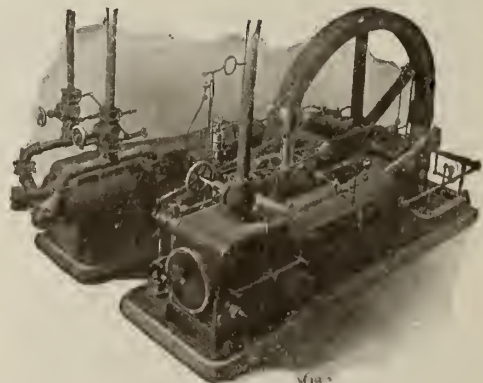
STANDARD VERTICAL SINGLE ACTING REFRIGERATING MACHINE
 Direct connected to Uniflow engine



ENCLOSED SINGLE ACTING REFRIGERATING MACHINE
 Direct connected to Uniflow engine



VERTICAL SINGLE ACTING
 ENCLOSED REFRIGERATING MACHINE



HORIZONTAL DOUBLE ACTING REFRIGERATING MACHINE
 Direct connected to Corliss valve engine

ARMSTRONG CORK & INSULATION COMPANY

126 Twenty-fourth Street
PITTSBURGH, PA.

BRANCHES IN ALL THE LARGE CITIES

Products and Services.

NONPAREIL HIGH PRESSURE COVERING for high pressure and superheated steam lines, boilers, etc.; NONPAREIL INSULATING BRICK for furnaces, ovens, kilns, boiler settings, etc.; NONPAREIL CORK COVERING for brine, ammonia and ice water lines and tanks.

CONTRACTORS for heat and cold insulation.

Nonpareil Corkboard Insulation for cold storage plants.

Nonpareil High Pressure Covering.

Nonpareil High Pressure Covering is made of diatomaceous earth (kieselguhr) and a small quantity of asbestos fiber for a binder. Diatomaceous earth is practically pure silica, being composed of the skeletons of microscopic plants that grew in the sea ages ago. It is estimated that there are 39 billion of these shells to the cubic inch, each one hollow and filled with air, and it is this large amount of entrapped air which gives Nonpareil High Pressure Covering its remarkable heat insulating value.

ADVANTAGES—Compared with other coverings, Nonpareil High Pressure Covering is not only a better nonconductor of heat, but will withstand much higher temperatures without calcining or disintegrating. It is particularly well-suited, therefore, for the insulation of superheated steam lines, enameling and japanning ovens, and other places where relatively high temperatures are encountered. Moreover, it will bear repeated wetting and drying without injury, and for this reason is an ideal form of covering for underground steam lines and those which come in contact with excessive moisture.

SERVICE DETAILS—Nonpareil High Pressure Covering is made in sectional and block form of various thicknesses, and is also supplied as plastic cement.

LITERATURE—Full information regarding Nonpareil High Pressure Covering is given in an 84-page bound book, which, together with samples of the material, will be cheerfully sent on request.

Nonpareil Insulating Brick.

Nonpareil Insulating Brick are also composed principally of diatomaceous earth (kieselguhr), and here again the remarkable heat insulating properties of this material are utilized to excellent advantage. For many years there has existed a real need for an insulation that could be used for reducing the amount of heat lost by conduction and radiation from boiler settings, steam drums, furnaces, ovens, hot blast mains, etc., and Nonpareil Insulating Brick meet these requirements more

nearly than any other form of insulation yet put on the market.

ADVANTAGES—Not only are Nonpareil Insulating Brick excellent nonconductors of heat, ten times more efficient than fire brick and common brick, but they also have structural strength and the ability to withstand relatively high temperatures. Their convenient brick form makes them easy to install in walls and arches where the courses of Nonpareil Brick may be bonded with fire brick or common brick.



INSULATING A BOILER SETTING WITH NONPAREIL INSULATING BRICK

The Nonpareil Brick are placed between the inner courses of fire brick and the outer course of common brick

SERVICE DETAILS—The standard, straight Nonpareil Insulating Brick are nominally 9 by 4½ by 2½ ins. and weigh about 1½ lbs. each. Various other shapes for arches, circles, etc., are carried in stock. For the purchaser's protection each brick is stamped with the trade mark "Nonpareil."

FURTHER INFORMATION—Literature, prices, full size sample brick, and complete information will be furnished on request.

Nonpareil Cork Covering.

Nonpareil Cork Covering, due to its composition, is the only satisfactory material for the insulation of cold pipe lines carrying drinking water, brine, ammonia, etc. It is made entirely of pure granulated cork, compressed and baked in moulds to fit the different sizes of pipe and various fittings in ordinary use.



NONPAREIL CORK COVERING

LITERATURE—The 48-page book, *Drinking Water Systems*, will be of great value to anyone interested in the supplying of properly cooled drinking water in mills, factories, office buildings, etc., while the 64-page book, *Nonpareil Cork Covering*, covers the application of the material in its various other fields. Either or both of these books, together with samples, will be sent on request.

BANNER ROCK PRODUCTS CO.

Manufacturers of Cold Storage and Heat Insulation

ALEXANDRIA, IND.

Products and Services.

ROCK CORK; ROCK CORK STUCCO SHEATHING;
ROCK CORK LATH; ROCK WOOL QUILT.

Contractors for application of our products in all kinds of cold storage installations, or, with the insulation, a competent superintendent to direct application.

Rock Cork.

DESCRIPTION—A board made of rock wool, bound with waterproofing crude paraffin binder, and in volume 88% air cells. Formed in slabs 16 by 36 in., and $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2 and 3 in. thick. Can be applied to brick or concrete walls in portland cement mortar and to lumber surfaces in asphalt insulating cement. Permanent walls and partitions are constructed by erecting 2 layers in portland cement mortar, and plastering both sides. Portland cement plaster adheres tenaciously to Rock Cork. Rock Cork is non-inflammable, being a mass of minute air cells, having walls of indestructible mineral.

ROCK CORK STUCCO SHEATHING—Made from Rock Cork composition $\frac{1}{2}$ in. thick, for application on exterior walls of dwellings or buildings receiving stucco finish. On brick, tile or concrete walls, apply in portland cement mortar. On lumber walls, nail with 3d nails and tin or galvanized caps, allowing 3 nails per sq. ft. Cover with 2-in. chicken netting or other wire fabric. Apply stucco finish direct in 2 coats, following usual compositions. Rock Cork stucco sheathing $\frac{1}{2}$ in. thick insulates a building from heat and cold equivalent to 8 in. brick veneer, and protects from moisture and sound. Use 1, $1\frac{1}{2}$ or 2 in. thickness of suitable widths of Rock Cork in connection with stucco sheathing, for raised panels, pilasters, vertical or horizontal borders, and water tables.

ROCK CORK LATH—A painted metal lath embedded in Rock Cork composition $\frac{1}{2}$ in. thick, made in 4-ft. lengths, 18 in. wide. Can be nailed to interior or exterior studs on 16- or 12-in. centers, and receive plaster or stucco finish for partition construction for outside stucco

finish. Resists heat, cold and moisture. Sound resistance is increased and weight of partition is but 60% of solid construction when granulated Rock Cork mixed with plaster composition is used. For hospitals, hotels and apartment houses.

ROOF INSULATION—For 1-in. thickness, use 16- by 36-in. sheets. This thickness conducts about one-half as much as two $\frac{7}{8}$ -in. boards with paper between. 1-in. Rock Cork weighs $1\frac{1}{4}$ lbs. per sq. ft.

FLOOR AND PARTITION DEADENING—Lay Rock Cork on floors, or granulated Rock Cork between strips. Apply to tile, brick or metal lath partitions in portland cement mortar, and plaster. Partitions for any purpose that have great sound resistance can be constructed as indicated above.

INSULATING EFFICIENCY—Many tests by different observers and by different methods place Rock Cork as one of the most efficient insulating materials known. Proof against water, fire and decay. The test of time, for 11 years, demonstrates its permanency. It is backed by a record of successful service in many leading cold storage warehouses, packing plants, ice storage rooms, ice cream plants, creameries, etc.

Rock Cork is acknowledged to give more insulating efficiency per dollar expended than any other material or composition known.

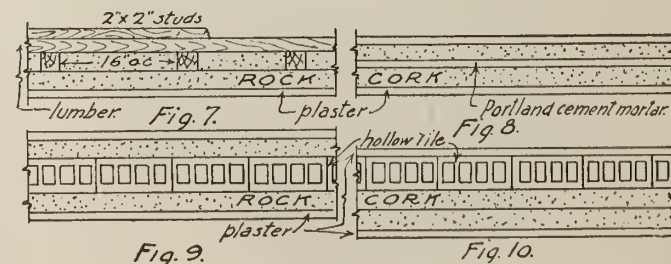
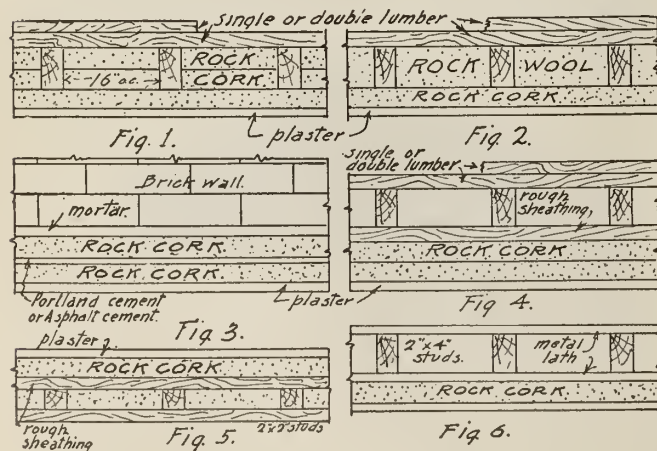
Rock Wool Quilt.

A flexible insulation for high temperatures, on boilers, furnaces, tanks. $1\frac{1}{2}$ - or 2-in. thickness. 3 by 8 ft. stock size. Other sizes made to order. Can be finished, if desired, after installation, with any plaster composition.

References.

Rock Cork has been installed in 32 states and in Mexico. Below some of our oldest installations:

Grocers' Ice & Cold Storage Co., Louisville, Ky.
Geo. D. Mansfield Co., Milwaukee, Wis.
Milwaukee-Waukesha Brewing Co., Milwaukee, Wis.
Syracuse Cold Storage Co., Syracuse, N. Y.
Cincinnati Abattoir Co., Cincinnati, Ohio
Burge Machine Works, Chicago, Ill.
Indiana Ice & Dairy Co., Anderson, Ind.
Schalk Bros. Ice Co., Anderson, Ind.
Indianapolis Abattoir Co., Indianapolis, Ind.
Kuhner Packing Co., Muncie, Ind.



FIGS. 1 TO 10 WALL AND PARTITION CONSTRUCTION WITH ROCK CORK

Figs. 1, 2, and 7 are designs for vestibules and passageways faced with lumber finish. Figs. 6 and 8 are partitions between rooms requiring plaster finish on both sides. Fig. 5 reduces lumber to minimum, is more substantial and as cheap to erect as laying up insulation in portland cement mortar with plaster on both sides, as Fig. 8. Figs. 3 and 4 are wall insulations.

CELITE PRODUCTS COMPANY

Producers of Insulating Material and Cements

11 Broadway
NEW YORK, N. Y.

BRANCH OFFICES

PHILADELPHIA, Liberty Building
PITTSBURGH, Oliver Building
LOS ANGELES, Van Nuys Building

CHICAGO, Monadnock Building
CLEVELAND, Guardian Building
SAN FRANCISCO, Monadnock Building

DETROIT, Book Building
ST. LOUIS, Syndicate Trust Building

Products.

SIL-O-CEL BRICK, BLOCKS, POWDER and CEMENTS, for the Insulation of all types of High Temperature Equipments where permanent and lasting insulation is required. Also used in Cold Storage Work; for Fireproofing and Sound Deadening.

CELCOTE, an Elastic Adhesive Cement especially prepared to Prevent the Infiltration or Air through the boiler, furnace or kiln walls, also used as Weatherproofing Coat for Sil-O-Cel Insulation.

Filter-Cel, a Porous Inert Material in powdered form, especially prepared to facilitate filtration.

Celite High Temperature Cements—Mixtures of ceramic materials scientifically compounded for laying, patching and coating firebrick linings of boilers and furnaces.

Sil-O-Cel.

GENERAL DESCRIPTION—Sil-O-Cel is a light weight highly silicious insulating material produced in the form of brick, blocks, powder and cements. Its heat conductivity factor is one-tenth that of ordinary fire brick, and it will withstand temperatures that completely destroy other forms of insulation.

Sil-O-Cel is used chiefly as an insulating backing for the refractory lining of all types of high temperature equipment and is sufficiently refractory, however, so that it will not fuse, shrink or decompose when placed against highly heated fire brick.

BOILER AND FURNACE INSULATION—To prevent the great heat loss from boiler and furnace settings due to conduction, radiation and convection. It is necessary to incorporate in the setting between the fire brick lining and the outer wall a material of high insulating value. Sil-O-Cel serves this purpose, due to the fact that it is not affected by the high temperatures encountered in work of this character.

The use of Sil-O-Cel Brick 4 in. thick in the walls, and from 2½ to 4½ in. of Sil-O-Cel Powder over the tops and drums of boilers will stop heat waste, save fuel, prevent cracks which cause air leakage and insure better working conditions in the boiler room.

STEEL PLANT INSULATION—Proper insulation of iron and steel



TRADE-MARK

plant equipment will increase the output of the furnace and prolong the life of the equipment. Hot blast stoves are insulated by packing from 3 to 5 in. of Sil-O-Cel Powder between the fire brick lining and the outer shell. Vibration of heat will not cause it to settle or shrink, and it protects the steel shell from strains caused by temperature changes. If preferred 2½ or 5 in. of Sil-O-Cel Brick may be used as an alternate.

Crowns of stoves require 2½ in. of Sil-O-Cel Brick laid directly over the fire brick.

Bustle pipes and mains are effectively insulated by placing 2½ or 4½ in. of Sil-O-Cel Brick between the refractory lining and shell.

Hot metal cars, ladles and mixers are best insulated with Sil-O-Cel C-3 cement especially prepared for this type of equipment.

INSULATION OF OIL STILLS—Sil-O-Cel insulation, when applied to oil stills and still settings, actually increases the capacity of the stills by saving heat which is ordinarily lost and making it productive. Both Sil-O-Cel Brick and Insulating Ce-



OIL STILLS INSULATED WITH SIL-O-CEL INSULATING BRICK

ment are recommended for still work, the insulation varying from 2½ to 4½ in. in thickness.

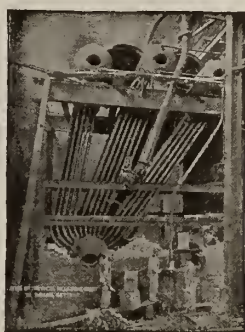
Proper insulation will insure a greater output from stills, more uniform internal temperature, more accurate temperature control and greater efficiency.

SIL-O-CEL INSULATING CEMENTS—These cements make a most effective insulation for irregular heated surfaces where it is impracticable to use Sil-O-Cel Insulating Brick or Powder. Supplied in three forms and are preferably applied in three coats: First, a sticking coat, second: the insulating coat, third: a hard finish coat.

VARIOUS USES—Sil-O-Cel Insulating Products will prevent heat loss and increase the output of heated equipment. Sil-O-Cel Insulation saves fuel, better working conditions and insures more accurate control of temperature. It is applicable to:

Annealing furnaces	Enameling ovens	Waste heat boilers
Annealing pits	Furnace doors	Japanning ovens
Bakers' ovens	Gas generators	Kilns
Boiler settings	Gas producers	Marine boilers
Breechings	Heat treating equipment	Malleable furnaces
Bustle pipes	High temperature flues	Metal mixers
Coke ovens	Hot blast stoves	Oil stills
Core ovens	Hot blast mains	Pipe covering
Dryers	Hot metal cars	Regenerators
Dust catchers		Soaking pits
Electric furnaces		Tanks and vats

INFORMATION—Bulletins containing engineering data on any of the above types of equipment will be sent on request. Detailed information on any specific insulating problem will be furnished by this company's Engineering Department.



LAYING UP SIL-O-CEL BRICK IN BOILER SETTING



HOT BLAST STOVES INSULATED WITH SIL-O-CEL BRICK

H. W. JOHNS-MANVILLE CO.

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PIPE and BOILER INSULATION; UNDERGROUND SYSTEM of PIPE INSULATION.
PACKINGS.
REFRACTORY CEMENTS.
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STEAM and RADIATOR TRAPS.
ASBESTOS ROOFINGS: BUILT-UP, READY-TO-LAY and CORRUGATED FORMS; ASBESTOS SHINGLES.
ASBESTOS WOOD.
Mastic Flooring.

Service.

Johns-Manville power plant, roofing and building materials are backed by the responsibility of the H. W. JOHNS-MANVILLE Co. which assures the engineer better service, better value and greater satisfaction, because of the long, economical service these materials afford. Full details, specifications and drawings will be gladly furnished by the engineering service department of the nearest branch office.

Johns-Manville engineers will be glad to confer on any problems of insulation of boilers, hot and cold pipe systems (inside, outside or underground); packing of rods and pistons; waterproofing, or the use of radiator or steam traps.

Johns-Manville Underground System of Pipe Insulation.

The underground method of distribution of steam and hot water is the most desirable, convenient and economical, provided the system installed meets three important qualifications:

(1) Its efficiency must be equal to, or greater than, that attained with properly insulated pipes running indoors. (2) Its insulating value must not depreciate more rapidly than the pipe itself. (3) Its cost per year, based on its saving of heat and its great durability, must be less than the cost of others.

The Johns-Manville Underground System of Pipe Insulation provides a permanent, efficient and economical means of placing underground, and insulating, pipes conveying steam or hot water.

Johns-Manville Pipe and Boiler Insulation.

One of the most important results of the development of asbestos by Johns-Manville has been the saving

of heat through insulation. Johns-Manville have developed materials, built on asbestos as a base, that retard the escape of heat from boilers, furnaces, pipes and flues. Twenty-five years' specialization, directed by the highest engineering talent, has enabled Johns-Manville to develop and produce insulations of exceptional efficiency and durability under every service condition.

Asbesto-Sponge, for example—a remarkable felt which combines the insulating value of sponge with the heat resistance and endurance of asbestos—ranks first in efficiency among commercial steam pipe insulations; or 85% Magnesia or Asbestocel, Zero, Anti-Sweat or Brine and Ammonia Insulations. Whatever the needs, they can be met efficiently with one of the Johns-Manville insulations tabulated below:

Service	Type of Insulation	Insulation Recommended
Steam pipes, all pressures	Sectional	Asbesto-Sponge Felted; 85% Magnesia
Medium and low pressure steam pipes	Sectional	Asbestocel
Low pressure steam and hot water pipes	Sectional	Asbestocel
Anti-freezing	Built-up and sectional	Built-up Hair Felt; Zero
Brine and ammonia pipes	Built-up and sectional	Brine and Ammonia; Anti-Sweat
Cold water pipes	Built-up and sectional	Anti-Sweat or Built-up
Boiler insulation	Sheet and block, and cement	Asbesto-Sponge; Asbestocel; 85% Magnesia; Cements, Nos. 302, 400, 85% Magnesia
Stack and flues	Sheet and block	Vitrobestos

The efficiency of the Johns-Manville system is at least 90% when installed according to the Johns-Manville specifications, and by them or under their supervision. This efficiency is maintained for a long period of time on account of the character of the materials used in the construction of this system.

Johns-Manville Packings.

Johns-Manville packing design provides for economy by reducing friction and preventing steam losses. By designing for service, Johns-Manville have reduced friction and wear of rods and packings at no sacrifice of steamtightness.

Engineers have found that instead of having to repack several times a season, a set of Johns-Manville sea rings often last several seasons, because the heavy wear on packings, wear of the rod, and loss of power

through friction, so common with other forms of packings, have been reduced to a minimum. Economical service is afforded by Universal piston packing, Service sheet, Kearsarge gaskets, Vulcabeston pump valves and by all the Johns-Manville line.

Johns-Manville Refractory Cements.

Johns-Manville high temperature cements are composed of highly refractory minerals, which, when thoroughly mixed with water to the consistency of mortar or grout, are especially adapted for use as a bond between, or coating of, fire brick for withstanding the action of flame and severe temperatures.

The three cements used for general plant conditions are Nos. 31, 26 and 32. Cements No. 31 and No. 26 are used for bonding, while No. 32 is used as a coating to protect the exposed face of the brick.

These cements are designed to resist high temperatures without fusing or melting, and to provide for continual expansion and contraction of fire settings without disintegrating. Their use in place of fire clay and other mixtures with lower fusing points will greatly increase the life of boiler and other fire brick settings.

Johns-Manville Electrical Materials.

The "Noark" line of electrical protective devices is complete. It comprises: cartridge enclosed fuses, renewable and non-renewable, cutout bases, main line and branch fuse and switch boxes, primary distribution fuse boxes, underground junction and distribution boxes, service meter protective devices, exteriorly operated switch boxes, all-safe switches, and a complete line of accessories.

This entire line is the result of many years conscientious effort to produce the best and most dependable electrical protective devices. The satisfactory service they render wherever used is positive evidence that this effort has been successful, and furnishes obvious proof of Johns-Manville responsibility.

Johns-Manville Steam Traps.

This trap is adapted to power plant requirements and is generally used in sizes with connections from $\frac{3}{4}$ to 2 in. inclusive. It permits the free discharge of water without loss of steam. The action is direct—that is, operation depends upon the movement of the water flowing into it, rather than the temperature or the pressure of the steam.

There is just one moving part—a ball, which is held against the discharge bushing by unbalanced pressure and rises when water flows into the chamber. Whenever the water level rises to a certain point above the discharge orifice, the buoyant force of the water rolls the ball up and exposes part of the discharge orifice, allowing free escape of water and air. As the water level lowers, the ball settles back and closes the discharge orifice, and the water seal which is maintained prevents steam leakage; operation is continuous, for it discharges as the water is received.

Johns-Manville Radiator Traps.

This device permits the free discharge of water and air from the radiator without loss of steam, whether the system operates by gravity or vacuum, and is similar to the Johns-Manville steam trap in construction and principle.

Johns-Manville Asbestos Roofings.

Asbestos rock fiber, a fireproof, timeproof and weatherproof mineral is the base of all Johns-Manville

asbestos roofings which are made in a variety of forms for every roofing need.

Johns-Manville Standard and "Colorblende" asbestos shingles. Made of asbestos fiber and portland cement united under hydraulic pressure. Furnished in various sizes and shapes, in four colors and two thicknesses, $\frac{1}{4}$ in. and $\frac{1}{8}$ in.

Johns-Manville asbestos ready-to-lay roofings for sloping roofs. Made of asphalt impregnated sheets of asbestos felt cemented together with natural base asphalts. Furnished in three or four plies, in sheets or rolls, ready-to-lay.

Johns-Manville asbestos built-up roofing for flat surfaces. Sheets of asphalt impregnated asbestos felts built up on the roof deck with hot asphalt, in the required thickness, by Johns-Manville workmen.

Johns-Manville corrugated asbestos roofing for skeleton frame buildings. Made of asphalt impregnated sheets of asbestos felt with a reinforcing center sheet of metal.

These roofings are approved by the Underwriters' Laboratories, Inc., take base rates of insurance and are backed by Johns-Manville service and responsibility. This company's engineering service department will be glad to confer and submit detailed specifications and estimates.

Johns-Manville Asphalt Mastic Flooring.

This flooring is in the nature of an asphaltic concrete and consists of a binder, or cement, made up of a combination of natural asphalts and a well graded mineral aggregate of torpedo gravel, crushed stone and sand, with particles ranging in size from those passing a $\frac{3}{8}$ in. mesh screen down to those which pass a 200-mesh screen.

Johns-Manville Mastic can be laid in any consistency between extreme hardness and softness and, while always dense, possesses a certain amount of resiliency. Does not cause foot soreness and fatigue like concrete and other non-yielding floor surfaces; and where employees of machine shops, factories, and other industries are compelled to stand while at work, it adds greatly to their comfort and efficiency. Furthermore being damp-proof, it is a protection against ailments common to dampness.

This is essentially a floor that is "made to fit"; therefore, each installation should be treated as an individual problem and a specification written to meet the exact requirements. A brief description of conditions sent to any of our Branch Engineering Departments will bring immediate response.

Johns-Manville Asbestos Wood.

A fireproof building material made of asbestos fiber and portland cement. Recommended for use as a fire barrier in factories, foundries, warehouses, machine-shops and wherever a fireproof building material is required, in any of the following forms:

Smoke breechings, roofing, sheathing, window casings, moldings, cabinets, tank linings, ceilings, floorings, battens, boxes and receptacles, fire doors and partitions. It is also impervious to the action of most commercial chemicals.

It has a gray surface which requires no painting, but it can be painted, varnished or grained in imitation of slate, marble or any hardwood.

Can be fastened with nails or screws and does not warp, distort, chip or weaken in service. Comparatively light in weight and has a modulus of rupture of 3500 lbs. per sq. in. under transverse loads.

Approved by the Underwriters' Laboratories, Inc.

MAGNESIA ASSOCIATION OF AMERICA

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Manufacturers of "85% Magnesia" Insulation for Power and Heating Systems

Products.

85% CARBONATE of MAGNESIA NON-HEAT-CONDUCTING COVERINGS for power, heating and ventilating systems, including 85% MAGNESIA SECTIONAL PIPE COVERING, MAGNESIA BLOCKS and MAGNESIA PLASTIC.

85% Magnesia for Pipe and Boiler Covering.

85% Magnesia is an inorganic, inert mineral composition, composed of 85% of commercially pure carbonate of magnesia, with which is incorporated sufficient mineral fiber to act as a binder, thus giving the necessary structural strength.

In substance, 85% Magnesia consists of myriads of microscopic crystalline cells, each one holding enmeshed an infinitesimal particle of *dead air*—the only accepted scientific principle of perfect heat insulation.

Application.

85% Magnesia is manufactured in the form of half sections, for pipes up to 10 in. in diameter; segments for larger sized pipes and curved surfaces; blocks for boilers and flat surfaces; and plastic (or fibrous powder) for irregular surfaces, filling of joints, etc.

Efficiency and Durability.

The efficiency of 85% Magnesia is equal to a saving of from 75% to 97% of the total heat wasted by bare pipes, the percentage varying somewhat with the temperature and thickness. (For the correct thickness for maximum saving at all pressures and temperatures, see Table No. 1.)

Many cases are on record where 85% Magnesia coverings have been in continual use for upwards of a quarter century, without any loss of efficiency. In many instances they have outlasted the metal pipes and boilers they protected, and have been removed in perfect condition and applied on the new work installed to replace the old.

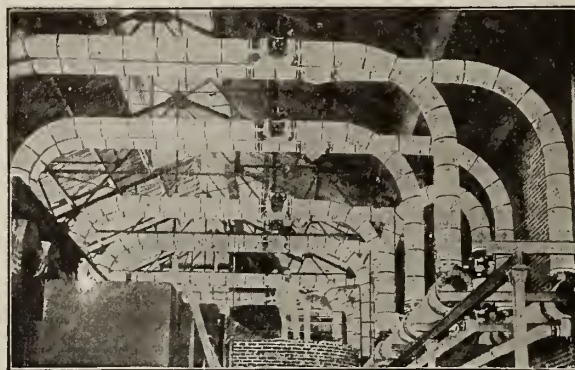
General Service Experience.

The insulation value of 85% Magnesia coverings is attested by the records of over 30 years' experience in the U. S. Navy, the leading steamship lines, railroads, locomotive builders, power and heating plants and the largest hotels, public buildings, skyscrapers and other large structures in America and elsewhere.

Magnesia Association Specifications.

For 85% Magnesia non-heat-conducting coverings for power and heating systems.

NON-HEAT-CONDUCTING MATERIAL—Non-heat-conducting covering material for all heated surfaces shall be 85% Magnesia covering, consisting of hydrated carbonate of magnesia, manufactured according to the standard formula ($4 \text{ MgCO}_3 \cdot \text{MgO}_2 \cdot \text{H}_2\text{O}$), and asbestos fiber. The mixture shall contain in combination not less than 95% of said magnesia and fiber, of which at least 85% of the whole shall be said magnesia.



85% MAGNESIA COVERED STEAM PIPES, CINCINNATI & COLUMBUS TRACTION CO., COLUMBUS, OHIO

FORM OF COVERINGS—Non-heat-conducting covering materials shall be furnished in the forms and dimensions specified in Table No. 2 of this specification. Pipes shall be covered with molded sections or segments. Boilers, heaters, and similar surfaces shall be covered with blocks and plastic cement. Flanges, fittings, and similar surfaces shall be covered with blocks and plastic cement, or plastic cement only.

THICKNESS OF COVERING—The thickness of non-heat-conducting coverings shall be in accordance with the following table, except as otherwise specified:

	Thickness
Superheated steam pipes:—	
Sizes up to 4 in.	**double standard
Sizes 4 in. and larger	
3 in. (double layer) and ½ in. Magnesia cement	
High pressure saturated steam pipes:—	
Sizes up to 4 in.	2 in.
Sizes 4 in. and larger	**double standard
High pressure saturated steam flanges.	2 in.
High pressure drips.	2 in.
Feed water pipes.	*standard
Heating system pipes.	*standard
Superheated steam flanges (removable)	2 in.
Feed water flanges.	1 in.
Low pressure heating flanges.	1 in.
Boiler tops.	2½ in. blocks and ½ in. Magnesia cement
Ends of boiler drums.	2½ in. blocks and ½ in. Magnesia cement
Feed water heater.	1½ in. blocks and ½ in. Magnesia cement

Note to Specification Writer—The thicknesses specified above represent good practice for average conditions: (i.e., coal \$4.00 per ton, 150 lbs. steam pressure, 150° Fahr. superheat). For scientifically correct thicknesses to meet any special condition see tables No. 2 and No. 3.

*See table No. 1, column 2.

**See table No. 1, column 8.

WORKMANSHIP—Workmen employed in the application of coverings shall be skilled pipe coverers.

STEAM AND HOT WATER PIPING—Single Thickness Covering—All single thickness pipe coverings shall be carefully applied so that seams and butt joints are tight. Coverings shall be finished with canvas jacket pasted on, and black japanned bands on 18-in. centers.

(Where pipe is so located that the coverings may be damaged, or where a particularly fine finish is desired, there should be applied, over the standard canvas jacket, sheathing paper, followed by an extra 8-oz. canvas jacket sewed on in the manner specified under Double Thickness Covering.)

Double Thickness Covering—All double thickness covering shall be applied by the broken joint method. The first layer of sectional or segmental covering shall be securely wired in place with No. 18 annealed iron wire; the second layer shall be ap-

plied so as to break both butt and lateral joints, and be secured in place by No. 18 annealed iron wire, not less than three separate loops to the section. Any cracks on the surface between the sections or segments shall be carefully filled with 85% Magnesia Plastic.

All double thickness covering shall be finished with an 8-oz. canvas jacket, neatly applied over heavy sheathing paper and well sewed on, approximately three stitches to the inch.

Fittings—Pipe fittings, including flanged fittings, shall be covered with 85% Magnesia Blocks and Plastic, or all 85% Magnesia Plastic, to a thickness not less than the covering on the pipes. The finishing coat shall be smoothly troweled, and finished with a canvas jacket to match the sectional covering.

Flanges—All high pressure steam flanges, except flanges on fittings, shall be covered with 85% Magnesia Blocks and Plastic, or all Plastic, made up on framework of 1/2-in. mesh iron wire netting, in two sections, so as to be easily removable and replaceable. Flange covers shall be finished with a canvas jacket to match the sectional covering. Low pressure steam and hot water flange covers shall be built up solid.

The covering on pipes at flange bolts shall be cut back and neatly beveled to allow sufficient space for the removal of the bolts without injury to the covering.

EXHAUST PIPING—Exhaust piping and exhaust mains, 10 in. and smaller, shall be covered with standard thick 85% Magnesia Sectional Covering (see table 1, column 2), finished with canvas jacket pasted on, and black japanned bands on 18-in. centers.

Exhaust piping and exhaust mains, 12 in. and larger, shall be covered with 85% Magnesia Plastic, or Blocks and Plastic, not less than 1 1/2 in. thick, finished with a coat of hard finish cement.

(Where exhaust piping is so located that the covering may be damaged, or where a particularly fine finish is desired, there should be applied, over the standard canvas jacket, sheathing paper, followed by an extra 8-oz. canvas jacket, sewed on in the manner specified under Double Thickness Covering.)

Fittings—Fittings (including flanges) on exhaust lines and mains shall be covered with Magnesia Plastic, or Blocks and Plastic, applied to the same thickness as the sectional covering, and finished with a canvas jacket to match the sectional covering.

BOILERS—**Boiler Tops**—All exposed boiler tops, or tops of drums, shall be covered with 85% Magnesia Blocks, finished with 1/2 in. of Magnesia Plastic and a coat of hard finish cement.

The covering shall be extended over the top surface of the brick setting on either side of, and in between, the boiler tops and drums, and over top of combustion chamber.

Ends of Drums—The ends of boiler drums, both heads and rings, shall be covered with 85% Magnesia Blocks and Plastic, or all Plastic, of thickness required, securely wired in place, as previously described, followed with a smooth finishing coat and covered with a canvas jacket to match the sectional covering. The covering of drum ends shall be beveled around manholes.

Boiler Walls—The side brick walls of boiler settings shall be thoroughly sealed against air infiltration by means of 2 coats of heavy paint made up of tar and asbestos; over this shall be applied 1 3/4-in. thickness of 85% Magnesia Plastic Cement, followed by a final 1/4-in. thick coat of hard finish cement.

The 85% Magnesia Plastic Cement shall be reinforced by means of 2-in. hexagonal wire mesh placed at a distance of from 1 in. to 1 1/2 in. from the brick wall and fastened thereto by means of No. 16 gauge iron tie wires, which shall be either embedded in the brickwork or fastened to expansion bolts embedded in the brickwork on 18-in. centers.

The covering shall be neatly beveled about all openings, and for a distance of 4 ft. from the boiler room floor it shall be protected by some form of sheet metal casing, which shall be provided by the sheet iron contractor.

SMOKE BREECHING—On connections from boiler to main smokestack, including portions running to economizer, there shall be applied, first, 1/2-in. mesh black iron wire cloth with 3/4-in. V-iron attached, to form air space, and fastened directly to the iron.

Block and Plastic material shall follow, as specified for boiler tops.

DUCTS AND STACKS—All hot and temperate air and cold air ducts and flues, and all exposed surfaces of fan casings, tempering coils, etc., shall be covered with 85% Magnesia Blocks, 1 in. in thickness, firmly secured with No. 18 galvanized iron wire, with all block joints pointed up with 85% Magnesia Plastic, and the edges of all exposed ducts protected with a light metal formed to an "L".

All said insulation (except that concealed in walls, ceilings, etc.) shall be finished in sheathing paper and an 8-oz. canvas jacket, well stretched, and neatly sewed, not less than three stitches to the inch.

HEATERS, RECEIVERS, RETURN TANKS, TRAPS, ETC.—All heaters, receivers, return tanks, traps, etc., shall be covered with 85% Magnesia Blocks and Plastic. (The steam or water temperature should govern the thickness of coverings specified, and in every case the thickness of the covering should correspond to the thickness of the pipe covering where similar conditions of heat and steam temperature are found.)

EXPPOSED COVERINGS—All pipes running outdoors or exposed to extremely low temperatures, whether steam or heating mains, shall be covered with 1 in. greater thickness than previously specified, and applied as provided under specification for steam piping, but finished with three-ply waterproof roofing (in place of canvas), applied with lapped joints and secured with No. 16 copper wire, spaced not over 8 in. on centers.

PAINTING—Such painting as is required by the engineer or architect is to be included in the general painting contract.

On interior insulation, the canvas jacket shall be thoroughly sized and painted two coats of standard lead and oil paint, of such colors as may be selected by the supervising engineer.

Explanation of Tables and Curves.

The thicknesses given in these tables and curves are the proper thickness for the maximum net saving for each condition. They are based on a period of service of 8,760 hours per year.

Where pipes are cold part of the year, multiply the cost of coal by the number of hours per year the pipes are hot and divide by 8,760; use the value obtained instead of the actual coal cost. 20% of the list cost has been allowed as the cost of application, and 13% of the total cost for the annual fixed charges (6% interest, 5% depreciation, 2% miscellaneous). The value of the heat losses used in calculating the net savings is based on a series of experiments, covering a period of three years, made for the MAGNESIA ASSOCIATION OF AMERICA by the Mellon Institute of Industrial Research of the University of Pittsburgh.

The tables below and on following page are for use in plants where costs are not accurately known. They are based on average conditions. In transforming the steam cost to coal cost, it has been assumed that 75% of the cost of steam is coal cost, that 1 lb. of coal will evaporate 7 lbs. of water, and that each pound of steam contains 1,000 B.t.u. above the feed water temperature.

TABLE NO. 1—THICKNESS OF "85% MAGNESIA" FOR MAXIMUM NET SAVING

S=Standard Thickness; DS=Double Standard Thickness (See Table No. 2)

COAL AT \$2.00 PER TON						COAL AT \$4.00 PER TON					
Size pipe, in.	Hot water 175° F.	Steam 5 lbs.	Steam 100-200 lbs.	200 lbs. 150° F. super-heat	200 lbs. 300° F. super-heat	Size pipe, in.	Hot water 175° F.	Steam 5 lbs.	Steam 100-200 lbs.	200 lbs. 150° F. super-heat	200 lbs. 300° F. super-heat
3/4	S	S	S	1 1/2"	DS	3/4	S	S	1 1/2"	DS	2"
1 1/2	S	S	S	1 1/2"	DS	1 1/2	S	S	1 1/2"	DS	2"
3	S	S	S	1 1/2"	DS	3	S	S	DS	DS	3"
6	S	S	1 1/2"	2"	DS	6	S	1 1/2"	DS	3"	3"
12	S	S	1 1/2"	2"	DS	12	S	1 1/2"	DS	3 1/2"	4"
24	S	S	2"	3"	DS	24	S	1 1/2"	DS	3 1/2"	4"
Flat	1"	1 1/2"	2"	3"	3 1/2"	Flat	1 1/2"	2"	3"	4"	5"
COAL AT \$6.00 PER TON						COAL AT \$8.00 PER TON					
Size pipe, in.	Hot water 175° F.	Steam 5 lbs.	Steam 100-200 lbs.	200 lbs. 150° F. super-heat	200 lbs. 300° F. super-heat	Size pipe, in.	Hot water 175° F.	Steam 5 lbs.	Steam 100-200 lbs.	200 lbs. 150° F. super-heat	200 lbs. 300° F. super-heat
3/4	S	S	DS	2"	2"	3/4	S	1 1/2"	1 1/2"	2"	3"
1 1/2	S	1 1/2"	DS	2"	3"	1 1/2	S	1 1/2"	2"	3"	3"
3	S	1 1/2"	DS	3"	3"	3	1 1/2"	2"	3"	3"	3"
6	1 1/2"	2"	DS	3"	4"	6	1 1/2"	2"	3"	4"	4"
12	1 1/2"	2"	DS	4"	4"	12	2"	3"	3"	4"	5"
24	1 1/2"	2"	DS	4"	5"	24	2"	3"	4"	5"	5 1/2"
Flat	2"	3"	4"	5"	6"	Flat	2 1/2"	3 1/2"	4 1/2"	6"	7"

N.B.—These tables, with the curves accompanying, are based on the latest determination of fact, arrived at by the Mellon Institute of Industrial Research, Pittsburgh, Pa.

The curves following are for use in plants where heat costs, steam temperatures, etc., are accurately known. They are applicable to all heated surfaces, since they are based on the temperature of the surface and the value of the heat in dollars per million B. t. u.

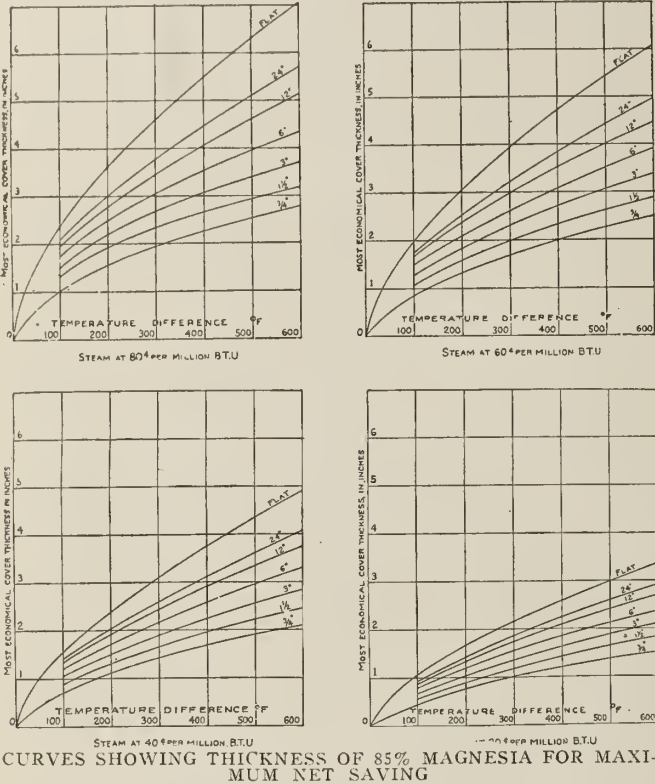


TABLE NO. 2—PRICE LISTS
Adopted August 1, 1907. 85% Carbonate of Magnesia pipe coverings for wrought iron pipes

Inside diameter of pipe, in.	Thickness of standard covering, in.	Price per lin. ft. canvas jacketed	Thickness of covering, in.	Price per lin. ft. canvas jacketed	Thickness of covering, in.	Price per lin. ft. canvas jacketed	Double layer double standard thickness, in.	Price per lin. ft. canvas jacketed	Double layer total thickness, in.	Price per lin. ft. canvas jacketed
1/2	7/8	\$0.22	1 1/2	\$0.46	2	\$0.75	1 3/4	\$0.65	3	\$1.20
3/4	7/8	.24	1 1/2	.49	2	.80	1 3/4	.70	3	1.35
1	7/8	.27	1 1/2	.52	2	.85	1 3/4	.75	3	1.40
1 1/4	7/8	.30	1 1/2	.56	2	.90	1 3/4	.80	3	1.45
1 1/2	7/8	.33	1 1/2	.60	2	.95	1 3/4	.85	3	1.55
2	1 1/8	.36	1 1/2	.64	2	1.00	2 1/8	.90	3	1.65
2 1/2	1 1/8	.40	1 1/2	.70	2	1.05	2 1/8	1.00	3	1.75
3	1 3/8	.45	1 1/2	.76	2	1.15	2 1/8	1.10	3	1.90
3 1/2	1 3/8	.50	1 1/2	.82	2	1.25	2 1/8	1.20	3	2.05
4	1 3/8	.60	1 1/2	.88	2	1.35	2 1/4	1.40	3	2.20
4 1/2	1 3/8	.65	1 1/2	.94	2	1.45	2 1/4	1.50	3	2.35
5	1 3/8	.70	1 1/2	1.00	2	1.55	2 1/4	1.60	3	2.50
6	1 3/8	.80	1 1/2	1.10	2	1.70	2 1/4	1.80	3	2.70
7	1 1/4	1.00	1 1/2	1.20	2	1.85	2 1/2	2.25	3	2.90
8	1 1/4	1.10	1 1/2	1.35	2	2.00	2 1/2	2.50	3	3.15
9	1 1/4	1.20	1 1/2	1.50	2	2.20	2 1/2	2.70	3	3.40
10	1 1/4	1.30	1 1/2	1.65	2	2.40	2 1/2	2.90	3	3.65
*12	1 1/2	1.85	1 1/2	1.85	2	2.70	3	4.10	3	4.10
14	1 1/2	2.10	1 1/2	2.10	2	3.00	3	4.60	3	4.60
16	1 1/2	2.35	1 1/2	2.35	2	3.30	3	5.10	3	5.10
18	1 1/2	2.60	1 1/2	2.60	2	3.60	3	5.60	3	5.60
20	1 1/2	2.85	1 1/2	2.85	2	4.00	3	6.00	3	6.00
24	1 1/2	3.30	1 1/2	3.30	2	4.50	3	7.00	3	7.00
30	1 1/2	4.00	1 1/2	4.00	2	5.50	3	8.40	3	8.40

*All coverings larger than 10 in. furnished in segment form; jackets and bands not included.
Double standard thickness—the inner layer is furnished in sections for pipe sizes up to and including 10 in. and in curved blocks for larger sizes. The outer layer is furnished in sections for pipe sizes up to and including 8 in. and in curved blocks for larger sizes.
Double 1 1/2-in. thickness—The inner layer is furnished in sections for pipe sizes up to and including 10 in. and in curved blocks for larger sizes. The outer layer is furnished in sections for pipe sizes up to and including 7 in. and in curved blocks for larger sizes.

85% CARBONATE OF MAGNESIA BLOCKS
For boiler covering and similar surfaces

Thick-ness, in.	Price per sq. ft.	Thick-ness, in.	Price per sq. ft.	Thick-ness, in.	Price per sq. ft.	Thick-ness, in.	Price per sq. ft.
3/8	\$0.30	1 1/2	\$0.45	2 1/8	\$0.64	2 3/4	\$0.83
1	.30	1 5/8	.49	2 1/4	.68	2 7/8	.87
1 1/8	.34	1 3/4	.53	2 3/8	.72	3	.90
1 1/4	.38	1 7/8	.57	2 1/2	.75	3 1/4	.98
1 3/8	.42	2	.60	2 5/8	.79	3 1/2	1.05
						4	1.20

STANDARD BLOCK SIZES
6 in. x 36 in. 3 in. x 18 in.

How to Use These Tables and Curves.

Determine the following factors in connection with the heated surfaces to be covered: cost of coal, steam pressure and size of pipes.

Select the table most nearly corresponding to the cost of coal, and the column in the table nearest to the condition of steam pressure or temperature. The thick-nesses in this column are the proper thicknesses for the pipe sizes given at the left.

EXAMPLE—Cost of coal \$3.75, steam pressure 150 lbs., size of pipe 12 in. Select the \$4.00 per ton table, and the column headed, "Steam 100-200 lbs." Run down this column to the 12-in. line and find that Double Standard is the proper thickness for maximum net saving.

Special Note to Architects and Engineers.

Occasionally when an architect or engineer is writing his specifications, he finds that brevity is so necessary that he can not enter fullest details. When such is the case on the subject of non-conducting pipe cover-ings, the use of the following abbreviated Magnesia As-sociation Specification will amply insure application of correct insulation :

"NON-CONDUCTING COVERING—All exposed boiler surfaces, all pipes, fittings, or appurtenances carrying steam, hot water or hot gases, where radiation would cause condensation or drop in temperature, or result in loss of B. t. u. which could be utilized, shall be thor-oughly insulated as specified in Magnesia Association Specification for 85% Carbonate of Magnesia Non-conducting Coverings."

Copies of Specification.

Copies of the Magnesia Association Specification, herein referred to, will be mailed to architects and engi-neers on request addressed to any of the members of the MAGNESIA ASSOCIATION OF AMERICA.

Should any insulating condition arise in practise not fully covered in this Specification, please send details of problem to one of the members of the MAGNESIA ASSO-CIATION OF AMERICA, and it will have expert considera-tion and prompt reply.

Handbook.

A practical handbook, "Defend your Steam," deal-ing fully with the manufacture, uses and application of 85% Magnesia coverings and with the theory and practise of heat insulation, and will be sent free on request.

NORRISTOWN MAGNESIA & ASBESTOS CO.

Pipe and Boiler Coverings and Asbestos Products

MAIN OFFICE

NORRISTOWN, PA.

BRANCH OFFICE: 23 Lewis Wharf, BOSTON, MASS.

FACTORIES: NORRISTOWN, PA., DOYLESTOWN, PA., and PLEASANT MILLS, N. J.

Products.

MAGNESIA ASBESTOS PIPE and BOILER COVERINGS, Exposed, Overhead and Underground.

Also, Asbestos Paper and Board, Cloth and Wick Packing, Sheet Packing and Gaskets, and Cements.

Note to Engineers and Architects.

This company has been in the active manufacture of pipe and boiler coverings, and heat and cold insulation materials for the past 20 years. There are so many different conditions which govern in every heat or cold insulation equipment that it is scientifically and physically impossible to recommend one or two styles of covering only.

This company manufactures eleven distinct types of covering and many variations of these particular types for varying or special conditions. They are not trying to push the sale of any particular one.

There is a covering for every condition from the highest steam pressure to the coldest water line, and for varying outside conditions, together with the conditions to be met to comply with the requirements of any installation in question, as to whether ultimate efficiency with high first cost or a lower first cost with a sacrifice of the highest point of efficiency are desired.

Trade-mark.

All of the products manufactured by NORRISTOWN MAGNESIA & ASBESTOS Co. are made under the brand name of "Diamond N." The resources of the company are behind the "Diamond N" trade-mark, and it is their desire to consult with and advise in accordance with their past experience on any such problems as may arise with architects and engineers or those desiring to use these products.

"Ideal" Covering.

Under general conditions, "Ideal" covering is recommended for highest steam pressure, and where highest efficiency is desired. It is a relatively high first cost covering, being made up of a center core of magnesia asbestos, enclosed in an outside jacket of wool felt, which allows it to be applied "broken joint" method, thereby increasing the efficiency of the covering as a whole. The jacket also affords an excellent protection to the center core against mechanical injury, where the covering is liable to be subjected to rough han-



TRADE-MARK

dling, vibration, knocks and bruises, etc., as in a boiler room, or where the pipe is located near the floor or within easy reach.

In a number of comparative tests between this and other "Diamond N" coverings, as well as standard coverings of other manufacturers, "Ideal" has never been surpassed in point of efficiency.

Asbestos Magnesia Covering.

This is the center core of asbestos magnesia which is used in making up the "Ideal" covering, with the wool felt jacket omitted. The efficiency is not quite so high as the "Ideal" covering, and the first cost is lower. It will not calcine under any working temperature. A perfectly white covering producing a very good appearance in an engine room, when erected.

Wool Felt Covering.

Made up of layers of wool felt paper. Good efficiency. Used mostly for hot water and cold water lines. It is asbestos lined for hot water lines, very durable and comparatively low in first cost.

Air Cell Covering.

Made of corrugated asbestos paper. An exceedingly light weight covering having fairly good efficiency, and very low first cost. Made in 2-, 3- and 4-ply, for ordinary low steam pressures, and 6- and 8-ply for steam pressures up to 125 lbs.

Frostproof Covering.

A wool felt jacket with hair felt ½ in. to 1 in. thick in the center. An exceedingly good covering to prevent freezing of water lines.

Indent Covering.

Made up of consecutive layers of asbestos paper, indented. Will stand the highest temperature, and is exceedingly durable. Very good efficiency. Can be used in the most severe cases of vibration, or where mechanical injury is to be avoided, even to the point of train pipe and locomotive insulation.

Ric-wiL Covering.

For underground work there is no covering on the market at the present time, which can compare with Ric-wiL underground pipe covering as a permanent, efficient and thoroughly mechanical job.

It consists of a terra cotta tile, heavily glazed, longitudinally split pipe, with the insulation integral with the tile. The pipe line is placed in the center of the insulation, supported on roller bearings, the whole tile supported on a base constructed so as to form a drain to carry away the surface water, and keep the tile line dry. Absolutely permanent construction.

Inquiries.

The above coverings are but a few of the eleven standard coverings which this company makes. Inquiries are solicited for any conditions of service.



"IDEAL" COVERING

For high pressure work and for pipelines exposed to weather when waterproofed

UNION FIBRE CO., INC.

Manufacturers of Insulating Materials

WINONA, MINN.

BRANCH FACTORY: YORKTOWN, IND.
AGENTS IN EVERY LARGE CITY

Products.

INSULATING MATERIALS: LINOFELT; FIBROFELT; WATERPROOF LITH; UNION LITH PIPE COVERING; UNION ROCK WOOL.

Engineering Data and Service.

In every large city we maintain offices, in charge of expert insulation men, capable of analyzing any problem and suggesting proper treatment. Full data as to requirements for any condition, together with complete estimates on materials, or workmanship, freely furnished. The practical experience of twenty years in handling the most difficult problems in insulation, condensation, machine vibration, acoustic correction, etc., is at the service of customers.

Linofelt.

A heat resisting quilt for sheathing buildings. Prevents passage of heat or sound through walls, floors, or ceilings. Chemically treated flax fiber, immune from decay, firmly stitched between layers of tough, Kraft paper, or of waterproof paper, muslin or burlap, as may be required. Uniform in thickness and quality, germ-proof and verminproof, and the most efficient heat and sound insulation on the market. From $\frac{1}{4}$ to 1 in. thick, in various widths and lengths. Special types for acoustic work, fireproof construction, etc.

Fibrofelt.

A light, self-sustaining, flexible insulating felt, in board form, from selected straw fiber. Odorless, sanitary, germproof and verminproof. Easily cut and applied like lumber. Especially adapted for prevention of roof condensation. Deadens sound and vibration in factory machinery.

Waterproof Lith.

A standard insulating block for refrigerating plants, cold storages, packing houses, creameries, ice storages, etc., composed of selected flax fiber and annealed rock wool. This wool, comprising 40% of Lith, contains 8% stone fiber and 92% entrapped air. Flax fiber adds insulating efficiency and necessary tensile strength not found in other wool blocks, or other cold storage insulation. Thicknesses are from $\frac{1}{2}$ to 3 in.; blocks 18 in. wide by 4 ft. long. Heat transmission, per inch thickness, per degree difference in temperature, per day, is 6.60 B.t.u's.

Union Lith Pipe Covering.

For ice water, brine, and refrigeration pipe and fittings, moulded to exact form from same material as Lith. Made in three thicknesses: Regular Brine, $2\frac{1}{2}$

in. thick, for zero to 25° Fahr.; Heavy Brine, $3\frac{1}{2}$ in. thick, for below zero service; Ice Water, $1\frac{3}{4}$ in. thick, for cold liquids between 25 and 50° Fahr. Unusually efficient, extensively used.

Union Rock Wool.

Blown from virgin rock by exclusive patented annealing process, it is the most durable and efficient wool obtainable. Recent infringement prosecutions prove its superiority. Furnished in bags, 50 lbs. each, in carloads or less, f.o.b. Yorktown, Ind. Wool packs in service to 14 lbs. per cu. ft. Excellent insulation, and especially adapted for filtration of chemicals, acids, etc.

Economy of Insulation.

A half-inch thickness of any of our products, used to prevent escape of heat through walls, roofs, etc., will easily save one-third its cost *every* year, in fuel alone, and maintain uniform temperatures. In cold storage service, its cost is only a fraction of the cost of the refrigeration it eliminates. For sound absorption, acoustic correction, etc., our products rank highest in every test, and compared with former methods, are absurdly inexpensive. A proper application under heavy, vibrating machinery adds years to the life of both buildings and machines.

Elimination of Roof Condensation.

In the coldest climate, under extreme conditions, one-inch thickness of Fibrofelt, applied in hot asphalt on concrete roofs, will absolutely prevent condensation, which for years has been so destructive. Hundreds of applications prove it. Any ordinary form of roofing can be used over the insulation, in the ordinary manner. Such treatment, by retaining interior heat, prevents roof concrete from attaining cold temperature at which condensation takes place, thus removing its cause.

Refrigerator Insulation.

Practically all efficient household refrigerators, fully 60% of the refrigerator cars in the country, and a very large percentage of the cold storage plants, packing houses, etc., in all parts of the country, are, and have been using our specially adapted products for years, with unqualified success. During the past year 82% of our shipments were to former customers, proving their satisfaction.

Estimates, Etc.

Complete data and estimates for any requirements freely furnished on request, together with personal service of any of the engineering forces.

CHEMICAL TOILET CORPORATION

Sanitary Indoor Closets for Unsewered Buildings

SYRACUSE, N. Y.

Products.

- PERFECTION INDOOR CHEMICAL CLOSETS.
- PERFECTION SEPTIC DISPOSAL SYSTEMS.
- PERFECTION CHEMICAL for Purifying Sewage.
- PERFECTION SOLVENT for Clogged Pipes.
- PERFECTION CESSPOOL SOLVENT.

Perfection Chemical Closet.

No water or sewer required. Designed for use in unsewered buildings; wherever folks live or work.

Chemical disposal of sewage provides safety, cleanliness, convenience; improves working conditions, and promotes contentment.

Approved by health, educational and industrial authorities for use wherever sewers and water are not available; destroys bacteria; prevents contagion.

Easily installed in any building. Tanks are set in ground or hung from floor. Cared for by emptying through drainage pipes to seepage pool and putting in new charge of Perfection Chemical once about every 4 to 6 months for average home; same for mills when one system is provided for each 12 to 15 employees.

Multiple Systems.

Any number of bowls may be joined for ventilation or drainage. Blue print suggestions furnished on application.

Perfection Septic Disposal Systems.

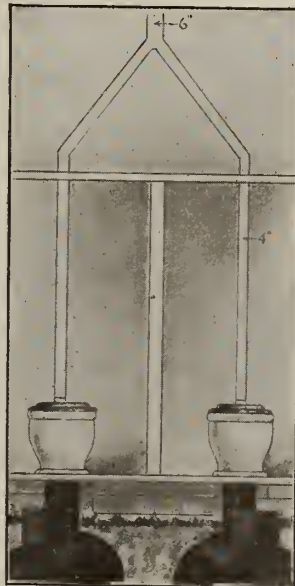
Septic tanks for use in connection with water flush systems where sewers are not laid. Also septic vault closets for use as an outdoor closet without water connections. Catalogue on request.

Perfection Chemical.

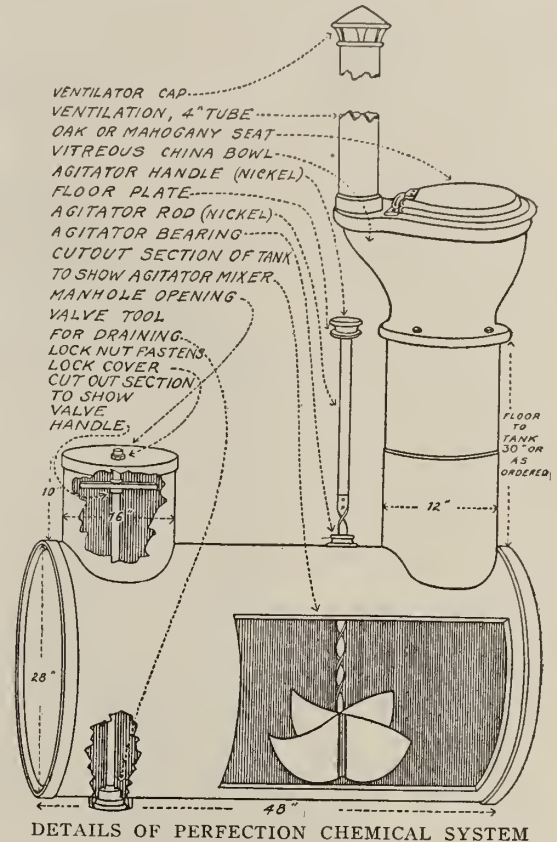
In 25-lb. cans; full charge for purifying 125 gals. of sewage. Destroys bacteria, liquefies and purifies sewage. No infectious disease or water pollution.



SINGLE BOWL INSTALLATION



AN INSTALLATION WITH TWO BOWLS



Specifications of Perfection Chemical System.

Storage tank of No. 14 gauge Toncan metal, 128 gals.; 12-in. drop tube connection; 16-in. manhole opening to provide access to drain valve. Tanks are protected against corrosion and guaranteed for long term service.

Drain valve closes and opens by rod connection. Pressure closing, no threads.

Simple spiral agitator or mixer is hand operated at side of bowl. No attachments or bearings inside of tank.

VITREOUS CHINA BOWL—Oak or mahogany anti-split seat. Metal drop tube connection to tank, 30-in. stock length or as required.

VENTILATION—4-in. white enameled ventilation for inside use, galvanized for outside, with roof fittings as required.

Perfection Solvent.

Drain pipe size for cleaning out any organic stoppage. 2-lb. size cleans out ordinary stoppage. Frequent use prevents trouble.

Perfection Cesspool Solvent.

Purifies and opens cesspools. Periodical use prevents trouble. Comes in 25-lb. cans.

KAUSTINE COMPANY, INC.

Sanitation Engineers and
Manufacturers of Waterless Toilet Equipment (Chemical)

BUFFALO, N. Y.

CHARLOTTE, N. C.

GREENVILLE, S. C.

TORONTO, CANADA

Products.

CHEMICAL WATERLESS TOILETS and VENTILATING URINALS for use where sewers and water supply are not available.

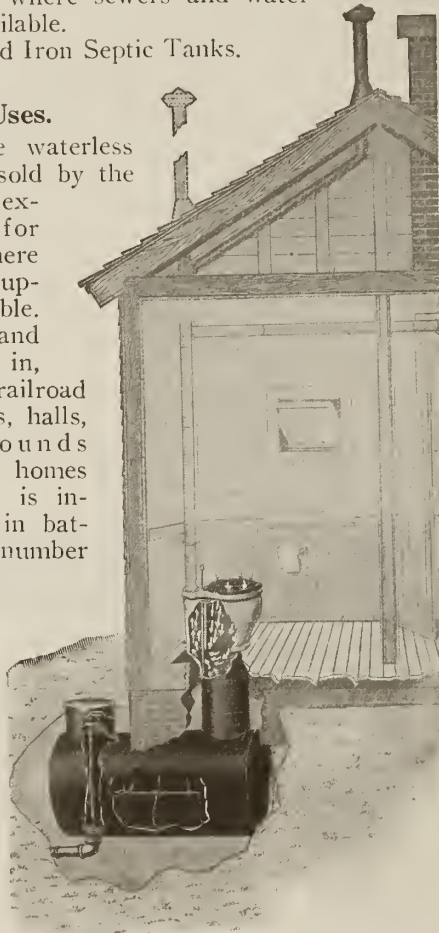
Also Enameled Iron Septic Tanks.

Adaptability and Uses.

The Kaustine waterless toilet, made and sold by the above company, is expressly intended for use in districts where sewers and water supply are not available. It is suited to, and largely in use in, schools, factories, railroad shops and stations, halls, churches, fair grounds and resorts, rural homes and cottages. It is installed singly or in batteries up to any number of units.

Features of the System.

Chemical sterilization and liquefaction, ventilation and aeration, and agitation are the main features of the Kaustine system.



SINGLE SEAT KAUSTINE SYSTEM

The Chemical Kaustine.

Kaustine (furnished exclusively by KAUSTINE COMPANY, INC.) is a flaked green crystal, prepared for use by dissolving in water. It accomplishes three distinct results:

- (1) Softens and disintegrates the sewage solids and toilet paper.
- (2) It destroys all germ life. It eliminates the odors of organic matter.
- (3) It changes the vegetable and animal matter to a pure chemical state and prevents putrefaction and decomposition, rendering the contents of the tank into preserved purity—a state from which these contents may be converted into a fertilizer or disposed of by a very simple method.

Sizes and Capacities.

The following table shows various sizes and capacities of tanks and number of bowls or individual urinals they are supposed to accommodate. Each tank is designated by a number, which should always be used in specifying when ordering.

STANDARD TANK TABLE

Number	Diameter, in.	Length, in.	Capacity, U. S. gals.	Number bowls intended	Lbs. Kaustine required
T-125	27	50	125	1	26
T-200	27	80	200	1	45
T-250	27	100	250	2	52
T-375	32	108	375	3	78
T-500	32	144	500	4	104
T-625	32	180	625	5	130
T-750	32	216	750	6	156

NOTE—T-200 tank is intended for use with 1 bowl, or 1 bowl and 1 individual urinal. There are conditions where it can be used to advantage.

Toilet and Ventilating Urinal Specifications.

CLOSET BOWL—Vitreous china, equipped with oak seat, hinges and fittings.

CHEMICAL TANK—Of No. 14-gauge Armco ingot iron, electro-welded, well made and durable. Form cylindrical.

VENTILATING SYSTEM—Pipes of Armco iron, enameled or galvanized to suit surroundings. Equipped with vent cap, roof safe and all necessary connections.

Installation Plans and Estimates.

The company supplies, through its Engineering Department, plans and estimates without charge. Inquiries are solicited from architects and builders for details and particulars regarding plans for installation.

The seats are installed same as water closets, requiring, however, proper ventilating facilities and location for tank. Tanks may be buried, or held by supports or suspended from ceiling. Must be directly under closet bowl.

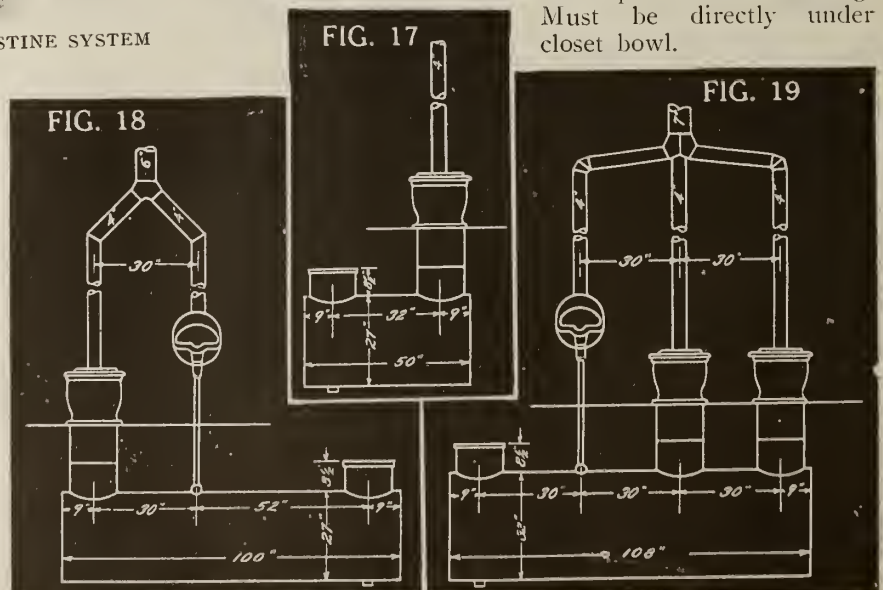


FIG. 17, ONE BOWL; FIG. 18, ONE BOWL AND ONE URINAL; FIG. 19, TWO BOWLS AND ONE URINAL

BETZ BROS., INC.

Manufacturers of Steel Toilet Partitions

Woolworth Building
NEW YORK, N. Y.

REPRESENTATIVES IN ALL PRINCIPAL CITIES

Product.

"STEELBILT" SANITARY TOILET PARTITIONS.

Partitions.

Our partitions are durable and strong, because they are made of steel with all parts electrically or oxy-acetylene welded. They are practically indestructible. They are sanitary, because non-absorbent, and also because all surfaces where dust or dirt might collect have been eliminated. In appearance they are neat and clean.

Partitions are made of heavy gage patent level steel, with stiles, rails and panels electrically welded together forming a unit. The post is formed with a lug at each end; the bottom lug fits into a cast base which fastens to the floor, the top fits into a cast cap, both of which allow for vertical adjustment (to correct unevenness of floor). The rear end of the partition fits over and is bolted to a tee shape member, which is fastened to the wall with expansion bolts, and is arranged for vertical and lateral adjustments to meet variable wall conditions.

Doors.

Stiles and rails are heavy gage drawn steel and are mitered and oxy-acetylene welded at corners, being electrically welded to panel. Joints are ground down to a smooth surface.

Caps and Bases.

Castings for caps and bases are neatly fitted. Caps are made to receive 1-in. diameter pipe, which passes through same and serves as bracing for partitions. The base is made of a special composition non-corrosive metal and is fastened to floor through center in a concealed manner with expansion bolts.



INSTALLATION "STEELBILT" TOILET PARTITIONS

SWEET'S CATALOGUE

BETZ
Steelbilt
TRADE MARK
TOILET PARTITIONS

Hardware.

The hardware furnished consists of special universal pivot hinge, 2 rubber bumpers, 1 door pull and 1 latch for each compartment.

Finish.

We furnish our partitions with 1 prime coat applied, or either one of the standard finishes such as olive green or gray enamel. Finish coats are baked on. All of the hardware, including cast caps and bases, are always finished the same as the partition proper. Our standard olive green enamel finish is recommended where service and durability is a special requirement. Other colors furnished if required.

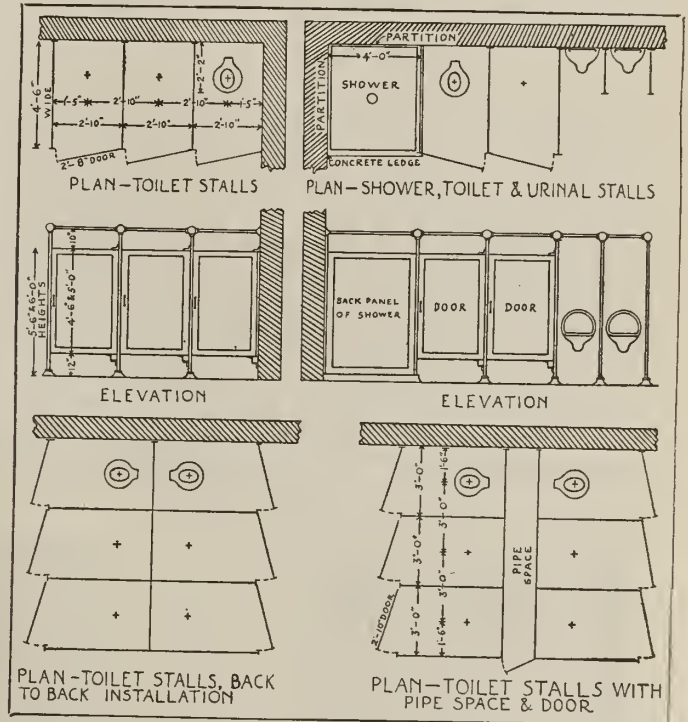
Erection.

Partitions and doors are delivered ready for erection. We will erect the partitions or they can be erected by customer's mechanic. They are easily erected and do not require specially trained men.

Cost.

Our "Steelbilt" partitions cost less than slate.

For prices and further information write Dept. "C." On application we will refer inquirers to our nearest representative.



PLANS AND ELEVATIONS OF BETZ BROS., INC., TOILET PARTITIONS

PARTITIONS AND DOORS IN STOCK

Partition		Partition		Door	
Width	Height	Width	Height	Width	Height
3 ft. 6 in.	5 ft. 6 in. from top of partition to floor	3 ft. 6 in.	6 ft. 0 in. from top of partition to floor	2 ft. 8 in.	4 ft. 6 in.
4 ft. 0 in.		4 ft. 0 in.		2 ft. 10 in.	
4 ft. 6 in.		4 ft. 6 in.		2 ft. 8 in.	
5 ft. 0 in.		5 ft. 0 in.		2 ft. 10 in.	

Above are sizes in stock, but standard sizes other than those mentioned can be furnished. Also special sizes and requirements, to suit conditions.

THE R. F. CARPENTER MFG. CO.

Steel Door and Partition Sections

984 East Sixty-fourth Street
CLEVELAND, OHIO

Products.

Manufacturers of CARPENTER'S "SANYMETAL" PARTITIONS and DOORS for toilet rooms, dressing rooms, shower baths, urinals, etc.

"SANYMETAL" DIVIDING PARTITIONS for offices and factories.

"SANYMETAL" GRAVITY ROLLER BEARING HINGES for all toilet doors.

Carpenter's "Sanymetal" Partitions and Doors.

Carpenter's "Sanymetal" consists of two essential units—a partition with an integral supporting post, and a door. For the partition, a heavy gauge, cold rolled steel sheet is electrically welded to a hollow steel vertical post, and fitted top, bottom and rear with rigid steel mouldings—all electrically welded into one complete whole. The door, of similar construction, is fitted with special spring or gravity roller bearing hinges, rubber bumpers, and pull. These two units, with necessary castings for base and caps, and pipe rails for top finish, constitute Carpenter's "Sanymetal" sections.

FINISH—Partitions and doors present an impervious hard enameled surface. Standard finish is olive green. Other colors furnished are Brewster green and gray. Sections can be supplied with a filler and primer coat and finished by the painter after the work is set. White enamel is best furnished in this way.

For showers and urinals a lead coated special steel is used, finished, like the partitions, with baked enamel.

ERECTION—Quotations will be given on "Sanymetal" either erected, or f. o. b., the work. The erection of "Sanymetal" is a simple matter. After work has been laid out, base castings are set. Into these the hollow vertical posts are set. A set screw in the castings makes the partition adjustable to uneven floors. The rear of the panel has a moulding electrically welded to it and mitered to the top moulding. This is bolted into a U-channel, which snugly fits the back moulding of the partitions.

This U-channel is first fastened to the wall, and allows the partition to be adjusted to uneven walls. With the required number of sections erected, the drawn steel tubing is run through the top castings and fastened to the walls, forming a solid brace to hold the partition.

Sanymetal
TOILET PARTITIONS
TRADE MARK REGISTERED

"Sanymetal" Steel Interior Dividing Partitions.

Sectional dividing partitions for offices and factories consist of a hollow metal post, a well built lower panel, and a glass

section above.

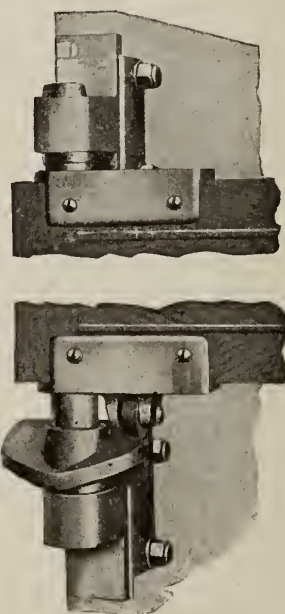
Flexible construction for any room dimensions. Can be installed with wire or metal ceilings. Top panels may be glass, metal or wire mesh. Partitions finished the same on both sides.

"Sanymetal" Gravity Roller Bearing Hinges.

Gravity roller bearing hinges for double and single acting doors of wood or steel made to fit "Sanymetal," slate, marble or wood partitions.

Hinge consists of five parts only. Upper hinge is a heavy casting with pivot carried in socket. Lower hinge is of similar design, the weight of the door being carried by a wheel rolling on a double inclined cam. Hinge can be used for either right- or left-hand door, and can be made for any thickness of material. The cam is reversible, one side making a double acting hinge, reverse side making an inswing hinge to hold door open when not in use. Cam is adjustable to make doors in pairs swing even, or to allow single doors to stand open 6 in. or more.

FINISH—The hinge is made in malleable iron or brass, with a black japanned or nickelplated finish.



"SANYMETAL" GRAVITY ROLLER HINGE

Bulletins.

"Sanymetal" partition and hinge bulletins sent on request.



"SANYMETAL" DIVIDING PARTITIONS



"SANYMETAL" COMBINATION SHOWING URINALS AND DOUBLE AND SINGLE DOOR TOILETS

THE HUGHES-KEENAN CO.

Manufacturers of Toilet Partitions
MANSFIELD, OHIO

Products.

Manufacturers of "HYGEA" TOILET PARTITIONS.

Ornamental Iron Work and "S & L" Pressed Steel Stairs.

Construction.

The "Hygea" construction consists of formed steel tubular posts, extending from the floor to a height of 6 ft. 6 in. (on standard partition, see details.) The backs of the posts are arranged to connect to the steel panel and form a mould or stile for that portion of the panel connecting to it. The panel is made with the upper and lower mould and a special channel and stile at the building wall, making a joint between wall and panel which is secure and also neat, adjustable and non-dirt-collecting.

The "Hygea" Wall Connection.

A channel-shaped member is provided with two flanges, slightly curved inward at the ends. These flanges stand at an angle, slightly more than 90° to the web which is bolted to the wall. These flanges are separated to a width which is slightly larger than the inside of the stile or wall moulding of the panel.

In connecting these members, it is necessary only to press the wall stile over this channel-shaped wall connection which holds the partition in place. To avoid any



possibility of shifting, through bolts are also inserted which make a rigid connection and allow for a variation in the alignment of the wall.

"Hygea" Toilet Doors.

These doors are formed with a single panel, having same patented top and bottom rails and side stiles as partition panels (see details).

Patented Mould and Panel Securing Device.

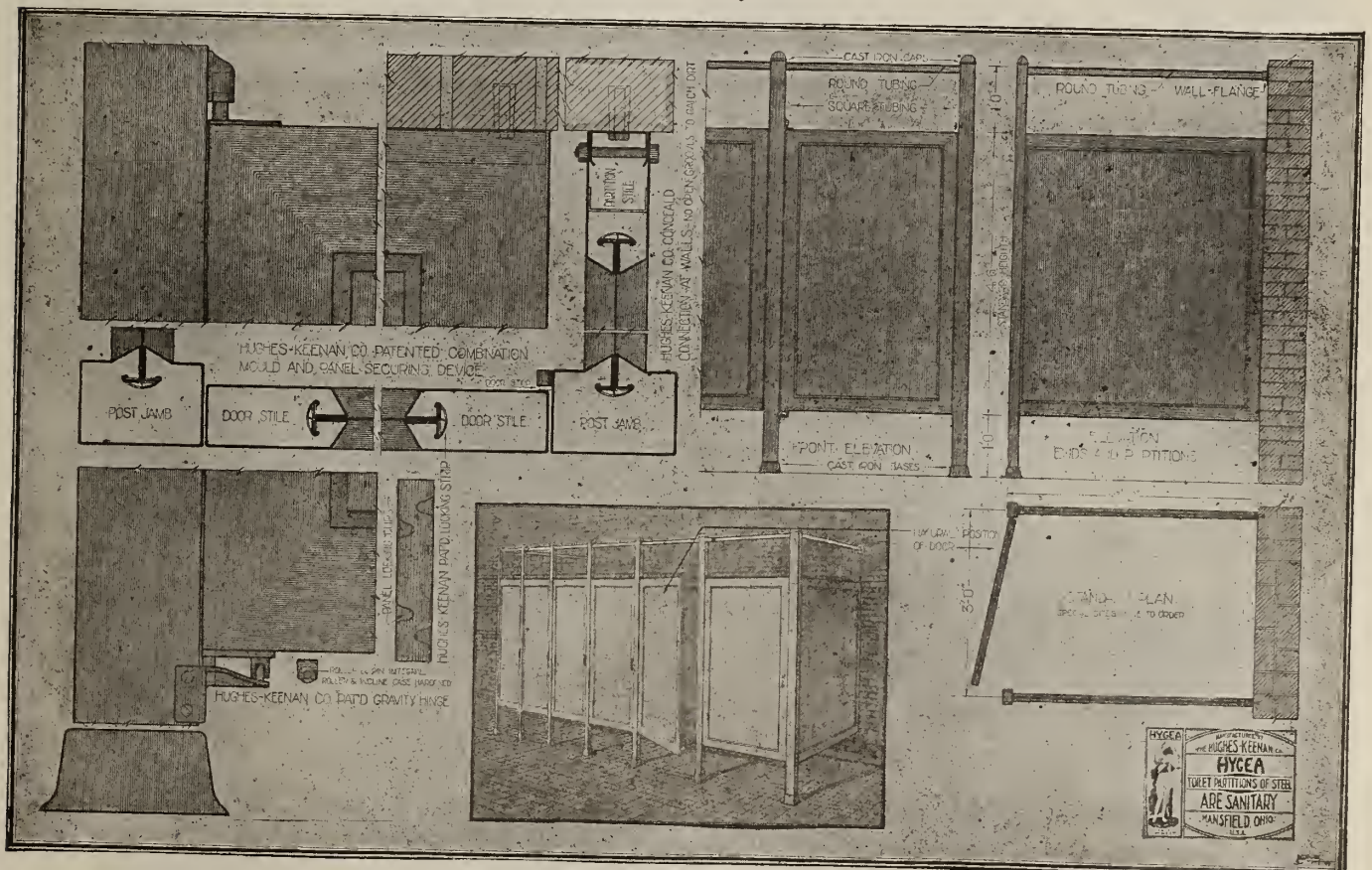
Another feature of the "Hygea" partition is this combination mould and panel securing device. The object of this is to eliminate any rivets, screws or objectionable edges of metal on the exposed surfaces of the panels. It also insures a panel which is free from waves or buckles.

Patented Gravity Hinge.

The pleasing and practical feature of THE HUGHES-KEENAN Co.'s patented gravity hinge is that it *requires no adjustments*. It is built for the purpose it serves—to allow the door to swing freely, smoothly and noiselessly and to stand slightly ajar when not engaged. No indicating lock is needed.

Installation.

Complete installations furnished and erected if desired. The "Hygea" toilet partition is a complete, sanitary installation.



DETAILS OF HYGEA TOILET PARTITIONS

HENRY WEIS MANUFACTURING COMPANY

Toilet Compartments

FACTORY AND GENERAL SALES OFFICE
ATCHISON, KANS.

CHICAGO, ILL., 455 Peoples Gas Building
BOSTON, MASS., 24 Milk Street

NEW YORK, N. Y., 103 Park Avenue
CLEVELAND, OHIO, 360 Leader-News Building

Product.

WEISTEEL COMPARTMENTS for Toilets and Shower and Dressing Rooms.

Weisteel Compartments.

Weisteel compartments have made good in steel mills, munition plants, packing plants, railway buildings, and schoolhouses where sanitary equipment of this kind is put to the hardest test.

Many of the largest industrial institutions, railway systems and school boards incorporate Weisteel compartments in their standard specifications and use them in all buildings.

Design.

Every sanitary requirement has been fully taken care of. All unnecessary joints have been eliminated; all parts are so shaped that water will not stand upon them and there are no projecting screw or bolt heads to catch dust or dirt.

Erection.

The erection of these compartments is so simple

WEISTEEL

TRADE-MARK

that any handy man with ordinary tools can do the work quickly. Only three bolts are required to erect the ordinary toilet compartment, and there is no drilling or fitting. Wall connections allow for variation in walls and permit setting of partitions out 1 in. from the wall where desired. Foot casting allows for adjusting height of front post to care for any variation in finished floors, and is fastened to the floor by concealed screw within the casting.

Units.

Weisteel compartments are built in special stock units for toilets, to suit almost every condition and can be shipped immediately from stock. Compartments are also built to suit all special conditions and for showers and dressing rooms. For toilets requiring utility or working space at the rear, space is enclosed completely with steel backs, ends and tops.

Engineers' Specifications.

PARTITIONS—Partitions with front and rear posts built in one unit of No. 16-gauge steel sheet, and con-



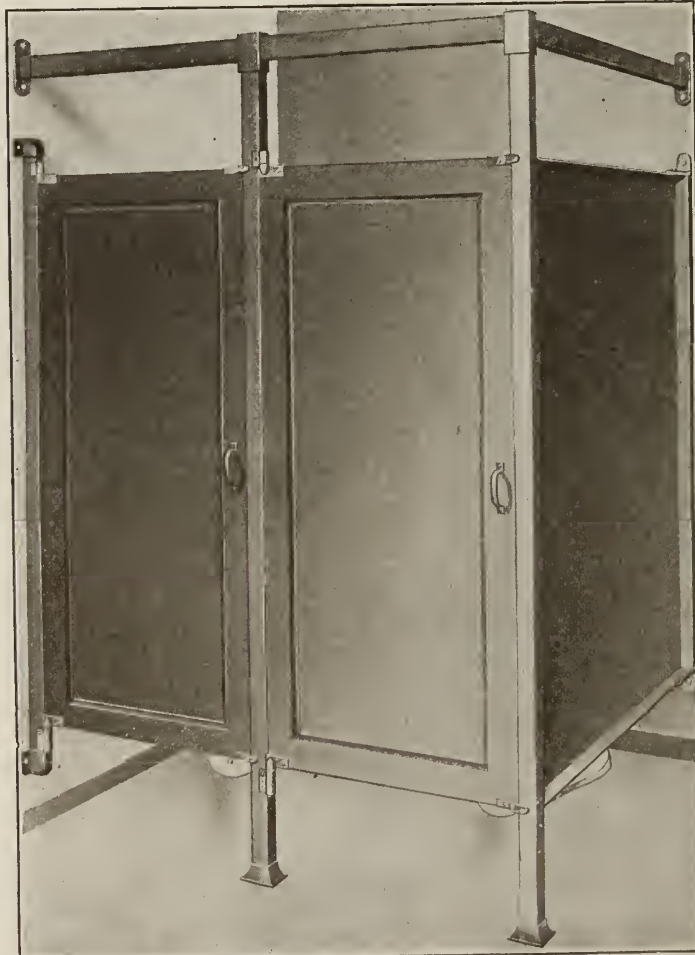
TOP FRONT POST



UPPER PIVOT BUTT



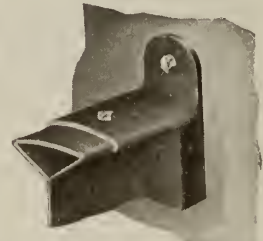
LOWER SPRING PIVOT BUTT



WEISTEEL COMPARTMENTS AS INSTALLED IN TOILETS, SHOWERS OR DRESSING ROOMS



BUMPER



WALL FASTENING



PHANTOM VIEW OF FOOT CASTING

sist of three members only, top and bottom rail of partition being formed from the partition sheet which is interlocked into the hollow metal posts at front and rear and securely welded into place. Partitions can finish any distance up from the floor or on the floor if desired.

DOORS—Door stiles and rails are formed of No. 22-gauge steel having panels of No. 16-gauge steel. Miters of stiles and rails are interlocked, countersunk and finished flush.

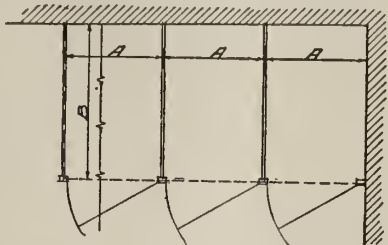
CASTINGS—Malleable iron castings are furnished at the top and bottom of front post, at wall to receive head rail, and at top and bottom of rear post to form wall fastening. Safety set screws having no projection are provided for fastening head rail into top post castings and wall flanges.

HARDWARE—All hardware with the exception of pivot butts is steel dead black finish and consists of specially designed spring pivot butts, single acting with yoke attachment; 3½-in. two-prong coat and hat hook; cast bumper stop with rubber filler at both top and bottom of door; 4-in. cast bar pulls, and a heavy slide bolt latch.

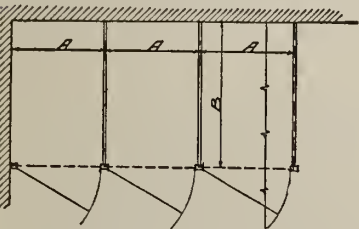
WOOD DOORS—Wood doors may be used instead of steel when desired; in which case, the standard hardware equipment is furnished with the necessary screws for attaching to wood.

HEAD RAIL—Rectangular tubing 1¼ by 1⅞-in. No. 16-gauge steel.

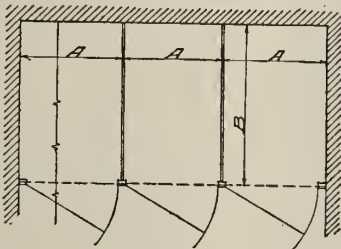
FINISH—All parts finished in either a prime coat of special grey metal filler and primer or hard baked on enamel of either olive green or battleship grey. All finish sprayed on under 40 lbs. pressure.



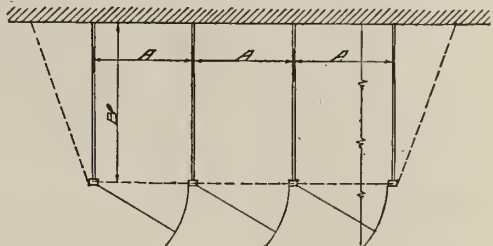
SERIES 2



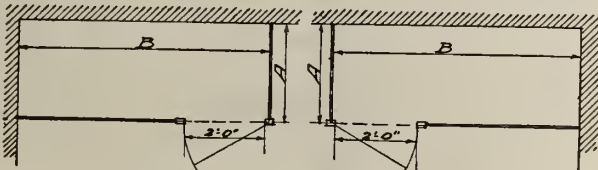
SERIES 1



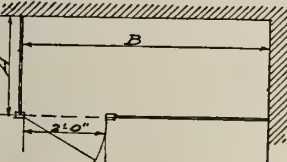
SERIES 3



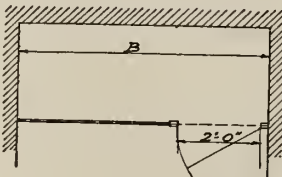
SERIES 4



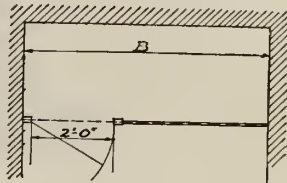
SERIES 5



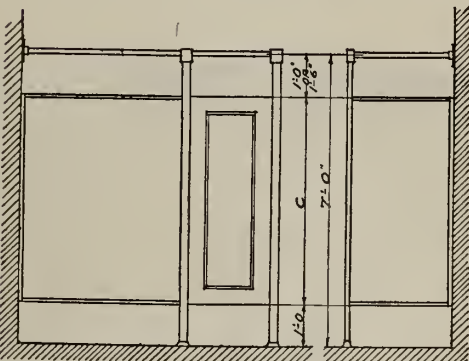
SERIES 6



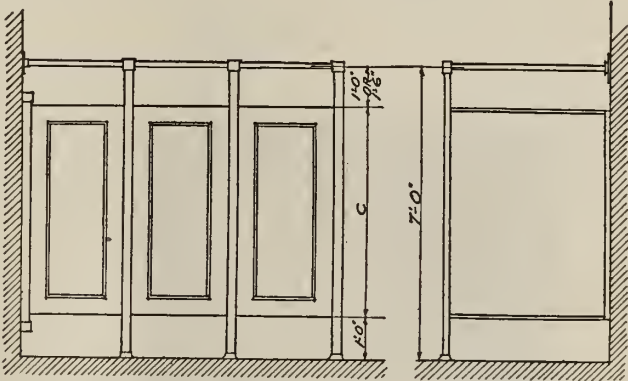
SERIES 7



SERIES 8



TYPICAL FRONT ELEVATION
SERIES 5-6-7-8 SIDE
SERIES 7-8



TYPICAL FRONT ELEVATIONS
SERIES 1-2-3-4. SIDE ELEVATION
SERIES 1-2-4

STOCK UNITS OF WEISTEEL COMPARTMENTS

Note—Series 1 and 2 are batteries of compartments where wall forms the end at right or left. Series 3 is a battery of compartments entirely between walls and where both ends are formed by walls. Series 4 is a battery of compartments having no walls at ends. In series 1, 2, 3 and 4 any number of compartments can be had in one battery. Series 5, 6, 7 and 8 are made in single compartments as shown.

DOORS—Width of doors in series 5, 6, 7 and 8 are 2 ft. 0 in. in all cases as shown. Width of all other doors in every case 2 in. less than dimension "A"; except in series 1, 2 and 3, where doors in end stalls are 3 in. less than dimension "A."

Swing of doors may be reversed where desired. Any of the above stock units can be had without doors where desired

DIMENSIONS OF STOCK UNITS

SERIES NOS. 1, 2, 3, 4, 5 AND 6			SERIES NOS. 7 AND 8	
Dimension "A"	Dimension "B"	Dimension "C"	Dimension "B"	Dimension "C"
2'-6"	4'-0"	4'-6"	4'-0"	4'-6"
2'-8"	4'-6"	5'-0"	4'-6"	5'-0"
2'-10"			5'-0"	
3'-0"				

Units without doors in Series 1, 2, 3 and 4 are also made in the following sizes for dimension "B": 2'-6", 3'-0" and 3'-6". Any stock unit can be made in special units with provision for utility or working spaces. Urinal partitions, also shower and dressing compartments, with or without doors, can be furnished in special units of any desired size.

THE CENTRAL BRASS MANUFACTURING CO.

Drinking Fountains, Valves, Faucets

CLEVELAND, OHIO

Products.

"QUICKCOOL" REFRIGERATING DRINKING FOUNTAIN.

"CENTRAL" GLOBE AND ANGLE VALVES.

SWIVEL DISC GLOBE VALVES.

QUICK-PRESSION FAUCETS for Sinks, Lavatories, etc.

Also, Gate Valves (2 in. only).

"Quickcool" Drinking Fountain.

(Trade-mark and patent applied for).

Has protected angle jet, giving absolute protection against mouth secretions and germ-laden dust. Serves equally well as a tumbler filler. Holds a 75-lb. cake of ice or over 100 lbs. of cracked ice.

Central Globe Valves.

Designed primarily for water, but suitable and guaranteed for steam up to 85 pounds. Globe valves $\frac{3}{8}$ in. to 1 in. Angle valves $\frac{3}{8}$ in. to $\frac{3}{4}$ in.

Swivel Disc Globe Valves.

A Jenkins type valve, guaranteed for steam up to 150 lbs. This valve made only in globe, $\frac{1}{2}$ in. to 2 in., screw end only.

Guarantee.

The products of THE CENTRAL BRASS MANUFACTURING Co. are absolutely guaranteed against defects in material and workmanship.

Catalogue.

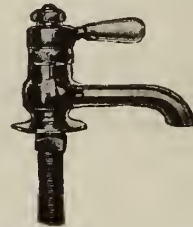
Engineers and architects are invited to ask for catalogue "J" giving detailed descriptions.

Deliveries.

While we can not maintain a constant stock of everything in our line, a point is made to give preferred attention to orders for specified goods.



QUICK-PRESSION SINK BIBB



QUICK-PRESSION AUTOMATIC BASIN COCK



QUICKCOOL DRINKING FOUNTAIN



CENTRAL GLOBE VALVE

JOHN SIMMONS CO.

Plumbing Supplies

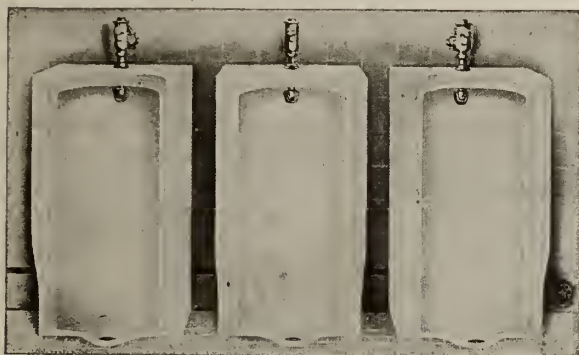
GENERAL OFFICES
102-110 Centre Street
NEW YORK, N. Y.

PLUMBING WAREHOUSE, Bush Terminal, BROOKLYN, N. Y.

Products.

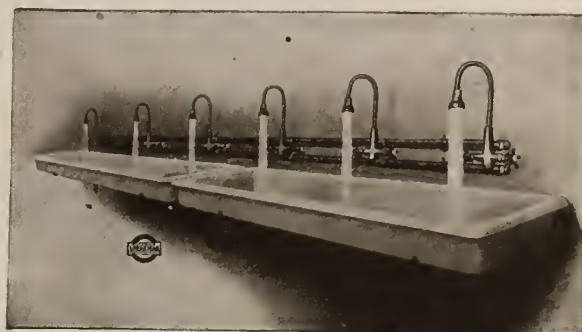
PLUMBING EQUIPMENT for Factory Installation.

Also, Cocks: Brass and Iron, for steam, water, gas, air, ammonia and acid; Ball, Basin and Hydrant.
For Pipe and Fittings, see page 404.



RANGE OF SOLID PORCELAIN URINALS

Urinal is glazed all over, and is fitted with nickelplated strainer for lead or iron pipe connection, nickelplated spreader, and nickelplated flush valve, the combination making the most sanitary outfit procurable. 18, 24 or 28 in. wide.



FACTORY LAVATORY OUTFIT WITH SPECIAL DOUBLE COMPRESSION FAUCETS WITH GOOSENECK AND SPRAY

Equipment for Factory Installation.

The efficiency of the employee is governed in large measure by his surroundings. Light, cheery quarters, with plenty of fresh air, have produced amazing returns in added output. The plumbing equipment is meeting with the careful consideration of many of the foremost manufacturing concerns. They realize that proper plumbing facilities lead to cleanliness, and cleanliness to better health for their workers.

Closet Combinations.

There are many different styles of closet combinations for use in factory installation. For this kind of work a heavy "Giant" bowl with integral seat, and nickelplated flush valve with brass oscillating handle is recommended.

REFERENCES—This company has completed contracts for this kind of equipment with the following concerns:

De La Vergne Machine Works
Downey Shipbuilding Corp.
E. I. du Pont de Nemours & Co.
Essex Foundry
Ford Instrument Company
General Chemical Company
West Virginia Pulp & Paper Co.



RANGE OF SOLID PORCELAIN "IDEAL" FACTORY LAVATORY BASINS WITH INTEGRAL SOAP HOLDERS

Basins are furnished either back to back or for wall support. Each basin measures 18 by 21 in. Inside measurement 15 by 17 by 6½ in. Range is supported on "Universal" cast iron floor brackets, and equipped with pipe supports, supply pipes for hot and cold water and Fuller or compression bibbs

Inquiries.

JOHN SIMMONS Co. has specialized in installations of this kind, and invites inquiries.

GLAUBER BRASS MFG. CO.

Finest Brass Goods Made for Plumbing, Gas and Water Works

GENERAL OFFICES AND WORKS
CLEVELAND, OHIO

Products.

FAUCETS and COCKS of every type, as used in plumbing, water and gas installations, the items of particular interest to the industrial trade being LAVATORY and WASH SINK FIXTURES, SANITARY DRINKING FOUNTAINS and BUBBLERS, SHOWER MIXING VALVES and SHOWER BATHS.

Metal.

All Glauber products are made from a rich bronze metal containing 86% copper, 6% tin, 4% zinc and 4% lead, a formula which has been adopted almost without any changes by the water departments of ten of the leading cities in the United States, whose engineers agree with us that only rich red metal can withstand the ravages of time.

Guarantee.

All goods made by GLAUBER BRASS MFG. CO. are sold under an absolute *five-year guarantee*, fully insuring the customer against loss and annoyance inevitably encountered in the use of inferior goods.

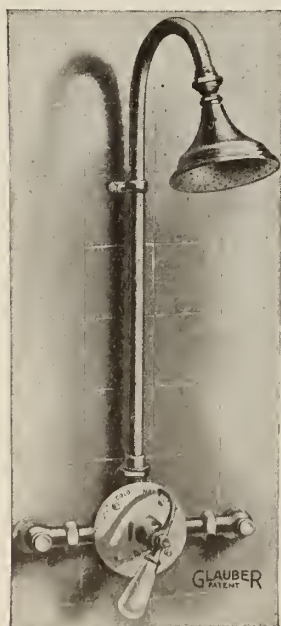
Shower Mixing Valves and Shower Baths.

Glauber mixing valves are unique in that they are the only ones operating on a two-way cam principle.

Ours was originally the "Paragon" valve, of which the company purchased the patent. The opening and closing of the ports is positive.

Other mixers are built on the piston valve principle, no provision being made to take care of expansion other than a loose fit. This permits seepage, resulting in faulty control of temperatures and in frequent scaldings.

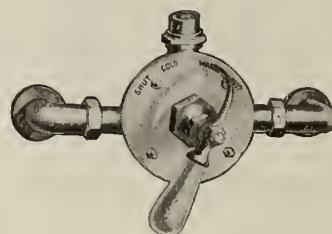
Glauber mixing valves are of such perfect mechanical construction that they can be successfully used to make hot water out of steam and cold water when equipped with steam packings. This is of interest to many industrial concerns, where steam lines already installed may be utilized, saving the installation of a hot water system.



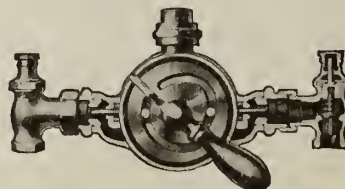
H-25. THE "CAROLINA"
EXPOSED SHOWER MIXING
VALVE
5-in. shower head. Center to
center of supplies, 10½ in.



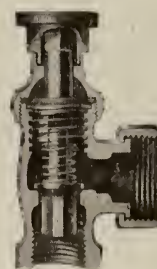
H-52 THE "IOWA"
SHOWER WITH
CHINA INDEXED
EXPOSED COM-
PRESSION VALVES
5-in. shower head



H-20 Virginia Exposed Mixing Valve
Distance center to center of supplies, 10½ in.



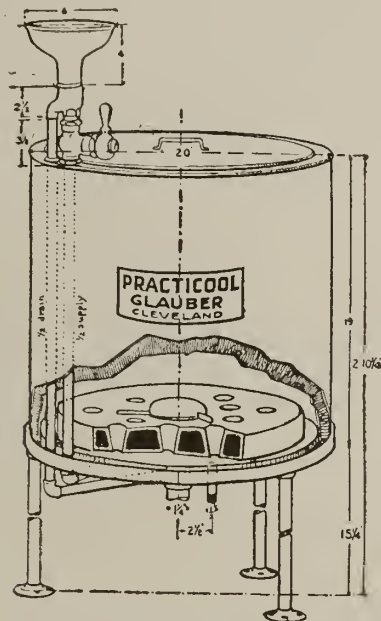
Front View of Valve Exposed
Distance center to center, 10½ in.



Detail
COMBINATION REGULATING STOP AND CHECK VALVE
Used in connection with Glauber Shower Mixing Valve

The Practicool Drinking Fountain.

A splendid means of serving employees with cool water, even during the hottest months. The fountain holds a 75-lb. cake of ice, which will last about 3 days under normal conditions. Besides being equipped with a Glauber sanitary bubbler, it is also equipped with the Coolerator, a galvanized cast iron water chamber holding 3 times as much water as a 40-ft. coil of $\frac{3}{8}$ -in. lead pipe and will therefore effect a 20% reduction. For instance, it is sufficient to reduce 40 gals. of 70° water to 50°. The fountain is durably constructed, being made of heavy iron with a galvanized iron ice chamber. Granulated cork is used for insulation. Being connected with waste and supply pipes, it requires no attention. The model illustrated is the No. 1 Practicool fountain. We also manufacture 3 other types. Write for information and prices.



ROUGHING-IN DIMENSIONS OF THE PRACTICOOL DRINKING FOUNTAIN



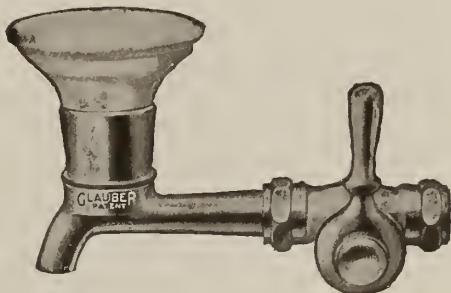
"PRACTICOOL" NO. 2 DRINKING FOUNTAIN

Sanitary Drinking Fountains.

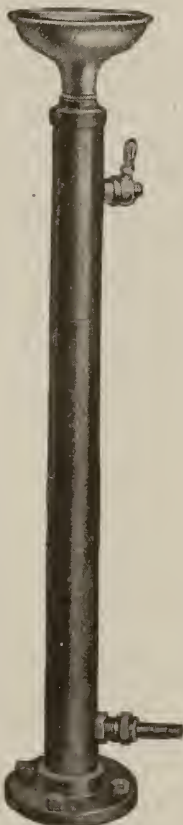
The common fault with drinking fountains in general is that they do not prevent contact between users' lips and the jet. This fault is not found in Glauber drinking fountains and, in addition, the jet is of such design that it throws a slightly palpitating bubble, automatically cleansing the bowl every time the bubbler is used.



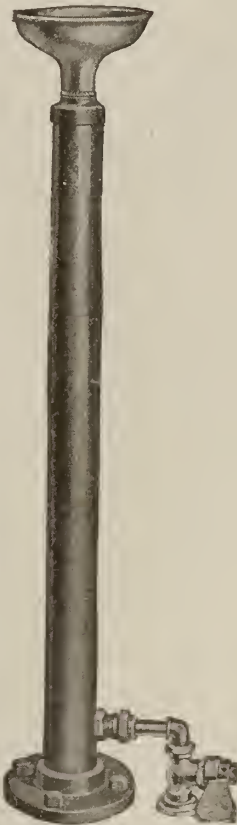
THE PRINCETON BUBBLER



THE GIRARD BUBBLER



PRACTICO PEDESTAL DRINKING FOUNTAIN

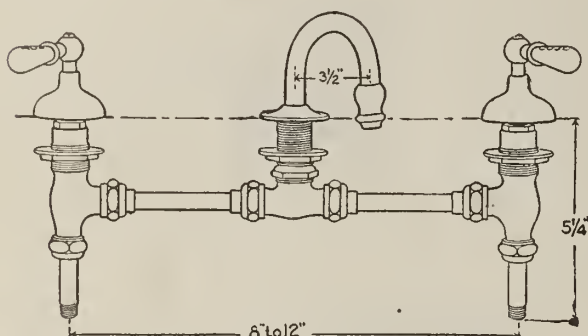


PRACTICO NO. 2 PEDESTAL DRINKING FOUNTAIN

Lavatory and Wash Sink Fixtures.

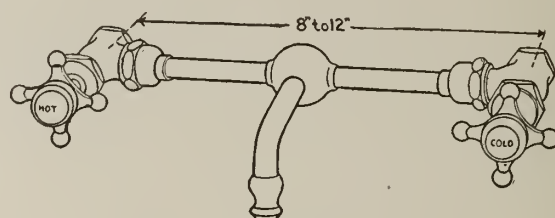
Attention is called to the fact that all these fixtures illustrated embody the modern and sanitary idea of *washing in running water*. The use of chain and plug or any other type of waste is dispensed with—a beehive

strainer being used instead, to compel the men to wash in running water. In this way the lavatories are kept clean and the men are not using the water more than once.

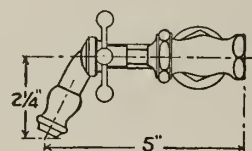


THE STEARNS

Nu-Rapid (quick compression) combination lavatory fitting with Salinas gooseneck spout. Fits any lavatory except those drilled for Standing or Ideal waste. Connections between valves and spout are lead pipe, providing ready adjustability of centers—anything from 8 to 12 in. Regular finish nickelplated



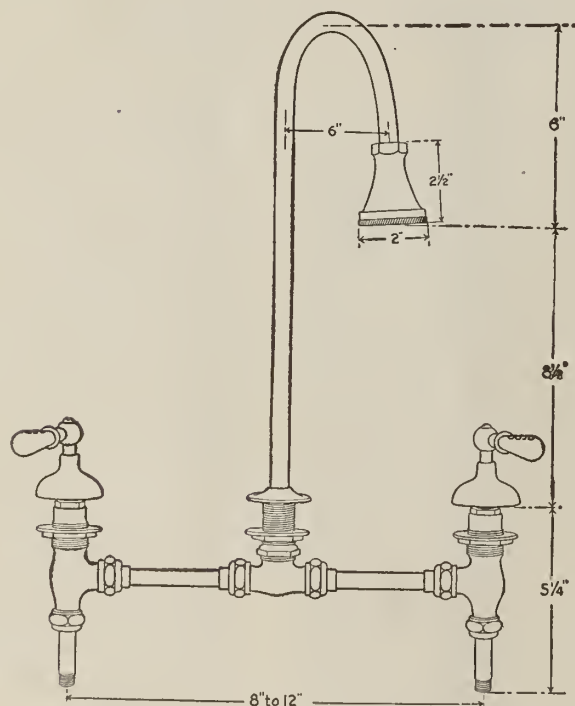
Elevation



Side View

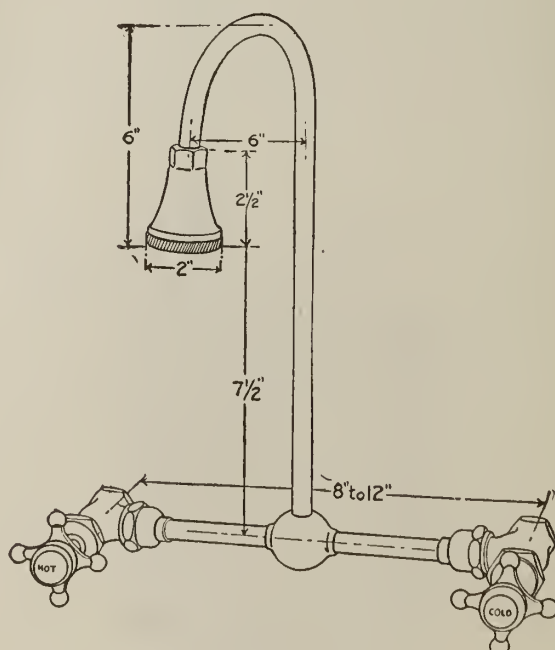
THE SAXON

Compression combination fixture for installation on wall above lavatory or trough or on sink back. Connection between valves and spout embodies our "lock-jaw" fittings, which combine the adjustability of slip joints with the rigidity of threaded connections. Inlets tapped female, 1/2-in. iron pipe. Loose cast brass wall flanges are furnished with each fixture



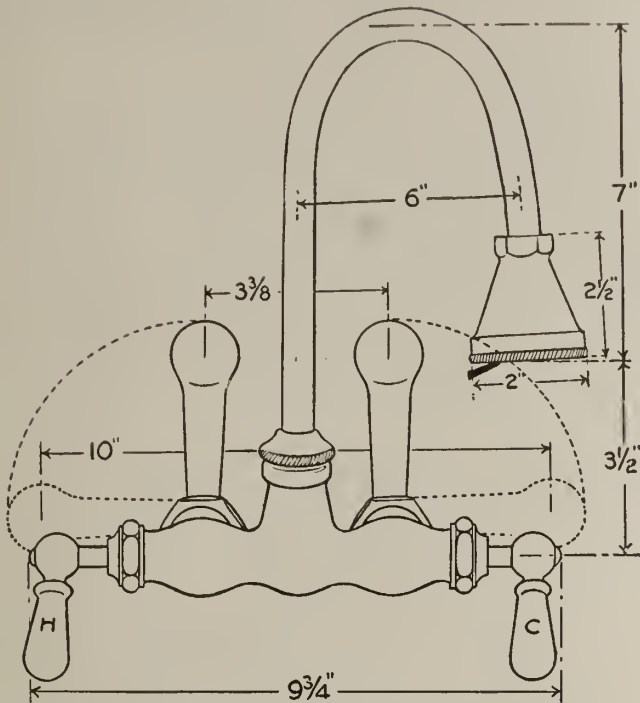
THE OVERLAND

Nu-Rapid (quick compression) combination lavatory fitting with "Carnegie" gooseneck and cast brass "No-Spread" rose spray. Fits any lavatory except those drilled for Standing or Ideal waste. Connections between valves and spout are lead pipe, providing ready adjustment of valve centers, 8 to 10 in. Exposed parts finished brass, nickelplated; parts below lavatory slab, rough brass, nickelplated, unless otherwise ordered



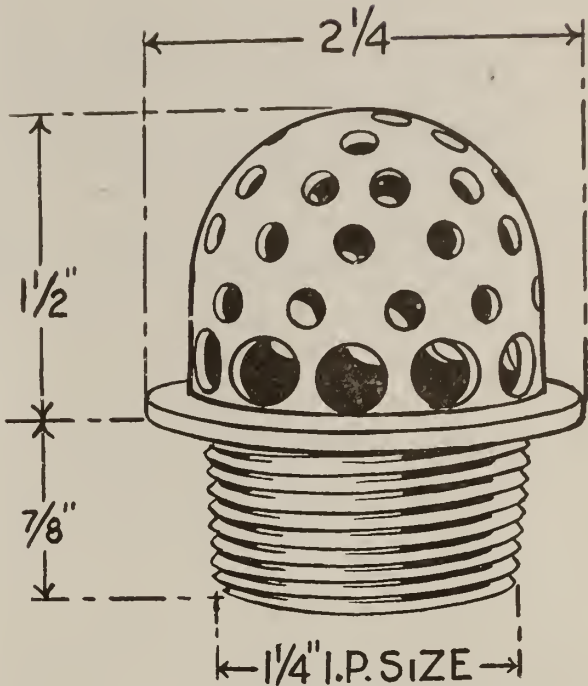
THE BRISCOE

Compression combination fixture with "Carnegie" gooseneck and cast brass "No-Spread" rose spray, for installation on wall above lavatory or trough or on sink back. Connections between valves and spout embody our "lock-jaw" fittings, which combine the adjustability of slip joints with the rigidity of threaded connections. Inlets tapped female, 1/2-in. iron pipe. Loose cast brass wall flanges are furnished with each fixture



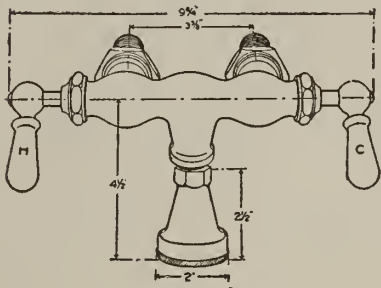
THE JORDAN—FRONT VIEW

Nu-Rapid (quick compression) combination fixture for wash sinks. Has "Carnegie" gooseneck and cast brass "No-Spread" rose spray; has "blendo" adjustable shanks, centers variable from 3 3/8 to 10 in. Shanks tapped 1/2-in. iron pipe. Nickelplated, unless ordered in finished brass



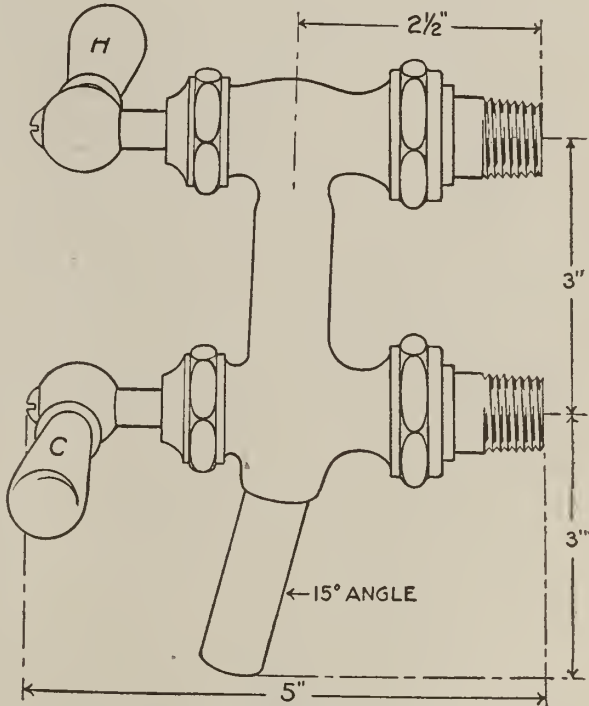
THE KISSEL

Beehive strainer for lavatories, sinks and troughs. Its purpose is to prevent filling the bowl with water, compelling the men to wash in running water—the sanitary way. Nickelplated, unless ordered in finished brass



THE CHANDLER

Nu-Rapid (quick compression) fixture for wash sinks. Has cast brass "No-Spread" rose spray, delivering cold, warm or hot water. Has union couplings with straight tail-pieces threaded 1/2-in. iron pipe. Nickelplated, unless ordered in finished brass



THE TEMPER-FLO

Nu-Rapid (quick compression) combination fixture for wash sinks. Delivers cold, warm or hot water. Has union couplings with tail-pieces threaded 1/2-in. iron pipe. Nickelplated, unless ordered in finished brass

JOSAM MANUFACTURING CO.

Double Drainage Drains; Double Eccentric Unions; Double Eccentric Concrete Inserts

MICHIGAN CITY, IND

(Formerly Cleveland, Ohio)

BRANCH OFFICES

NEW YORK, N. Y., 7 West 45th Street
ST. LOUIS, MO., 317 DeBaliviere Avenue

SAN FRANCISCO, CAL., 1002 Merchants National Bank Building

CHICAGO, ILL., 231 Insurance Exchange Building
CLEVELAND, OHIO, 3063 East 61st Street

Products.

JOSAM DOUBLE DRAINAGE DRAINS for Shower Stalls, Floor, Roof and Garage; DRAIN and TRAP COMBINATIONS; DOUBLE ECCENTRIC UNIONS; DOUBLE ECCENTRIC CONCRETE INSERTS and SOCKETS.

Specially designed Cast Iron and Brass Drains, Refrigerator Drains.

Advantages of Josam Double Drainage Drains.

Double drainage drains prevent leakages to ceiling below at points of contact between the metal and floor or roof. Economy in installation. Absolutely trouble-proof. Once installed no further attention is necessary.

Materials.

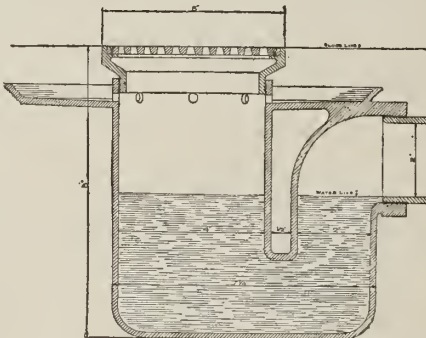
All numbers made in cast iron, black or galvanized finish; and all brass, plain or nickelplate finish.

Josam Double Drainage Drain and Trap Combination.

200A SERIES—

Heavy cast iron body with adjustable brass strainer to suit floor thickness variations. Regular finish black japan. Galvanized extra. Also furnished in all brass.

Strainers for porcelain shower receptors furnished.



DETAILS, 200A SERIES DRAIN AND TRAP

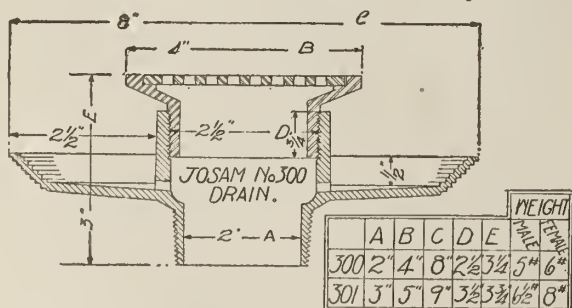
2003A, SPECIAL SHALLOW TYPE—

Same construction as 200A, but designed for shallow installation. This number comes fitted

with flashing ring and bolts to clamp and holds flashing permanently. Also nickelplated brass strainer and adjustable collar.

Josam Double Drainage Drain for Shower and Urinals.

300 SERIES—Without trap, for shower stalls. The body is of cast iron and strainer nickelplated brass.



DETAILS, 300 SERIES DRAIN



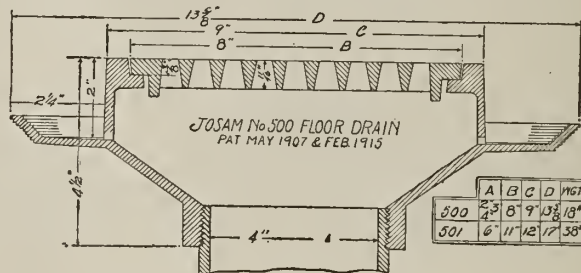
This number can be installed in connection with independent trap to suit construction. Can furnish either flat, convex or concave nickelplated strainers. Adjustable to variations in floor thickness.

DATA, 300 SERIES DRAIN

No.	300	301
Strainer.....	4"	5"
Outlet.....	2"	3"
Price.....	\$6.80	9.60

Josam Double Drainage Drains or Cesspools.

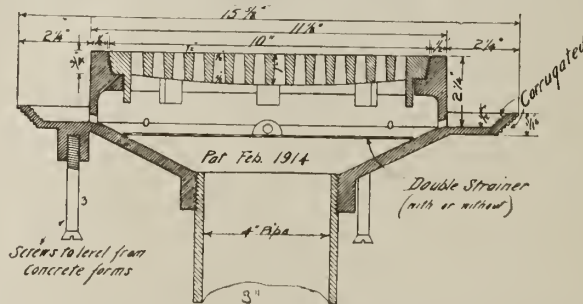
500 SERIES—For dairy, laundry, warehouse or factory floors. Made of cast iron with antitilting cast iron grate, or brass grate furnished if desired.



DETAILS, 500 SERIES DRAIN

No.	500	500	500	501
Strainer.....	8"	8"	8"	11"
Outlet.....	2"	3"	4"	6"
Price.....	\$7.50	7.50	7.50	12.00

500A SERIES—Extra heavy type made of cast iron and especially adapted for packing house, dairy, laundry or cold storage buildings where heavy trucking is necessary, also suitable as garage drains. The supplementary grate is of utmost importance in preventing sewer stoppage. This series comes equipped with leveling screws for adjustment to suit floor variations. Also has an extra heavy cast iron non-tilting grate 1 in. thick.



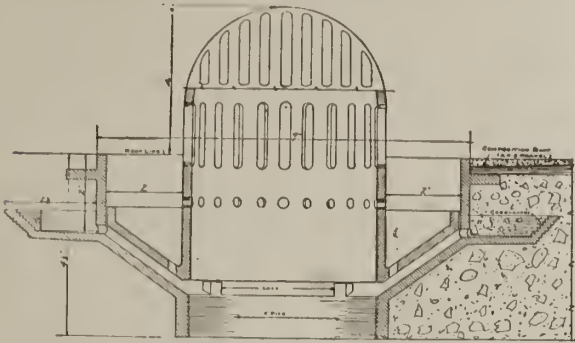
DETAILS, 500A SERIES DRAIN

No.	500A	500A	502A	502A	502A	502A
Strainer.....	10"	10"	14"	14"	14"	14"
Outlet.....	3"	4"	4"	5"	6"	8"
Price.....	\$10.00	10.50	12.00	14.00	18.00	24.00

Josam Double Drainage Drains for Roofs.

400 SERIES FOR CONCRETE ROOF—All roof drains have removable strainer and sediment cup cast integral, to catch gravel, etc., making it easy to remove and clean out. Tapped for standard iron pipe thread. All cast iron.

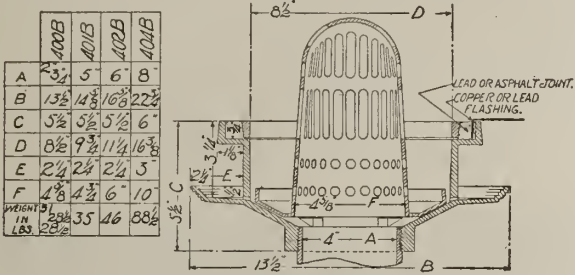
Soil pipe connectors for all sizes and all series of roof drains can be furnished.



DETAILS, 400 SERIES ROOF DRAIN

No.	400	400	400	401	402	404
Outlet	2"	3"	4"	5"	6"	8"
Price	\$12.00	12.00	12.00	14.00	16.00	20.00

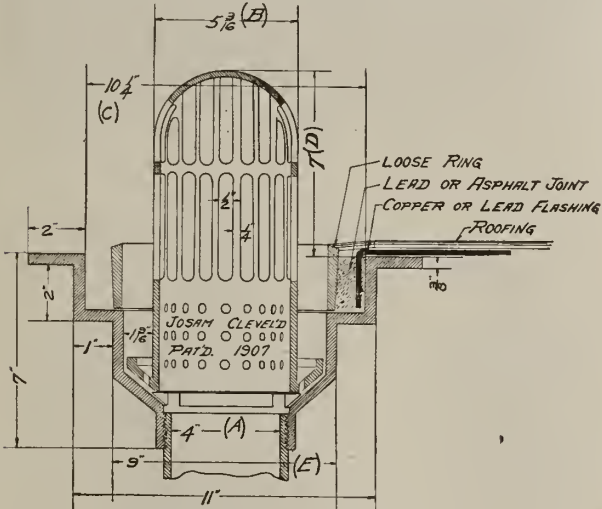
400B SERIES FOR CONCRETE ROOF—Construction as in 400 series with a loose cast ring additional. This ring forms a wall for making a poured lead, pitch or asphalt joint to tie copper or lead flashings in place.



PAT. MAY 1907 & FEB. 1913.
DETAILS, 400B ROOF DRAIN

No.	400B	400B	401B	402B	404B
Outlet	2"	3"	5"	6"	8"
Price	\$13.00	13.00	15.00	17.00	24.00

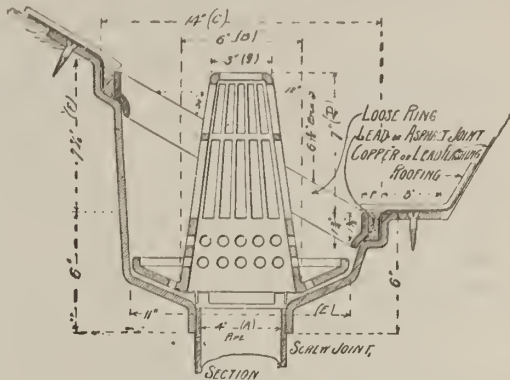
400AA SERIES FOR WOOD ROOF—The design and construction of this series is the same as the 400A series. It was designed for installation where space is limited and is 5 1/2 in. less in diameter than the 400A.



DETAILS, 400AA SERIES DRAIN

No.	400AA	400AA	400AA	400AA	400AA	400AA
Outlet	2"	3"	4"	5"	6"	8"
Price	\$16.00	16.00	16.00	18.00	20.00	28.00

400C SERIES FOR SAWTOOTH AND BOX GUTTERS—All cast iron. For wood roofs, it has not the double drainage feature. Can furnish either caulk or thread joint.

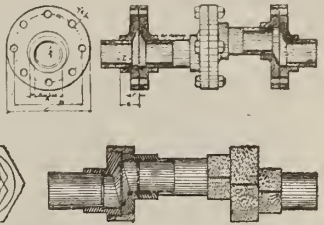


DETAILS, 400C ROOF DRAIN

No.	400C	401C	402C	404C
Outlet	4"	5"	6"	8"
Price	Caulk joint \$26.00 Threaded joint \$27.00	28.00 29.00	30.00 31.00	On Application

Josam Double Eccentric Unions.

Josam double eccentric unions for coupling pipes in line or pipe 1/2 in. or less out of line in any direction. Also made in flanged union type.

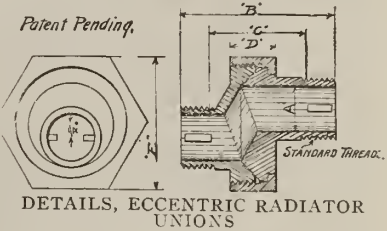


JOSAM DOUBLE ECCENTRIC UNIONS

DIMENSIONS, RADIATOR UNIONS

A	B	C	D	E
1 1/2"	2 1/8"	1 5/8"	3 1/4"	1 15/16"
3/4"	2 1/8"	1 5/8"	3 1/4"	2 3/16"
1"	2 7/8"	1 3/4"	3 1/4"	2 3/8"
1 1/4"	3"	1 3/4"	3 1/4"	2 11/16"
1 1/2"	3 1/4"	2"	1"	2 1/8"

For couplings in line or anything 1/2 in. or less out of line.



DETAILS, ECCENTRIC RADIATOR UNIONS

Josam Double Eccentric Concrete Inserts.

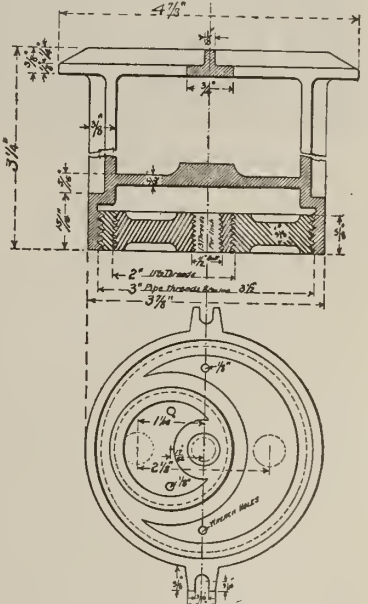
Consist of a socket with a large and small threaded insert.

Sockets are embedded in the concrete; and where there is no eccentricity, the socket can be used alone.

By using the two inserts, eccentricities up to 2 in. can be overcome.

For use in installing hangers for shafting.

For installing machinery, stair railings, theater seats, etc.



DETAILS, DOUBLE ECCENTRIC CONCRETE INSERT

FOAMITE FIREFOAM COMPANY

Manufacturers of Chemical Fire Extinguishers

CABLE ADDRESS:
"FOAMITE, NEW YORK"

200 Fifth Avenue
NEW YORK, N. Y.

Products.

FIRE PROTECTION SYSTEMS; PORTABLE FIRE ENGINES; FIRE EXTINGUISHERS.

Engineering Service.

The Engineering Department of the FOAMITE FIREFOAM COMPANY is at the disposal of engineers, architects and corporations, for the solution of their fire protection problems. We will gladly submit designs for complete fire protection systems for oil refineries, manufacturing plants, factories and mills. Where the fire risk is great and obviously outside the range of ordinary fire protection apparatus, correspondence is specially solicited.

Foamite Firefoam Method of Extinguishing Fires.

The principle of Foamite Firefoam is based on the well-known fact that carbonic acid gas is the most deadly enemy of fire. In applying this gas the problem is to prevent its being blown away from the fire by the

generated high pressure, is eight times the capacity of the container. Foamite Firefoam is not dangerous or harmful in any way. It does not soak in or damage like water.

Efficiency.

The efficiency of Firefoam leaves nothing to be desired. In many instances it has extinguished fires within a few minutes, in gasoline and oil tanks up to 55,000-barrel capacity and 114-ft. diameter. It is the standard form of fire protection in many of the large oil companies throughout the United States. Oil and gasoline fires are especially mentioned because apparatus which will put out such fires on a large scale can easily extinguish fires of a less dangerous character.

Apparatus.

The portable engines are made standard in 40-, 250-, 500-, and 800-gal. sizes. Special engines are built of the non-portable type, in any capacity up to 12,000 gals. and larger.



FIERCE FIRE IN PIT (11 by 13 ft.) AT COKE PLANT
Tar, benzol and gasoline burning. Foamite Firefoam engine just starting



FIRE SHOWN OPPOSITE COMPLETELY EXTINGUISHED
Firefoam coats the burning walls and floats on the burning inflammables in the bottom of the pit, completely extinguishing the fire and making refashing impossible

wind or draft created by the fire, and to retain it as a blanket on the burning surface, thus cutting off the air and quickly smothering the fire.

Foamite Firefoam solves this problem completely by holding the carbonic acid gas in the form of a blanket of foam that coats all burning substances and fireproofs them, thus rendering re-ignition difficult. It is very light and floats on all burning inflammable liquids, quickly smothering flames which would merely be spread by water and ordinary chemical extinguishers. The blanket of foam keeps down fumes and smoke; it also insulates and fireproofs, thus preventing the spread of fire. In these two respects, coating and floating, Foamite Firefoam is unique and is vastly superior to any other type of fire extinguishing material. Furthermore, Foamite Firefoam has great capacity, as the quantity formed and discharged from the apparatus, at self-



HAND PAIL
3-gal. capacity. Code word: Follow.



HAND EXTINGUISHER
2½- to 5-gal. capacity. Code word: Exit



PORTABLE ENGINE
40 gal. Code word: Fader

GLOBE AUTOMATIC SPRINKLER CO.

Engineers and Contractors for Fire Protection
Heating and Power Piping Equipments

2019-2035 Washington Avenue
PHILADELPHIA, PA.

FACTORIES: PHILADELPHIA, PA., WARWOOD (WHEELING), W. VA.

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RICHMOND, VA., Times Dispatch Building
ST. LOUIS, MO., 1025 Pierce Building
SPRINGFIELD, MASS., Hitchcock Building

Products.

Manufacturers of DEVICES for AUTOMATIC SPRINKLER SYSTEMS:

Automatic Systems: Dry Pipe and Wet Pipe.

Outside Systems: Cornice, Roof and Window.

Standpipe Systems: Yard Hydrants, Tanks and Mains.

DRY PIPE VALVES, ALARM CHECK VALVES.

Heating Department: One- and Two-gravity (steam) Systems, Gravity Hot Water Systems, Forced Hot Water Systems, Vacuum Systems, also Power Piping Equipment.

Information and Approval.

The National Fire Protection Association, in 1903, adopted resolutions which provided that automatic sprinklers should be installed by recognized automatic sprinkler companies and that they should not be sold to be erected by those not experienced in the installation of automatic sprinkler equipment, unless the sprinkler company furnishing the devices guaranteed such installation to comply with the National Board of Fire Underwriters' rules.

The GLOBE AUTOMATIC SPRINKLER Co. guarantees its own installation; and all the devices installed are fully approved by the Underwriters' Laboratories, Inc., and all insurance bureaus in the United States and Canada.

Globe Automatic Sprinklers.

Sprinklers are simple automatic valves consisting of a bronze frame, bronze upper and lower levers, a bronze die stamped fusible link, a bronze die stamped fixed water distributor, a bronze die stamped valve and a die stamped copper gasket.

Frame is provided with a turned seat. Between this seat and valve is placed the copper gasket, which insures a tight, leakless joint when sprinkler is not in operation. Valve is held closed by a pair of levers, at out end of which is placed a link, made to fuse at different temperatures.

Special Features—Model C.

(1) Perfected tilting bar construction, insuring a



TRADE-MARK

perfect mechanical carrying of load and removing all strains from fusible metal. (2) High factor of safety due to tilting bar construction. (3)

Positive and uniform fusing due to removal of strain from solder, enabling it to function freely and instantly. (4) Dependability of operation assured through positive and instant separation of link plates, caused by tilting bar. (5) Use of die stamped parts wherever possible, insuring uniformity of manufacture, extreme and uniform strength, and maximum resistance to corrosion.

Globe Dry Pipe Valves.

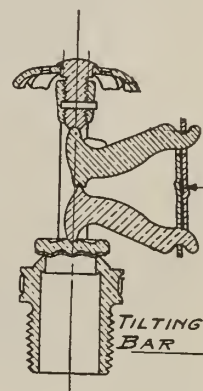
Designed for use in automatic sprinkler systems wherever it is not possible to keep piping filled with water at all times—due to absence of (or insufficient) heating facilities; or, when sprinklers are placed in cold storage vaults, open driveways, loading platforms, etc. It is simply constructed and reliable in operation. Any air pressure exceeding 12 lbs. will prevent valve from opening, regardless of water pressure in ordinary system. For technical details of application, construction, connections, and installation, write for special folder describing Globe dry pipe valves.

Globe Alarm Check Valves—Model E.

Used in connection with wet pipe sprinkler systems in buildings of every character for giving an immediate alarm upon opening of a Globe sprinkler. It is simple, reliable and positive in action; all parts readily accessible. Complete equipment consists of an alarm check valve, a retarding or variable pressure chamber, water motor for mechanical alarm, and a circuit closer for electrical alarm.

Co-operative Service.

Engineers, architects and contractors are invited and urged to avail themselves of the facilities the GLOBE AUTOMATIC SPRINKLER Co. extends through its numerous offices to consult with its engineers, from the inception of plans to the end, that good and economical engineering may distinguish the completed structure.



SECTION OF MODEL C SPRINKLER HEAD
Made in 4 fusing temperatures, 165°, 212°, 280°, 360°

WESTINGHOUSE ELECTRIC & MFG. CO.

Manufacturers of Apparatus for the Generation, Application and Control of Electric Power

EAST PITTSBURGH, PA.

ATLANTA	CHARLESTON	DAYTON	KANSAS CITY	NEW YORK	SAN FRANCISCO
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BLUEFIELD	CHICAGO	DETROIT	MEMPHIS	PORTLAND	TOLEDO
BOSTON	CINCINNATI	DULUTH	MILWAUKEE	ROCHESTER	WASHINGTON
BUFFALO	CLEVELAND	INDIANAPOLIS	MINNEAPOLIS	ST. LOUIS	WILKES-BARRE
BUTTE	COLUMBUS	JOPLIN	NEW ORLEANS	SALT LAKE CITY	

DALLAS, EL PASO, HOUSTON, TEX.: WESTINGHOUSE ELECTRIC & MANUFACTURING CO. OF TEXAS

CANADA: CANADIAN WESTINGHOUSE CO., LTD., Hamilton, Ont.

MEXICO: COMPANIA INGENIERA, IMPORTADORA Y CONTRATISTA, S. A. (Successors to G. & O. Braniff & Co.), City of Mexico

Products.

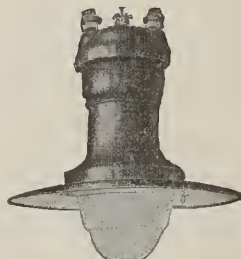
ARC LAMPS and MAZDA STREET LIGHTING EQUIPMENTS; SWITCHBOARDS; SWITCHBOARD INSTRUMENTS; CIRCUIT BREAKERS; LIGHTNING ARRESTERS; FEEDER REGULATORS.

MOTORS, DIRECT CURRENT, SQUIRREL CAGE and SLIP RING ALTERNATING CURRENT; MILL MOTORS; CRANE and HOIST MOTORS; ELEVATOR MOTORS; SYNCHRONOUS MOTORS; WESTINGHOUSE CONTROLLERS.

Mazda Lamp Fixtures and Arc Lamps.

A complete line of "Luxsolite" fixtures for high candlepower Mazda lamps; street hoods for low candlepower Mazda lamps, suitably arranged with diffusing globes, or Holophane refractors, for any service. Also ornamental posts, brackets, cut-out pulleys, mast arms and other specialties forming a complete line of equipment for any locality.

Modern high efficiency arc lamps for all kinds of circuits are available for any service. Series regulators and safety coils to meet all requirements are regularly furnished.



LUXSOLITE FIXTURE WITH REFLECTOR AND SKIRTED REFRACTOR

Switchboards.

Westinghouse switchboards, by use of 7-in. meters and remote-control oil breakers, require a minimum of floor space. Front of board is entirely symmetrical; all indicating meters match perfectly in appearance. A complete line of standard panels is listed for prompt shipment.



TYPE JD SWITCHBOARD PANEL

Switchboard Instruments.

Westinghouse instruments comprise the only complete line of 7-in. A.C. instruments with 14 1/4-in. scales, on the market, and have full, open, glass fronts; corresponding D.C. instruments have scales that are equal to any 9-in. instruments previously used. Three of these 7-in. instruments can be mounted horizontally on a 24-in. panel, and two on a 16-in. panel.



7-IN. INSTRUMENT

Circuit Breakers.

TYPE CA CARBON CIRCUIT BREAKERS—Designed particularly for the severe current and interrupting conditions met with in operating low voltage direct and



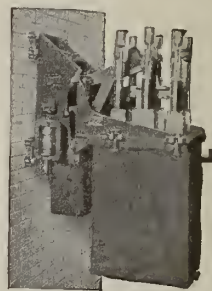
TRADE-MARK

alternating current systems; made for both manual and electrical operation.

TYPE CD CARBON CIRCUIT BREAKERS—May be used for motor starting control of industrial circuits, and for control of feeder circuits. They are supplied for voltage up to 750, and for capacities up to 300 amperes.

TYPE F OIL CIRCUIT BREAKERS—Comprise a complete line of moderate capacity non-automatic and automatic, manually and electrically operated breakers.

For indoor service the breakers are made in panel mounting, remote-control wall mounting and pipe mounting forms, and for outdoor service in pole and subway mounting forms.



TYPE F-3 OIL CIRCUIT BREAKER

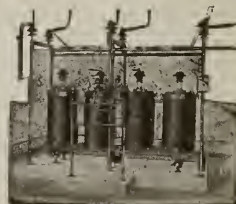
Indoor, electrically operated, wall mounting, automatic, three-pole, single throw, 500 amperes, 13,200-volts

Lightning Arresters.

Westinghouse electrolytic arresters have been developed for maximum results and have the greatest freedom of discharge and protective effect possible in the present state of the art.

The Westinghouse impulse gap, when used with electrolytic arresters in place of the plain sphere gap, selects high frequency or steep wave front static impulses and discharges them at a much higher voltage than the normal frequency discharge voltage of the gap, thus adding greatly to the protective value of this form of arrester.

A complete line of arresters and choke coils for all classes of service is provided.



ELECTROLYTIC ARRESTER

Feeder Voltage Regulators.

These regulators permit maintenance of uniform voltage at center of distribution of each feeder of an alternating current transmission system, by independently compensating the voltage drop. In the induction type practically an infinite number of steps of regulation are offered. Maintenance expense is low.

Made for all classes of service, and for circuits of any commercial size, voltage or frequency. For automatic motor operation, the regulator is operated by a motor and electric brake controlled through a set of relays and a line drop compensator.



INDUCTION FEEDER REGULATOR

Westinghouse Electric Motors.

Westinghouse electric motors can be supplied for every service and for operation on every commercial circuit. Some of the different types are listed below, complete information on motors for any service in any industry can be obtained on request at our nearest office.

MOTOR APPLICATIONS

INDUSTRY	TYPE	LEAFLETS
Brick and clay plants	CS, and CW	CS3072
Cement plants	CS, CW	2321, 3860, 3553, CS3073
Chemical plants	CS, CW	2321, 3860
Coal mines	CS, SK	2321, 2359
Contractors	CS, SK, CI, CW	2321, 2359, 3687, 3860
Electric shovels	CS, CW, SK	2321, 3860, 2359, 3710
Electrochemical	CS, CW, SK	1160, 3820, 2359-A
Flour mills	CS, CW	2321, 3860
Hoists	CW, CI, K	3860, 3687
Industrial locomotives		3723
Laundries	CS	2321, 3725
Leather	CS, CW	2321, 3860
Metal mines	CS, SK	2321, 2359
Metal working	SK and CS	2359, 2321, CS3042
Paper mills	CS, CW, SK	2321, 2359, 3505, 3506 3507, 3508
Printing plants	SK, CW	2359, 3792, CS3185
Pumping plants	CS, CW, SK	2321, 3860, 2359, CS3082
Refrigerating	E, G	1150, 2409-A
Rubber	CS, CW, SK	2321, 3860, 3693
Smelters	MC, MA, CS, CW	1101, 2383, 2321, 3860
Steam railroads	CS, SK, Arc Welding	2321, 2359, 3668, CS3042
Steel mills	MC, CS, CW, SK	2361, 2383, 2321, 3860, 2359
Woodworking	CS, CW	2321, 3860

MILL MOTORS—For steel mills and other severe services where varying speed is required, the type MC motor for direct current, and the type MA for alternating current are used. They have steel frames, massive shafts, very large bearings, fireproof insulation and other features that insure reliability. Commutating poles in type MC motors insure sparkless commutation.

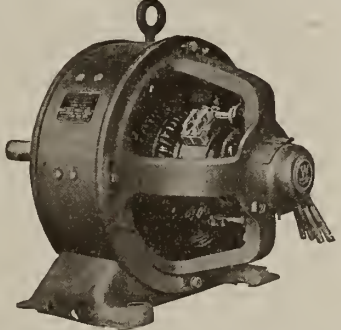
Capacities, type MC motors, 5 to 250 h. p.; type MA motors 5 to 162 h. p. for 25 cycles.



MILL MOTOR
Direct and alternating current

DIRECT CURRENT MOTORS—Type SK motors are for general service in all industrial applications using direct current and are supplied for either constant or adjustable speed service. Especially adapted for driving machine tools. They are supplied either open, semienclosed or totally enclosed, according to the conditions under which they must operate.

Capacities 1½ to 250 h. p., 115, 230 and 550 volts.



DIRECT CURRENT MOTOR

ALTERNATING CURRENT WOUND ROTOR MOTORS—Types CW and CI motors for polyphase circuits are for constant or varying speed service where the starting conditions are severe, and the starting current must be kept low. They are built along the same mechanical lines as the type CS motors, but have different rotors. For intermittent service, such as hoists, cranes, etc., use the

CI motor, and for continuous service use the CW motor. Capacities from ½ to 650 h.p.

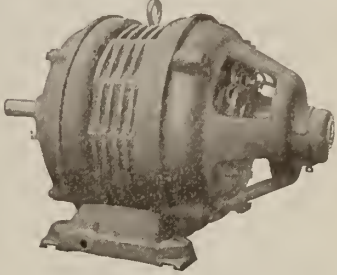
ALTERNATING CURRENT SQUIRREL CAGE MOTORS—Type CS motors for polyphase circuits are for general constant speed service in practically all industries.

Capacities with type CSA motors ¼ to 650 h. p.



SQUIRREL CAGE MOTOR

ELEVATOR MOTORS—Specially designed for elevator service. They have high starting torque and ample overload capacity and are very quiet in operation. Built in several different classes to suit different classes of elevator service for both alternating and direct current.



ELEVATOR MOTOR

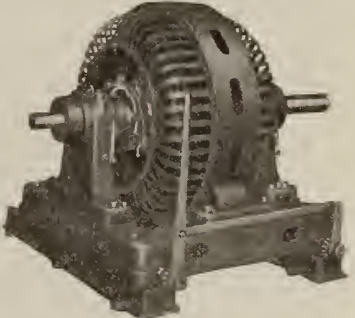
SMALL POWER MOTORS—Made in sizes from 1/20 to 3 h. p. for operation on all commercial direct and alternating current lighting circuits, to drive any small machine that requires a small amount of power.

CRANE AND HOIST MOTORS—For severe intermittent service when high starting torque is required; type K motors for direct current, 2 to 52 h. p.; type CI, 1½ to 300 h. p.



DIRECT CURRENT CRANE MOTOR

SYNCHRONOUS MOTORS—Westinghouse synchronous motors, either belted, coupled or engine-type for compressor drive, operate at any power factor. Different types for different requirements. They are an ideal drive for ammonia compressors, because they are right in speeds and rugged yet simple in construction. Their application causes better voltage regulation, improved line conditions, higher operating efficiency with lower maintenance costs.



TYPE G SYNCHRONOUS MOTOR
WITH PEDESTAL BEARINGS

Westinghouse Controllers.

Westinghouse controllers can be supplied for every kind of service, hand or automatic operation. Long experience in the manufacture of motors and their application to machines in all industries has enabled us to build controllers fitted for the service they are to perform for both direct and alternating current motors. They are characterized by strength, simplicity and compactness of construction, as well as ease of installation and operation. All wearing parts can be easily and economically renewed.



CONTROLLER

GENERAL ELECTRIC COMPANY

GENERAL OFFICE
SCHENECTADY, N. Y.

PRINCIPAL WORKS

SCHENECTADY, N. Y. LYNN, MASS. NEWARK, N. J. WATSESSING, N. J. ERIE, PA.
PITTSFIELD, MASS. HARRISON, N. J. CLEVELAND, OHIO FORT WAYNE, IND.

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LITTLE ROCK, ARK.....634 Southern Trust Building	
+Warehouse	*Southwest General Electric Co. s Service Shop

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GENERAL SALES OFFICES: 120 Broadway, NEW YORK, and SCHENECTADY, N. Y.

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FRANCE AND COLONIES: COMPAGNIE FRANCAISE THOMSON-HOUSTON, Paris	VENEZUELA: WESSELHOFFT & POOR, Caracas
GREAT BRITAIN AND IRELAND: BRITISH THOMSON-HOUSTON Co., LTD., Rugby; INTERNATIONAL GENERAL ELECTRIC Co., INC., London.	

GENERAL ELECTRIC COMPANY

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*Information will be supplied by applying to our nearest office.

Products.

The products of the GENERAL ELECTRIC COMPANY comprise practically every kind of Apparatus and Machinery used in the Generation, Transmission, Distribution and Use of Electrical Energy. Complete index of products and bulletins on page 1051.



TRADE-MARK
Guarantee of Excellence on
Goods Electrical

Engineering Service.

The factory, engineers, laboratory and equipment of the GENERAL ELECTRIC COMPANY are at the disposal of all engineers in authority or responsible for the design, erection or operation of manufacturing or engineering equipment.

At each district office a specialist of this company is at the service of such persons wishing authoritative advice on all electrical matters. Catalogues, special bulletins and prices are readily obtained at the nearest branch office.

Unified Responsibility.

It is entirely practicable for the engineer to standardize with G-E equipment throughout. By this procedure, all parts inter-relate and much time as well as capital investment in spare parts can be saved. The added advantage of having all electrical equipment built by one company, ready for immediate installation and operation, is obvious.

Guarantee.

The name "General Electric" on any electrical device is a guarantee of quality, backed by over a quarter century's experience in the generation, transmission, distribution and application of electricity. Its thousands of products in use in all parts of the world have established the G-E trade-mark as the modern guarantee of excellence on goods electrical. As commercial installations have been made in almost every section of the country, prospective purchasers can be referred to appliances in active service.

General.

It is a well recognized fact that a knowledge of the

many functions wherein electricity enters into modern engineering practice is essential to every engineer and to every official in charge of manufacturing operations. Most manufacturing plants maintain their own engineering departments, but only the largest of them have engineers devoting their attention exclusively to electrical problems.

The purpose of these pages is to show in a broad way the scope of utility of electrical equipment as applied to the generation, transmission, conversion, distribution and utilization of electricity; also to point out the various decisions relative to electrical equipment that the average industrial engineer or official may be called upon to make, and to show how the GENERAL ELECTRIC COMPANY may co-operate therein, by furnishing engineering service, as well as equipment.

Every factory, either at its inception or as a state in its development, may be required to decide upon:

- (a) The type of generating and current converting apparatus.
- (b) The kind of switchboard, switches, circuit breakers and measuring instruments. If decision (a) is necessary, this decision will also have to be made. Even in case of purchase of power, it would be necessary to make decision (b).
- (c) The type and size of transformers, lightning arresters, electrical conductors, and other electrical transmission apparatus.
- (d) The kind and size of electrical conductors.
- (e) Motors and control for particular applications.
- (f) The type of wiring specialties.
- (g) Electrical equipment for battery charging, arc welding, industrial heating, material handling, etc.
- (h) The various requirements for lighting, including lamps.

It is manifestly impossible to display all the products manufactured by the GENERAL ELECTRIC COMPANY, but descriptions and illustrations of typical apparatus are given, together with concrete suggestions that may aid in reaching a decision on the points tabulated.



Curtis Steam Turbines.

Hand in hand with high pressure steam, the use of the superheater, and condensers for high degrees of vacuum, comes the steam turbine.

Its advantages have long been recognized, and, as a result, practically all the electric power produced by large steam stations is generated by turbines.

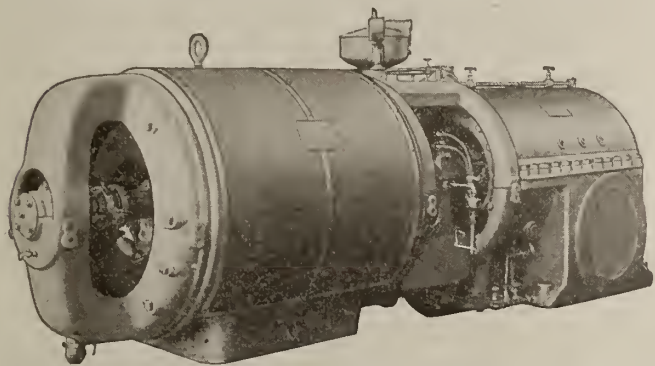
The Curtis steam turbine, as manufactured by the GENERAL ELECTRIC COMPANY, is distinguished by its low cost of operation and reliable service.

Electric power must first of all be cheaply generated, and secondly, must be dependable, as breakdowns, during working hours, seriously cripple production, thereby increasing production costs.

Curtis turbines are usually constructed with the first stage wheel carrying 2 rows of revolving buckets, followed by several stages, each containing a single row. The very small sizes are built with one or more stages, each with 2 or 3 rows of revolving buckets.

No internal lubrication is necessary, and since the oil is circulated through the bearings in a closed system, the cost of oil is very small.

A protective emergency governor is supplied with



300 KW., 3600 R.P.M., ALTERNATING CURRENT CURTIS STEAM TURBINE

each turbine. When the turbines drive generators or other apparatus requiring close speed regulation, a separate and sensitive governor controls the speed of the machine. These governors are simple in design and have nothing about them to give trouble.

The exhaust steam from the turbine is free from oil and may be used for heating the boiler feed water, or for heating the building, or for other low pressure industrial purposes.

Curtis turbines give the maximum of power with a minimum of floor space and head room.

They are built in sizes of 500 watts upward for direct current generators, and from 100 kw. upward for alternating current generators; also for low and mixed pressures.

The prime requisites, characteristic of Curtis turbines, may be sub-divided as follows:

ECONOMY—(1) High initial efficiency maintained in service.

(2) High steam economy over wide range of load.

(3) Ability to effectively utilize extreme steam conditions, i.e., high pressure, superheat, and vacuum.

(4) Low cost of supplies, repairs and maintenance.

RELIABILITY—(1) Simple mechanical construction.

(2) Short shaft: disc type wheels.

(3) Proper proportion of turbine and generator to each other.

(4) Absence of distortion, due to sudden change in internal temperatures.

Bulletins 42201A, 42010, 62010 to 62013.

LOW AND MIXED PRESSURE TURBINES—The low pressure turbine is designed to take exhaust steam from engines, pumps, air compressors, hoists, etc., and convert it into useful power.

The mixed pressure, in addition, will carry all or any portion of its rated load on high pressure steam.

Low and mixed pressure turbines are of the same general construction as the high pressure machines and embody all the well-known advantages of the Curtis type of turbine.

TURBINE GENERATOR HEADLIGHT SETS—To meet the rigid requirements of steam locomotive headlight service, a turbine generator set has been designed especially to supply power for the headlight and cab lights, although its use may be extended also to other applications including steam shovels, derricks, wrecking cranes, oil well drilling outfits, launches and tugboats.

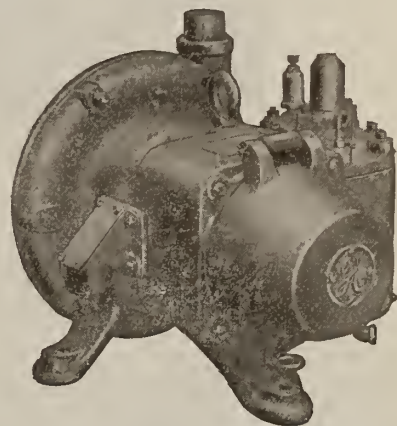
This set consists of a single-stage Curtis turbine direct-connected to a compound-wound generator governed on the steam end by a self-contained pressure regulating valve, and controlled electrically by a stationary magnetic brake coil and rotating copper disc which maintains practically constant voltage under different loads.

For locomotive headlight service the set is made in a 500 watt, 32 volt capacity for operation on 125-, 225-lb. boiler pressure.

For industrial applications the set is made in a 500-watt, 110-volt capacity for operation on 70 to 170 lbs. boiler pressure.

Parts are interchangeable so that sets of either voltage can be furnished to operate on either range of boiler pressure when requested.

Bulletin 42014A.



TYPE CY-32-B 3600 R.P.M. HEADLIGHT TURBINE GENERATOR

500-watt 32-volt 125 to 225 lbs. steam pressure.
500-watt 110-volt 70 to 170 lbs. steam pressure

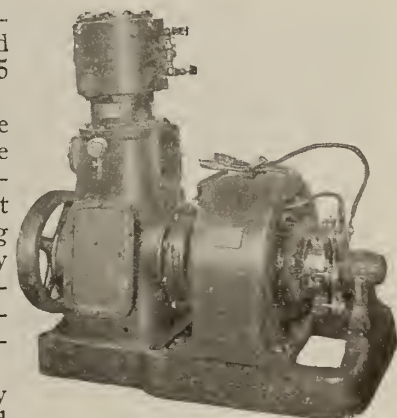
Steam Engine Generating Sets.

Made for small plants, and for lighting construction operations in isolated places, requiring 75 kw. or less.

These sets have the great advantage of being manufactured completely at one factory, insuring perfect fit, uniformity of finish, and a thorough test of the combined unit before shipment is made.

Used extensively for both power and lighting service.

Bulletin 42300.



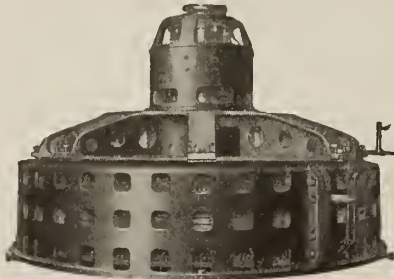
SINGLE CYLINDER, FORCED LUBRICATION ENGINE, WITH D. C. GENERATOR

Water Wheel Driven Generators.

The GENERAL ELECTRIC COMPANY is producing units ranging in capacity from 37½ kv-a. to 32,500 kv-a.

Both horizontal and vertical types are individually designed to meet most efficiently the various requirements imposed by the supply of water available for any given development and the operating conditions involved in either constant or fluctuating hydraulic heads.

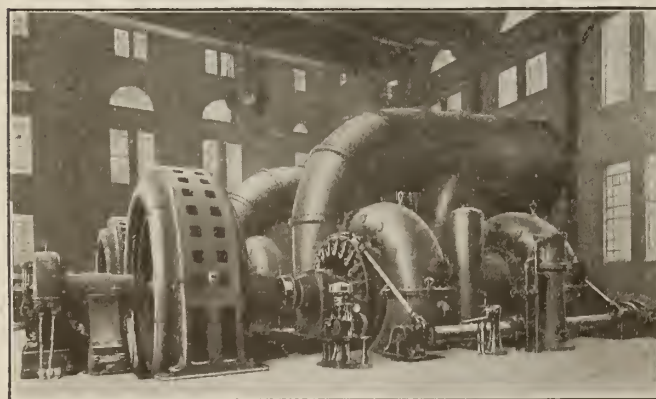
In addition to water wheel driven generators, the GENERAL ELECTRIC COMPANY manufactures all classes of electrical apparatus necessary for the complete equipment of hydro-electric stations, and the service of the company's engineers are always at the disposal of prospective customers to assist in selecting apparatus which will insure safety and reliability in operation and the most efficient utilization of the water power.



3500-VOLT VERTICAL SHAFT WATER WHEEL DRIVEN GENERATOR



WASHINGTON WATER POWER CO., LONG LAKE DEVELOPMENT ON THE SPOKANE RIVER



TWO 17,400-KV-A., 200 R.P.M., 4000-VOLT GENERATORS INSTALLED IN LONG LAKE POWER STATION

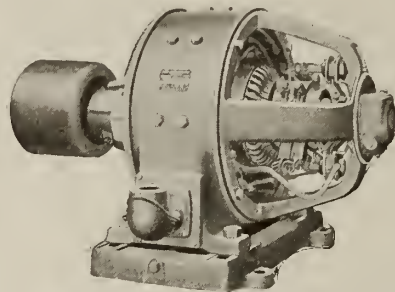
Ultimate installation will consist of 4 units of this capacity. These generators have a capacity of 19,500 kv-a. with forced ventilation

More than 3,000,000 kv-a. G-E wheel generators are in successful operation.

Bulletin 40600.

Belt Driven Generators.

The GENERAL ELECTRIC COMPANY manufactures belt driven D.C. generators in capacities from a fraction of a horsepower to 300 kw. capacity in standard voltages. A.C. generators are designed for various frequencies, voltages and phases, from 7½ to 550 kw.



TYPE RC GENERATOR WITH SLIDING BASE AND PULLEY

Detailed information covering these generators will be found in bulletins 40400B, 40019, 40021.

Motor Generator Sets.

The GENERAL ELECTRIC COMPANY has developed a large number of motor-generator sets including a wide range of sizes and types adapted to different purposes.

Motor-generator sets may be divided into three general classes: those made up of D.C. machines, those made up of A.C. machines, and those made up of both A.C. and D.C. machines.

The first class includes the balancer, battery-charging, booster, and the electrolytic sets. The second class, made up of A.C. machines, is known as frequency converters, which tie in between separate power systems with different frequencies. The third class, made up of both A.C. and D.C. machines, includes battery-charging, exciter, lighting, railway and power sets. This class is perhaps the most important and certainly the largest of the three.

A.C. is almost universal, but for some applications D.C. is still preferable. Practically all street cars are driven by D.C. motors; some of the newest and most up-to-date railroad electrification work is D.C. For power work, where variable speed is required, D.C. is now generally installed, and for electrolytic and battery-charging D.C. is absolutely necessary. With the great majority of power being generated and distributed as A.C., there is required a motor-generator set, a synchronous converter, or some form of rectifier.



300-KV-A WATER WHEEL GENERATOR VIRGINIA COTTON MILLS

Small size motor-generator sets up to 100 kw. are generally driven by induction motors; while larger sets are driven by synchronous motors. The synchronous motor has the advantages of power-factor correction and constant speed, while at same time it is cheaper to build.

Motors may be wound for any standard voltage up to 13,200, although in all but very large sizes it is probably more economical to step down the voltages to 6,600 or less through transformers.

For induction motors, Type M slip ring motors with external resistances are recommended above 750 kw.; for smaller sizes, Type K squirrel cage motors are generally used.

D.C. generators of standard sets range in size from 1/20 to 2000 kw. 600-volt machines of the railway type.

All new motor-generator sets, except those for railway and mine hoist work, are rated according to the latest A. I. E. E. rules; that is, machines are rated to give maximum output continuously without exceeding 50° C. No overload rating is given.

Bulletin 42552A.

Frequency Converter Sets.

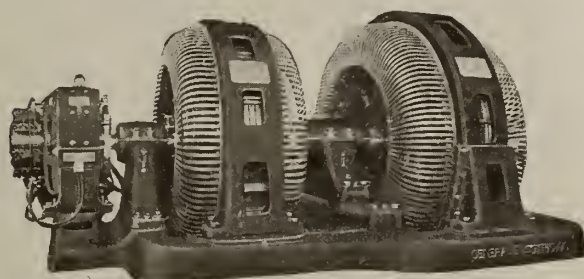
These sets are primarily designed to change from one cycle condition to another; for example, a small town laid out for 25-cycle operation is absorbed by a large transmission company which operates on a 60-cycle basis.

Excitation is a complicated subject and no fixed rule can be laid down. Stations containing 3 or more units are usually provided with a motor-generator set and a spare, either of which is capable of furnishing the excitation for the whole station. This arrangement is economical.

If sets are not running in parallel and are subject to widely diverging loads, automatic voltage control is impossible with the single exciter system.

With a direct-connected exciter for each set the flexibility of the control is greatly increased, and there is a possibility of automatic voltage control for each set. See exciter on end of shaft in illustration of frequency converter.

Bulletin 42552A.



FREQUENCY CONVERTER WITH DIRECT-CONNECTED EXCITER

Boosters.

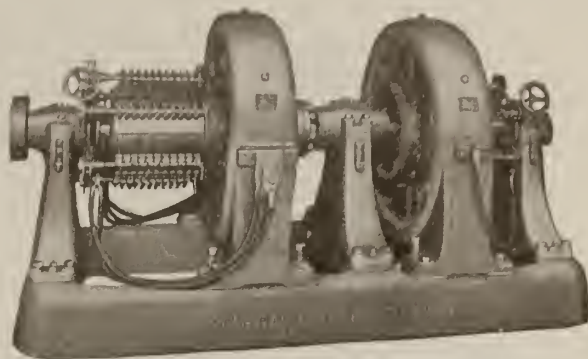
Booster sets are for use in railway stations to raise the potential of the feeders extending to distant points of the system; for storage battery charging and regulation; for station excitation systems; and in connection with the Edison 3-wire lighting system. The design of the various sets is closely dependent upon their application.

Booster sets are constructed in either series or shunt wound types and may be arranged for either automatic or hand regulation, depending on nature of service required.

Where there are a number of lighting feeders con-

nected and run at full load for only a short time each day, it will generally be economical to install boosters rather than to invest in additional feeder copper.

Bulletin 42552A.



SHUNT WOUND BOOSTER DIRECT-CONNECTED TO MOTOR

Balancer Sets.

A balancer set is a form of D.C. compensator. It consists of two D.C. machines connected in series across the line, either machine acting as a generator or motor depending on whether its side of the line is the more heavily or the more lightly loaded. By compounding the machine it is possible to equalize the voltages on both sides within 2%, even under conditions of maximum unbalancing.

These machines are rated by amperes carried in the neutral and not by the per cent. of unbalancing or kw. capacity of machines. Standard sizes range from 28 to 4000 amps.

In practice it is customary to connect a balancer to the line without fuses, as it has been found more advantageous to run the risk of damaging the balancer set rather than lose the neutral of the system.

Bulletin 42552A.



BALANCER SET

Synchronous Converters.

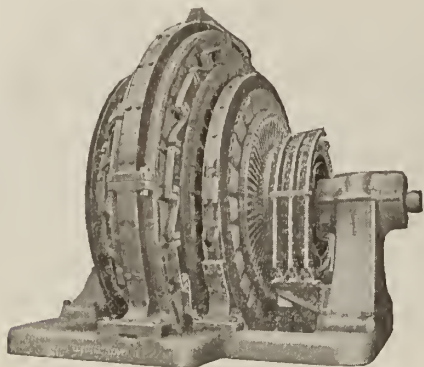
G-E synchronous converters are well known through their extensive use by railroads, electric light and power plants, large industrial projects and electrochemical operations in all sections of the country.

The commutating pole synchronous converter introduced by the GENERAL ELECTRIC COMPANY has been so successful in operation that it is now practically a standard design for all the larger sizes. These machines in the smaller sizes are especially suitable where substation equipment is subjected to infrequent peak loads.

The momentary overload capacity of the small commutating pole machines, 3 times normal load, allows the selection of substation units with less regard to the limitations imposed by occasional peaks. In the larger machines for city railways, the use of commutating poles has made it possible to build standard converters with

better commutating characteristics, lighter weight, and decreased cost.

For low-voltage industrial and electrolytic work, the regulating pole or booster type of synchronous converter is recommended.



SYNCHRONOUS CONVERTER WITH REVOLVING ARMATURE BOOSTER

For industrial service it is often desirable to transform a small amount of power from alternating to direct current; in which case Type TC 25- to 100-kw. capacity, 115- or 250-volt unit may be specified.

Bulletin 42500.

Portable Substations.

Most electric roads have certain sections on which it is necessary to handle heavy traffic occasionally, or on which traffic can be normally handled by one machine. In either case, economy in operation may be obtained and the cost of equipment reduced by the use of a portable synchronous converter substation, which can be easily transported and put in operation at any point where additional power is necessary. Its use in some cases may save the cost of a spare unit in several substations.

The GENERAL ELECTRIC COMPANY has in successful operation many of these portable substations, consisting of synchronous converter, transformers, switchboard and accessories arranged ready for operation in a specially built car.

Bulletin 42500.



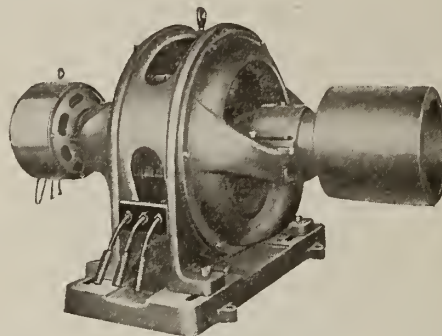
500 KW. PORTABLE SUBSTATION. 60000 VOLTS A.C.; 1200 VOLTS D.C.

Synchronous Condensers.

Synchronous condensers consist of standard TB belt-driven alternators with squirrel cage windings. This winding increases starting torque, so that machine may be started from starting compensator or from starting taps on transformers. It is the most effective anti-hunting device on the market and will keep motor in step, if possible to operate a synchronous motor on system.

The machines may be operated as synchronous condensers at ratings of 30, 45, 60, 90, 120, 180 and 240 kv-a. at 240, 480, 600, 1150 or 2300 volts, 60 cycles, 2- or 3-phase, with a temperature rise not exceeding 50° C. on armature or field.

Bulletin 40400B.



BELT DRIVEN ALTERNATOR WITH D.C. EXCITER

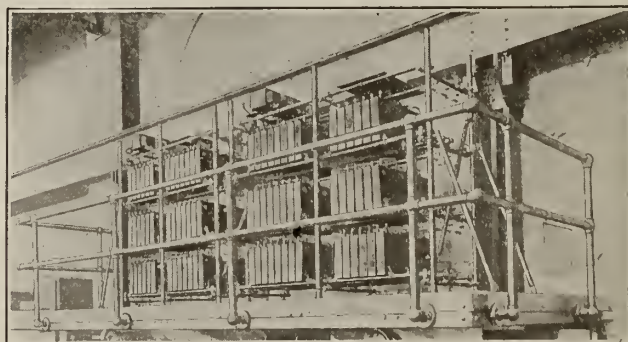
Static Condensers.

The GENERAL ELECTRIC COMPANY has recently developed and perfected a static condenser designed primarily for improvement of power factor. The advantages of static condenser equipment over synchronous apparatus are most pronounced for capacities of 500 kv-a. and less, although in several cases they are more economical at 1000 kv-a. or higher ratings. Other advantages are: comparatively low cost in the smaller sizes; extremely low losses; practically no attendance, and long life due to absence of moving parts.

Static condenser equipments for 2300-volt service consist of a number of condenser units—a reactor for damping out the higher harmonics in voltage wave, a discharge resistance for draining condenser charge when disconnected from line, and an oil circuit-breaker for control of the equipment.

For 220, 440, and 550-volt service, an auto-transformer is provided, which steps the voltage to 1200 for condensers, to provide for most economical use of active material.

Static condensers have been standardized for circuits ranging in frequency from 40 to 125 cycles, in voltage from 220 to 2300, and in capacities from 30 to 300 kv-a., although they can be supplied for other voltages and capacities whenever necessary.



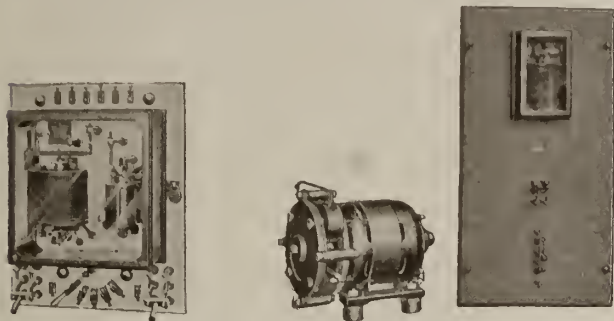
3-PHASE, 60-CYCLE 350-KV-A. GE STATIC CONDENSER

A recent installation of a 3-phase, 350 kv-a. static condenser has effected an increase in power factor of .65 to .85, enabling generating equipment to carry 24% greater load, reducing excitation requirements 20% and improving voltage regulation, eliminating necessity for new generator, boiler and auxiliary capacity.

Bulletin 49714B.

Voltage Regulators.

GENERATOR VOLTAGE REGULATORS—Designed to control A. C. or D. C. stations having a capacity as high as 200,000 kw. These regulators are intended for switch-board use, but certain types can be mounted on pedestals.



Type TD, Form G

Type CD, Form A and Regulating Counter EMF Motor

D. C. GENERATOR VOLTAGE REGULATORS

A comparatively new D. C. voltage regulator has been designed for the control of D. C. generators, 35 kw. and above supplying lighting and mixed power and lighting service. The voltage is held constant by a coil which controls contacts operating in the field of the small motor mounted on the back of the regulator panel. The motor armature generates a counter EMF opposing the field of the generator being controlled, the amount depending on the action of the regulator contacts. A magnetic brake on the motor keeps the motor speed within proper limits.

The principal advantages of a steady voltage: more economical lamps may be used; fewer lamp renewals; saving in energy; no loss of revenue; reduction of number of switchboard attendants.

Bulletin 45500A.

**A. C. GENERATOR VOLTAGE REGULATORS**
For bracket, panel and pedestal mounting

FEEDER VOLTAGE REGULATORS—Voltage on each feeder may be maintained constantly at normal by installing an induction voltage regulator in each feeder. These regulators are designed for the control of single-phase or polyphase circuits of any standard voltage, frequency or current capacity. Supplied for hand or motor (remote) control. Motor operated regulators made automatic by addition of certain auxiliaries.

Principal Advantages: Improved service; savings in installation costs; line drop can be correctly compensated for under all conditions of load.

Adapted for outdoor use by addition of covers to protect auxiliary apparatus as illustrated. A panel may be furnished for auxiliaries, making installation a compact unit.

Bulletin 45402.

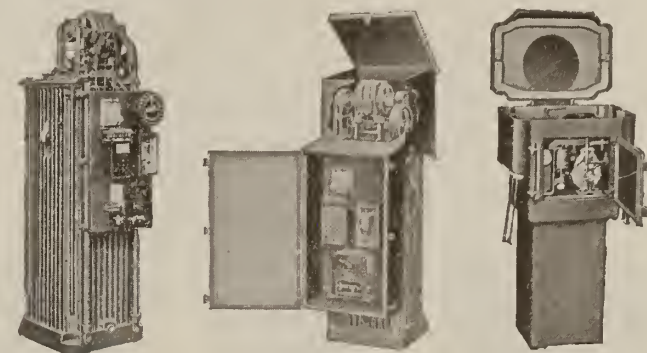
The GENERAL ELECTRIC COMPANY has developed regulators suitable for pole mounting at or near center of load. This type can be used advantageously for regu-

lating voltage of a feeder taken from a transmission or power system and supplying a small village or community.

The same conditions prevail on a long feeder from which power is taken at a number of points along its length. Although all regulators for outdoor service are of the induction type, 2 designs have been developed: Type PIRS, a self-contained design for the control of single-phase feeders of 25 kv-a. or less and Type IRS, a modification of the standard station design for the control of either single-phase or polyphase feeders of over 25 kv-a.

Standardized rating of PIRS Type, 2.3 kv-a., 60-cycle, 2300-volt primary, 230-volt secondary, 10-amp., single-phase, oil-cooled automatic.

Bulletin 45505.



For Indoor Service

For Outdoor Service

Pole Type

FEEDER VOLTAGE REGULATORS**Lever Switches.**

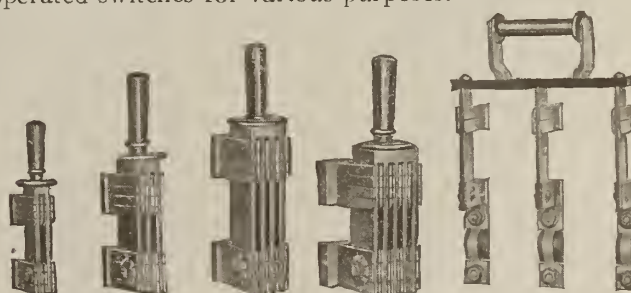
For D. C. circuits the use of lever switches is general—as a circuit breaking device within certain capacities, as a starting device (in connection with starting resistances) for motors or synchronous converters, and as a disconnecting device in series with circuit breakers.

For A. C. circuits their use is not quite so general as a circuit breaking device; oil circuit breakers being recommended for large capacities and for circuits above 440 volts. Extensively used as disconnecting devices for isolating oil current breakers and other apparatus.

All G-E lever switches are constructed to withstand severe and constant usage and meet all the requirements of the National Board of Fire Underwriters. The ratings are based on maximum current which the device will carry continuously without causing a temperature rise of more than 28° C.

Switches are made either single or double-throw, 1, 2, 3 or 4-pole and with straight or spade handle.

Air brake switches of other designs are also available, such as control switches for use with electrically operated apparatus, switches of different types for transferring or disconnecting instruments, coils, plug switches for constant current lighting circuits, and electrically operated switches for various purposes.

1500
amps.2000-3000
amps.4000
amps.5000-6000
amps.**SWITCH WITH
LINK FUSES
SPADE HANDLE****LEVER SWITCHES**

Air Circuit Breakers.

The GENERAL ELECTRIC COMPANY has been manufacturing many types of air circuit breakers for over 20 years. The satisfactory operation given in all kinds of railway, industrial and building service is an indication of the quality and excellent design of the G-E air circuit breaker. The advantage of purchasing G-E air circuit breakers, which come mounted on switchboard ready for immediate operation, is obvious.

For direct current systems the use of air circuit breakers is universal as an automatic device for taking care of abnormal conditions on machine or feeder circuits. These conditions may be overload or short circuit, underload, under voltage, over voltage, reverse current, or unbalanced voltage in 3-wire systems. Some of these are taken care of directly by breaker as a self-contained device, and some by use of auxiliaries acting to trip breaker either mechanically or electrically. By means of a shunt trip or under voltage release, the breaker may also be actuated by operation of some other device, such as limit switches, relays, speed limiting devices on machines, and push button control. In addition, breakers are used occasionally as non-automatic breaking devices by omission of overload parts.

For alternating current systems above 440 volts, air circuit breakers are only rarely employed, since the oil circuit breaker covers the larger part of this field. The conditions most commonly taken care of are overload and under voltage. These same conditions as well as reverse power, reverse phase, and various other abnormal disturbances can be taken care of by means of alternating current relays used in connection with the tripping mechanism of the breaker.

The hand operated air circuit breaker is type most commonly used. By use of remote control breakers the station wiring can very often be laid out to better advantage, resulting in a large saving of cable. For such conditions electrically operated breakers are available.

Self-contained solenoid operated breakers up to 3500 amps., alternating current and 4000 amps. direct current are listed below. For breakers above these capacities refer to the General Office for information.

All G-E air circuit breakers are approved and listed by the Underwriters' Laboratories, Inc., and will carry full rated loads continuously with a temperature rise not in excess of 30° C.



Type C P

Type C K

Type C K 2

Type C G

Type C P 3

GENERAL ELECTRIC AIR CIRCUIT BREAKERS

DATA FOR THE SELECTION OF AIR CIRCUIT BREAKERS

Types and Bulletins	Class of Service	Amperes	Volts	Poles	Functions
DIRECT CURRENT					
Type C P 47530	High grade switchboard. Breakers of medium capacity for any service.	15-1200 15-1200	250 650	S-P. and D-P. S-P.*	CP Reverse current Overload and reverse current Underload Overload and underload CP, CK and CK2 Overload † Shunt trip Attachments, Low voltage release Shunt trip coil Auxiliary switches Mechanical interlocks Relays
Type CK 47502	High grade switchboard. Breakers of large capacity for any service.	1500-6000	250	S-P. and D-P.	
Type C K2 47502	High grade switchboard. Breakers of large capacity for any service.	1500-10,000	650	S-P. and D-P.	
Type CG 47520	For motor driven machine tool application, cranes, rectifiers, etc. For light duty. To be used for power and lighting service on isolated boards not over 76 in. high. Should not be used to line up with panels containing Type C P, C K or C K2 breakers.	3-300	550	S-P. and D-P.	Overload † Shunt trip Underload Overload and underload Overload, low voltage and reverse current Low voltage and reverse current Attachments, Low voltage release Shunt trip coil Auxiliary switches Relays

Types and Bulletins	Class of Service	Amperes	Volts	Poles	Functions
ALTERNATING CURRENT					
Type C P 47530	For motor driven machine tool application, cranes, rectifiers, etc.	15-1200 15-1200	480 650	S-P., D-P. and T-P. S-P. and T-P.	Overload † Shunt trip Underload
Type CK 47502	For light duty. To be used for power and lighting service on isolated boards not over 76 in. high. Should not be used to line up with panels containing Type C P, C K or C K2 breakers.	1500-3500 1500-3000	480 480	S-P., D-P. and T-P.	Overload and underload Overload, low voltage and reverse current
Type C K2 47502		1500-3500	650	S-P. and D-P.	Low voltage and reverse current
Type CG 47520		3-300	600	S-P., D-P. and T-P.	Attachments, Low voltage release Shunt trip coil Auxiliary switches Relays

SOLENOID OPERATED BREAKERS ‡					
Type C P3 67550	High grade switchboard. Breakers of medium capacity for any service.	15-1200 D-C. 100-1200 D-C. 800-1200 A-C. 100-1200 A-C.	650 650 650 650	S-P. S-P. S-P. S-P.	Overload or non-automatic Overload or non-automatic
Type C K3 67550	High grade switchboard. Breakers of large capacity for any service.	2000-4000 D-C. 2000-3500 A-C.	650 650	S-P. S-P.	Overload or non-automatic Overload or non-automatic

† Alternating and direct current circuit closing relays can be used to trip solenoid breakers, the contacts of the relays completing the circuit of the trip coils of the breakers.

* Double pole 250-volt breakers can, with slight changes, be made suitable for 650-volt service.

‡ Can be made non-automatic by omission of overload parts.

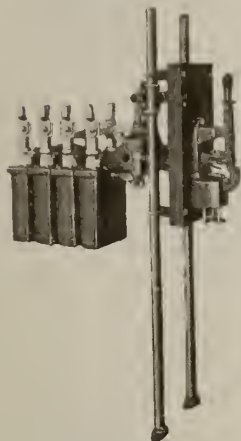
Oil Circuit Breakers.

A wide and thorough knowledge of conditions, and years of experience in designing and building oil circuit breakers, which fulfil every requirement in long-continued service, have enabled the GENERAL ELECTRIC COMPANY to place on the market complete and comprehensive lines of oil circuit breakers to meet a great variety of conditions. These lines comprise breakers for service on potentials up to 155,000 volts and above, and in current capacities up to 5,000 amperes. They are liberally designed and strong in construction, and combine every essential of reliability and satisfactory operation.

Oil circuit breakers are either hand or solenoid

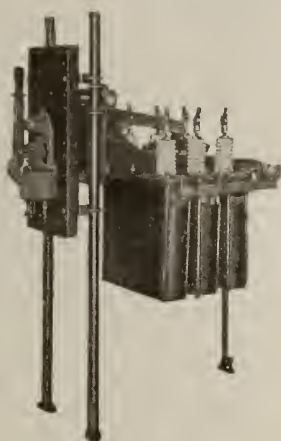
operated. A few hand operated breakers are non-automatic only, all others can be obtained for both automatic and non-automatic service. Solenoid operated breakers can be equipped with standard coils for tripping at 125, 250 or 600 volts D. C. Coils for tripping at other voltages can be furnished on request. Oil circuit breakers can be equipped with circuit opening and circuit closing auxiliary switches for electrically interlocking, for indicating or for controlling an auxiliary circuit; bell alarm switches; under-voltage release for tripping breakers; relays for every purpose.

Parts are accurately constructed in order to insure perfect adaptability to any like breaker, or to any similar function of the same breaker.



Type FK35

Recommended for use up to 7,500 volts on systems where breakers of moderate capacity—400 to 800 amp.—are required. Bulletin 47445



Type FK32

Recommended for use up to 15,000 volts on systems of moderate capacity where service is severe. Bulletin 47450

OIL CIRCUIT BREAKERS FOR GENERAL USE ON LOW VOLTAGE SYSTEMS

These breakers are of standard unit construction, each unit consisting of oil tank, cover insulators, studs and contacts. Thus a single, double, 3- or 4-pole breaker is made up respectively of 1, 2, 3 or 4 standard units plus frame, breaker mechanism and either manual or solenoid-operating mechanism.

Each standard unit is suspended from frame of the oil circuit breaker by attaching the oil tank to under surface of frame. Each oil tank is held in position by hook bolts.

Ratings are based on the maximum current breakers will carry continuously without overheating



Type FP10

This type with 2-coil overload trip is designed for starting and controlling 25-, 40- and 60-cycle induction motors of 25 h.p. or less, up to 600 volts, but not above 50 amps. for automatic or non-automatic service.

Made 3- and 4-pole, single throw, quick make-and-break as follows:

Non-automatic; with 2-coil, series overload, inverse time trip, with undervoltage instantaneous trip; with inverse time overload trip and undervoltage instantaneous trip for 4-pole breaker only (this breaker can be adapted for 3-pole service); with time delay overload protective plugs and undervoltage release (3-pole only). Bulletin 47419A



Type FK20

Designed for starting and controlling induction motors in industrial applications, especially in some branches such as textile and flour mills, coal mines, in the pumping and refining of oil, etc., where inflammable dust or gases are present.

Built automatic and non-automatic for 2-, 3- and 4-wire systems, single throw, up to 2,500 volts and 300 amps. The trip coils can be operated at 25% overload without exceeding the temperature limits prescribed by American Institute of Electrical Engineers. Bulletin 47433A

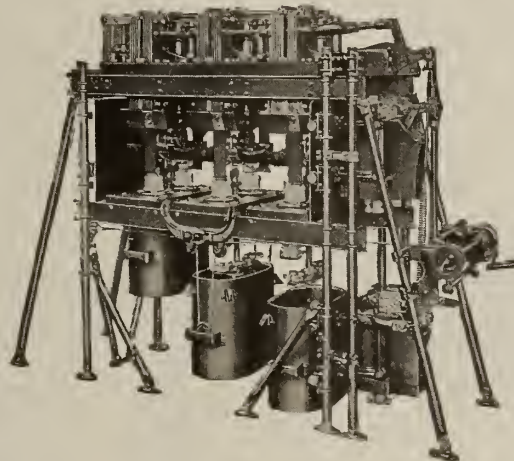
OIL CIRCUIT BREAKERS FOR USE IN FEEDER OR MOTOR CIRCUITS



Type FH

MOTOR OPERATED BREAKER, MODERATE CAPACITY

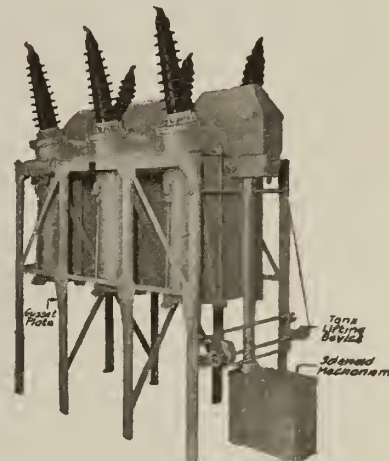
This type, very generally used in central stations, is an unusually reliable A. C. circuit breaking device. Designed for use up to 70,000 volts and as high as 4,000 amps. Motor operated, and made also in removable truck form so that the entire breaker on any pole may be removed for inspection or adjustments. Bulletin 47495



Type FK25

OIL CIRCUIT BREAKER, FOR HIGH CURRENT CAPACITY

Designed for use on low voltage, high ampere capacity A. C. circuits. Built for 600 volts; 3,000, 4,000 and 5,000 amps.; 3-pole, single throw. Bulletin 47471



Type FK36

LARGE CAPACITY HIGH VOLTAGE BREAKER

For ratings from 15,000 to 155,000 volts and above; 3-pole, single-throw. This breaker is made in three types for different interrupting capacities at any voltage. The FK36 is designed for indoor use; FK36 for outdoor use. Bulletin 47478

Switchboards.

The GENERAL ELECTRIC COMPANY offers a complete line of switchboards for all systems of electrical distribution. It has divided switchboards into three broad classes as follows: "Standard Unit Panels," "Modified Standard Unit Panels" and "Special Panels."

THE STANDARD UNIT PANEL—This has been developed, classified and listed to meet certain conditions which have been found to occur repeatedly in connection with control and distribution of electric power. It has not been developed for voltage above 1500 direct current or 3500 alternating current, although later it will be extended beyond these limits.

It is advisable whenever possible to use standard unit panels, for they are less expensive than the other classes, requiring less time to build and ship, though quality and workmanship are the same.

Standard unit panels may be ordered simply by one or more catalogue numbers, taken from the GENERAL ELECTRIC COMPANY's switchboard bulletins. Each bulletin is complete in itself and covers panels in a distinct class. They are shown in outline and the equipment is specified in every detail necessary to enable one to select just what is needed.

These panels are so designed that they can be assembled in different combinations, to form a complete switchboard having a neat, uniform appearance, both front and back, all parts on the back being easily accessible. All equipments on these boards are made by a single company, thus centralizing responsibility for behavior of the entire switchboard.

THE MODIFIED STANDARD UNIT PANEL—Of same general design, construction and appearance as standard unit panel, but recommended to meet requirements which are either modifications of conditions covered by standard unit panel or are in voltage or capacity beyond its scope.

THE SPECIAL PANEL—This is constructed to meet unusual conditions of voltage, capacity, control, architecture, etc.; the Panama Lock control boards serve as an extreme example.

CO-OPERATIVE SERVICE—Industrial and consulting engineers are invited to confer with switchboard specialists stationed in the principal branch offices of the company. Sketches, detailed drawings and specifications of any such special boards, or the adaptation of standard unit panels will be cheerfully and quickly furnished on request.

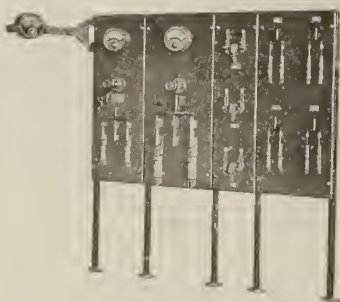
Bulletin 47001.

D. C. Switchboards, Small Capacity Plants.

D. C. 2-WIRE GENERATOR AND FEEDER PANELS—These panels are particularly adapted to use where it seems necessary to keep initial expense as low as possible, as in small manufacturing plants and office buildings. Furnished with or without separate generator switches.

Panels without generator switches made for both floor and wall mounting.

Feeder circuits on a single panel up to 6 and protected by fuses or circuit breakers.



TYPICAL STANDARD UNIT BOARD FOR 2 GENERATORS AND 7 FEEDERS

125- and 250-volt D. C. standard unit small plant switchboards, wall or floor mounted on supports 64 or 76 in. high. For 2-wire general power and lighting service.

Bulletin 47050A.

D. C. SINGLE POLARITY MINING PANELS—Particularly adapted for use in small mining plants where mining locomotives are operated in accordance with the usual railway practice.

As the *negative is grounded*, the circuit breaker is connected between negative brush and series field of machine to protect the machine in case of grounds, either internal or between the machine and bus. The series field of an incoming machine may be connected in multiple with those of the running machines and the voltage adjusted before closing main switch, which insures correct polarity of incoming machine and the least disturbance in paralleling.

Generator panels are 250/275-volt up to 330 kw. or 550/575-volt up to 368 kw.

Feeder panels are single and double circuit up to 1200 amps. per circuit.

Bulletin 4877.

D. C. 3-WIRE GENERATOR AND FEEDER PANEL—Designed especially for Edison 3-wire service in small plants; the generator is protected from grounds or short circuits across lines or between neutral and outside lines by a double pole, double coil, overload circuit breaker.

Panels are suitable for operation on ungrounded or grounded circuits, and subpanels can be furnished for additional feeder circuits or to take care of break down service.

Ammeters are furnished for both sides of generator armature circuit, so that balancing of system is easily determined.

125/250-volt D. C. standard unit 3-wire combination generator and feeder panels up to 100 kw. 76 in. high for 2- or 4-feeder circuits and 90 in. high for 6-feeder.

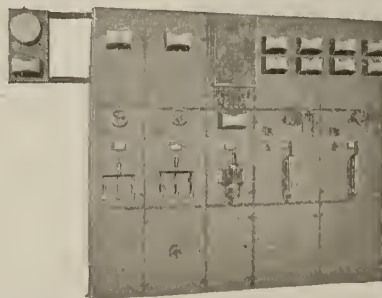
Bulletin A-4189.



STANDARD UNIT 3-WIRE GENERATOR AND FEEDER PANEL

D. C. Switchboards, Large Capacity Plants.

DIRECT CURRENT EXCITER PANELS—Used with and line up with any G-E alternating current panels 90 in. high.



STANDARD UNIT SWITCHBOARD WITH D. C. EXCITER PANELS

Various alternatives in instrument equipment are available, and panels can be used with or without

generator voltage regulators and with shunt or compound exciters operating alone or in multiple. When panels are to be used with exciters that are units of motor generator sets, such panels are equipped with reverse current circuit breakers, which open only when there is danger of the generator motoring from the exciter bus. 125-volt D. C. standard unit double polarity exciter panels. Single or double circuit, with or without voltmeter and with or without fuses.

Bulletin A-4036.

POWER STATION SWITCHBOARD—These panels are used with one set of busbars to which all generators are connected by single throw lever switches and circuit breakers. When generators are run in parallel, equalizer switches mounted on pedestals near the machines are used.



D. C. STANDARD UNIT DOUBLE POLARITY 2-WIRE LARGE POWER STATION SWITCHBOARD

Feeder panels are available with either circuit breaker or fuse protection and with 1 double pole or 2 single pole lever switches per circuit. Feeder panels are furnished with or without ammeters, and on 125- and 250-volts panels can be furnished with small capacity circuits up to 12.

Panels may be furnished for grounded or ungrounded systems. Generator panels up to 6000 amps., feeder panels up to 4000 amps., 125 and 250 volts—1200 amps., 600 volts.

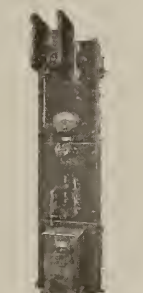
Bulletin 47070.

STANDARD UNIT PANEL FOR EDISON 3-WIRE SYSTEM—Especially designed for Edison 3-wire service; special provision is made for trouble arising between either of outside lines or between neutral and outside. Each generator panel contains a double pole, double coil, overload circuit breaker; and equipment is so arranged that series fields can be established in the proper direction before a generator is thrown on bus. Panels are suitable for operation on ungrounded or grounded 3-wire circuits.

125/250-volt D. C. standard unit 3-wire generator and 2- or 3-wire feeder switchboards. Generator panels up to 200 kw. and feeder panels up to 1200 amps.

Bulletin 47070 contains considerable information on the proper control equipment for 3-wire generators.

PANELS FOR RAILROAD SERVICE—These standard switchboard units provide for the control of direct current machines and circuits which actually furnish current to the trolley wire or third rail on railway systems that operate with a grounded negative return. All panels are suitable for either main station or substation installation. Equipments for the alternating current side of synchronous converters and for other alternating current railway apparatus are



STANDARD UNIT, 1200-VOLT PANEL WITH WATT-HOUR METER FOR 2 SYNCHRONOUS CONVERTERS IN SERIES

available, together with auxiliary direct current panels, such as exciter panels.

Standard unit panels for railway service can be obtained as listed below:

600- to 1500-volt D. C. switchboard panels, single polarity, 3-section, 90 or 99 ins. high.

Panels, designed to line up together, are listed to control:

Generators and Converters—

100 to 2400 kw. on 600-volt systems.

100 to 1000 kw. on 1200- and 1200/600-volt systems.

125 to 1200 kw. on 1500- and 1500/750-volt systems.

Feeders—

2000 amps., maximum on 600-volt systems.

1200 amps., maximum on 600-volt systems with series boosters.

1200 amps., maximum on 1200-, 1200/600-, 1500- and 1500/750-volt systems.

Generator and converter panels are all arranged for parallel operation of machines at like voltage.

Bulletin 47010.

A. C. Switchboards, Small Capacity Plants.

A. C. GENERATOR AND FEEDER PANELS—Used mostly in small alternating current plants where there is likelihood of later extensions.

As units can be added at any time they constitute a flexible arrangement. Panels can be used for generators operating independently or in parallel. Also each generator can be connected separately to its own exciter or exciter can be run in parallel. Generator voltage regulators can be used. Panels are used with one set of busbars, to which all generators and feeders are connected by means of single throw lever switches or circuit breakers.

Both separate and combination generator and feeder panels. Generator panels, up to 200 kw. 240 volts, 400 kw. 480 volts. Feeder panels, 2 to 9 circuits with fuses, 2 to 6 circuits with circuit breakers.

Bulletin 47131.

These panels (Fig. B) are intended for use in small alternating current plants where ultimate capacity will not exceed 1500 kv-a. The panels are quite similar to those mentioned above, but oil circuit breakers are used instead of lever switches and circuit breakers. Oil circuit breakers for generators are non-automatic, and for feeders are automatic with two overload coils.

The oil circuit breakers are in all cases arranged for mounting on backs of panels. Sufficient range in capacity and arrangement of circuits is available to take care of conditions in average industrial plant.

Both separate and combination generator and feeder panels.

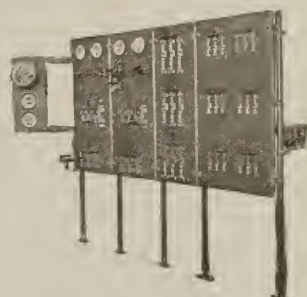


FIG. A. ALTERNATING CURRENT STANDARD UNIT PANELS, 240-480 VOLTS

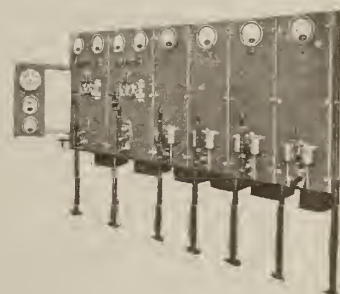


FIG. B. ALTERNATING CURRENT STANDARD UNIT PANELS, 480-600 VOLTS

Generator panels up to 5000 kw. 480 volts, 680 kw. 500 volts. Feeder panels up to 800 amps. Bulletin 47133.

STANDARD A. C. PANELS—Intended for general power and lighting service in small industrial and municipal plants up to 1500 kv-a. Separate generator and feeder panels are furnished for parallel operation and can be used with or without a generator voltage regulator.

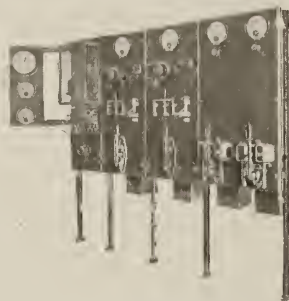
All instruments listed with panels are secondary and are operated from current and potential transformers included with the panels.

Both separate and combined generator and feeder panels. 1150- and 2300-volt alternating current standard unit switchboard. Generator panels up to 640 kw., at 2300 volts, feeder panels up to 200 amps.

Watt-hour meter equipment can be furnished. Bulletin 47135A.

SERIES ARC AND INCANDESCENT PANELS—For controlling constant current transformers in plants of any size. Made in 1150 and 2300 volts. For installation near the constant current transformers, which they control.

Switch equipment consists of safe and convenient plug switches and tubular expulsion fuse combined in single unit. On panels where secondary voltage is greater than 2300, ammeters are connected in series with circuit and are provided with insulating covers and with insulating bushings for ammeter studs where they extend through panel. Panels are available provided with watt-hour meter subbases used as a check upon the general meters in the station.



STANDARD UNIT A. C. PANELS



STANDARD UNIT SERIES ARC AND SERIES INCANDESCENT PANEL

A. C. Switchboards, Large Capacity Plants.

INDUCTION MOTOR STARTING PANELS—These panels are not intended to line up with other panels in a switchboard.

Panels for squirrel cage motors, where the compensators do not have self-contained oil circuit breakers, are provided with a combination of oil circuit breakers so interlocked that incorrect sequence of operation in starting a motor is impossible. Panels with low voltage release attachments are available. These are often particularly desirable where large numbers of motors are installed in isolated or unattended locations and all on one system. On panels for squirrel cage motors without compensators, compensator core and coils are furnished.

Bulletin 47140.

For starting and controlling squirrel cage, external resistance or internal resistance 3-phase induction motors up to approximately 4000 h. p.



2200-VOLT ALTERNATING CURRENT STANDARD UNIT PANEL

A. C. SWITCHBOARD PANELS WITH OIL CIRCUIT BREAKERS—For use similar to that described above, and can be used for higher voltages because of the use of oil circuit breakers. The generator panels have non-automatic oil circuit breakers, and feeder panels are furnished with 1- or 2-coil, automatic, series oil circuit breakers for use with current transformers. Panels are particularly adapted to low voltage plants where generators and feeders are of large capacity.

Bulletin 47163.

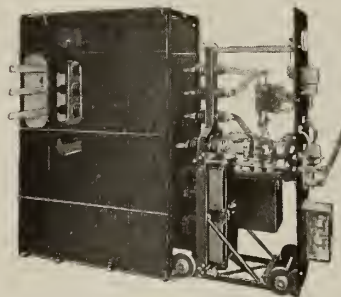
Still other panels for similar service have the oil circuit breakers mounted on pipe framework remote from panel. Thus oil circuit breakers can be used for higher ampere and rupturing capacity.

Bulletin 47164.

Safety First Panels.

Marked progress has been made in developing means which will prevent accidental contact with oil circuit breakers while alive, and this development has also increased the efficiency of operation by giving greater ease of inspection, adjustment, and replacement. The method is to enclose and interlock the oil circuit breakers, with their necessary auxiliary apparatus, in a housing so that: (1) Access cannot be had to them while alive; (2) They can be swung out or drawn out from the housing when dead.

The Truck Type Panels are especially adapted to group mounting and make a most desirable switchboard from the standpoint of safety to life, the elimination of fire risk and continuity of service.



"SAFETY FIRST" TRUCK TYPE PANEL



"SAFETY FIRST" SWING-OUT PANEL

Each complete unit consists of two elements—the truck or movable element carrying the panel, oil circuit breaker and instrument transformers; and the stationary or housing element enclosing the truck (when it is in an operative position), the buses and the terminal of the incoming and outgoing cables. All current carrying parts are completely enclosed when alive; and when withdrawn for inspection or repairs, the wiring and apparatus on the truck are accessible from all sides and electrically dead.

Bulletin 47100.

The Safety Enclosed Swing-Out Panel has a circuit breaker enclosed in a steel housing and so interlocked with the housing that the panel can be swung out only when the breaker is in the "off" position and the disconnecting device is therefore carrying no current. The interlock also prevents the panel from being swung back into the operating position when the breaker is in the "on" position.

Bulletin 67105.

Switchboard Instruments.

The GENERAL ELECTRIC COMPANY has developed and perfected a complete line of indicating and recording instruments for all classes of work. These are of

such mechanical excellence that they have become the standard for highest grade instruments.

For further information relative to any of the following instruments, see bulletins on the subject.

ROUND PATTERN VOLTMETERS AND AMMETERS—For use on D. C. circuits. Wide opening in cover together with large needle, facilitates reading the indications. Equipped with zero adjusting device. Cases are cast iron and dustproof. Constructed on the well known D'Arsonval principle. Type D ammeters ranging from 80 to 3000 amperes are furnished with external shunt.

Bulletin 46017.

Round pattern voltmeters and ammeters for use on A. C. circuits, although primarily for A. C. work, can also be used on D. C. Neat and pleasing in design. Operate on the Thomson inclined coil principle and with the wide scale opening, wide needle and legible scale can be easily read from a distance.

Bulletin Y-492.

HORIZONTAL EDGEWISE VOLTMETERS, AMMETERS AND WATTMETERS—G-E horizontal edgewise instruments are exceedingly accurate and may be relied upon to give long and satisfactory service. Instruments are of uniform size, presenting a pleasing appearance when installed. Primarily designed for A. C. service, but can be used on D. C. voltmeters and ammeters constructed on the well known Thomson inclined coil and D'Arsonval principles; watt-meters on the direct reading dynamometer principle. Made for back connection only, in dull black finish.

Bulletin 46016.

FREQUENCY AND POWER FACTOR INDICATORS—Horizontal edgewise instruments with same style of case as the voltmeters, ammeters and wattmeters. The type H Frequency Indicator shows on direct reading scale the cycles per second of any A. C. system. Adjustable for characteristics of circuits on which installed. Standard instruments wound for 100 to 125-volt circuits only; up to and including 650 volts if desired.

Power factor indicator shows on direct reading scale the power factor, lagging or leading, of balanced 3-wire 2-phase, 3-wire 3-phase or 4-wire 2-phase systems. Furnished for any potential up to and including 650 volts.

Bulletin 46016.

SYNCHRONISM INDICATORS—For synchronizing 2 or more A. C. machines. Can be furnished with swinging brackets and lamps for mounting on side of panel or pivoted brackets and lamps for mounting at top of panel. Bulletin 46015.

TYPE CR CURVE DRAWING VOLTMETERS AND AMMETERS—Portable and switchboard types have high torque, give accurate results and clear, unblotted records. Furnished for front or back connection. Voltmeters can be furnished with extra tap on resistance for use on both A. C. and D. C.

Capacities of ammeters, up to and including 200 amp.; voltmeters, up to and including 750 volts A. C. or D. C.

Bulletin 46021.



ROUND PATTERN
VOLTMETER



HORIZONTAL EDGE-
WISE AMMETER

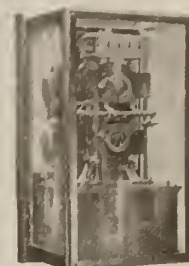


SWITCHBOARD TYPE
CURVE DRAWING
AMMETER

THOMSON D. C. ASTATIC WATTHOUR METERS—Especially designed for switchboard use. Made in back connected form only, and enclosed in rectangular glass case. Covers are removable from the front.

Armatures and damping magnets are astatically arranged, thus minimizing the effect of stray fields. Damping magnets are enclosed in a laminated iron shield, thereby protecting them from the effects of short circuits. Meter is provided with spherical armature and field coils, gravity control brushes and small commutator; and is of dull black finish. Write for additional information.

Bulletin 66351.



ASTATIC WATT-
HOUR METER

Portable Instruments.

TYPE DP2 PORTABLE VOLTMETERS AND AMMETERS—Designed for secondary standards and general testing purposes on D. C. Constructed on the well-known D'Arsonval principle. DP2 ammeters are self-contained up to and including 30 amp.; higher capacities furnished with 200 millivolt portable shunts. Contained in polished mahogany case.

Bulletin 46013, Section 100A.

TYPE P3 PORTABLE VOLTMETERS, AMMETERS AND WATTMETERS—Extremely accurate for laboratory and general testing purposes. Voltmeters and Wattmeters made on the dynamometer principle, ammeters on the Thomson inclined coil principle. Designed for A. C. but can be used on D. C. by taking reverse readings. Magnetically damped and protected from stray fields.

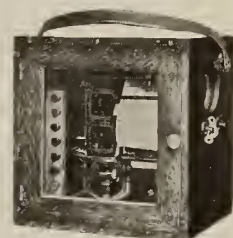
Bulletin 46013, Section 100A.

TYPE CP PORTABLE CURVE DRAWING VOLTMETERS, AMMETERS AND WATTMETERS—For motor testing and other work where desirable to make periodic or temporary arrangements for testing.

Bulletin 46013, Section 100A.



TYPE DP2 PORTABLE
VOLTMETER



PORTABLE CURVE
DRAWING INSTRU-
MENT

G-E Flow Meters.

G-E flow meters provide a means of accurately measuring the flow of steam, water, air, gas, oil, etc. through pipes and closed conduits. Flow meters can be furnished in the following types:

High pressure up to 300 lbs. gauge:

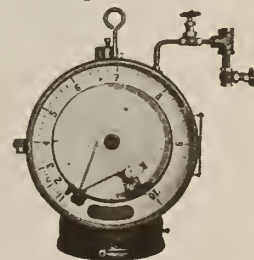
- Type F recording
- Type F-2 recording, integrating
- Type F-3 indicating, recording
- Type F-4 indicating, recording, integrating
- Type F-5 indicating

Low Pressure up to 65 lbs. absolute

- Type F-6 recording
- Type F-7 recording, integrating
- Type F-8 indicating, recording
- Type F-9 indicating, recording, integrating
- Type F-10 indicating

Type T Portable testing meter, high or low pressure furnished with carrying case.

Bulletin 46501-C.



INDICATING, RECORD-
ING, INTEGRATING
FLOW METER

Wires and Cables.

The GENERAL ELECTRIC COMPANY manufactures wires and armored cables suitable for use under various conditions.

All wires and cables are tested before shipment. A pressure test of at least twice the working pressure is applied. After the pressure test, an insulation test is made with a 250-volt battery and delicate reflecting galvanometer.

RUBBER INSULATED—Three types of rubber insulation have been standardized:

"Red Core" is a high class insulation used primarily on wires for house wiring, and is superior to the requirements of the National Board of Fire Underwriters.

"Tricoat" insulation was designed for those desiring a very high grade wire, somewhat better than "Red Core," but less expensive than the "30 Per Cent Hevea."

"30 Per Cent Hevea" insulation meets the 1907 Specifications of the Rubber Covered Wire Engineers' Association and is the best rubber compound for absolutely high grade work. The core may be white or black, as desired.

BRAIDED WIRE—All wires and cables with N. E. C. rubber insulation, No. 8 B. & S. and smaller carry a single braid, while No. 6 B. & S. and larger are regularly made with either 2 braids, or 1 tape and 1 braid; and in accordance with Underwriters' requirements, are equal to double braid and suitable for conduit work. If 1 tape and 2 braids are required, orders must so specify, and extra charge for extra braid will be made.

N. E. Code, "Red Core," braided, twin wire is finished with talc, which insures ease in pulling wire into conduits; no extra charge made for this feature. All the braided, rubber covered wires may be finished in this way, if desired, without additional cost.

These rubber covered braided wires and cables are distinguished by 1 red and 1 black thread woven parallel in braid.

WEATHERPROOF AND SLOW BURNING WIRES AND CABLES—Standard weatherproof wires and cables are manufactured strictly in accordance with the requirements of the National Board of Fire Underwriters, with 3 braids placed directly over the copper core, thoroughly impregnated with a black, weatherproofing compound, and then polished to remove all superfluous compound and give a smooth exterior finish. Double braid weatherproof wire furnished on order.

When the number of braids is not specified, wire

with 3 braids, commonly called triple braid, is always furnished; if double braid is required, requisitions or requests for quotations should so state. A stock of triple braid wire is carried.

Slow burning wires and cables are similar to the triple braid weatherproof in construction except that the impregnating material is a white, flameproof compound.

BAND STEEL ARMORED CABLES—The conductors are double taped with mild band steel between two wraps of asphalted jute. Our standard practice is to apply these steel tapings in the same direction, the outer tape covering the joints of the inner. However, if required, the steel tapes may be applied in reverse directions without additional cost, but we do not recommend this construction. A final wrap of asphalted jute protects the armor from corrosion. These cables are especially adapted for mine use, subways and tunnels; on bridges, generally in iron pipe; and overhead through city streets.

This cable is also furnished lead encased suitable for direct burial in earth without conduit. It can be applied to any voltage up to 25000 volts. Its principal uses are ornamental lighting systems for parks, residential districts and small towns.

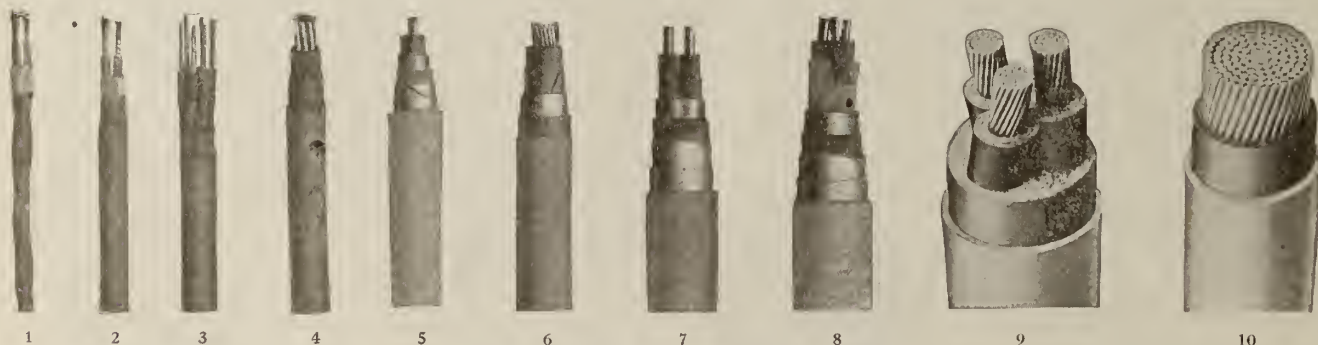
STEEL WIRE ARMORED CABLES—Similar in construction to band steel armored, except that one layer of wire is used between the jute wrappings instead of band steel. The cable is designed so that the armor will carry the weight of the cable, if necessary to install in a vertical position.

Armored cables without lead may be used in dry mines and subways where cable is subjected to mechanical injury. By lead encasing under the armor this type of cable becomes the standard for submarine work or for use in wet mines. This cable is also adaptable for direct burial in the soil.

ASPHALTED JUTE CABLES—Depending upon conditions, these consist of leaded or unleaded cables covered with jute coverings and asphalt compound. Such cables are recommended for use in mines, when not exposed to mechanical injury, in wet ducts and for direct burial in the soil, where a tile or board laid over it will give sufficient mechanical protection.

CABLE CONNECTING DEVICES—A standard line of cable connecting devices of reliability and convenience is also manufactured. It includes copper cable connectors, end bells, cast iron coupling boxes, junction boxes and fuse boxes.

Detailed information is given in bulletin 49302.



GENERAL ELECTRIC WIRES AND CABLES

1. Heater Cord (Type H.)

2. Deck Cable

3. Border Cable (Type B.)

4. Cable Rubber-Insulated—D. B.

5.

6.

7.

8.

} Band Steel Armored Cables

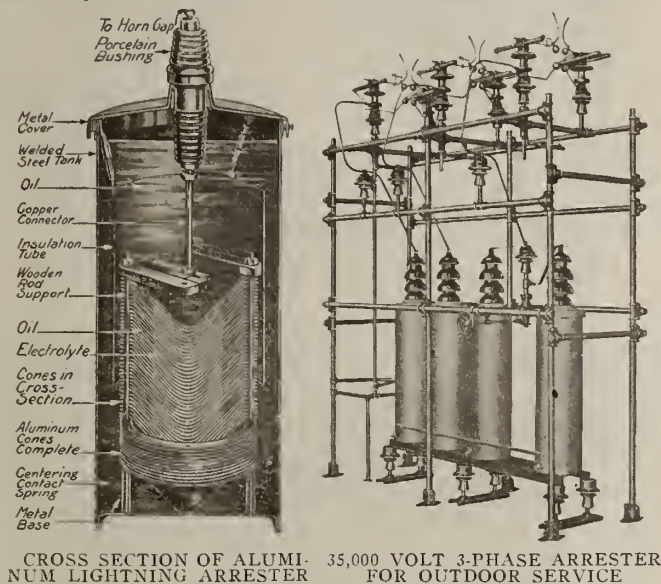
9. Three Cord Paper Insulated Cable

10. Single Cord 2000000 C.M. Cambria Leaded

Lightning Arresters.

Protection against lightning is required to preserve continuity of service. The GENERAL ELECTRIC COMPANY manufactures lightning arresters and choke coils for the protection of all kinds of service. The most commonly used types and their service are given below.

ALUMINUM ARRESTERS—For the protection of important generating and transforming A. C. apparatus of large stations of any voltage. On account of high speed of discharge and enormous discharge capacity, capable of quickly and thoroughly relieving lines of dangerous surges. Construction is clearly shown by accompanying illustrations and in general consists of stacks of aluminum cells between lines and ground. Stack is built up of aluminum cones supported on treated wooden rods and separated from each other by treated fiber washers.



CROSS SECTION OF ALUMINUM LIGHTNING ARRESTER 35,000 VOLT 3-PHASE ARRESTER FOR OUTDOOR SERVICE

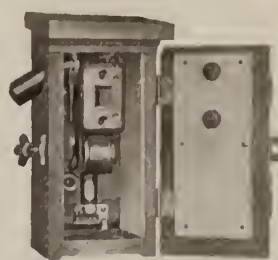
Cell electrolyte partially fills spaces between cones and is in contact with part of surface of the upper and lower cone. Stack of cones is placed in steel tank which is filled with oil for cooling and insulation. A circular insulating barrier concentric with cone stack is hung within tank to increase the insulation between stack and wall of tank and to augment oil circulation. Stacks are connected to line through high-speed gaps, set to discharge without permitting the apparatus to be subjected to dangerously high potential. Gaps for all arresters above 7500 volts are sphere gaps arranged so that they may be readily opened for disconnecting or closed for charging. All gaps are equipped with charging resistances and charging contacts. Each arrester is equipped with transfer switch for changing connections between ground stacks and one of line stacks in order that all stacks may be equally charged. Gaps and transfer switch are mounted on pipe framework, all parts of which are thoroughly weatherproofed by galvanizing or sherardizing.

Several types are made ranging from 1,000 volts up to 155,000 volts.

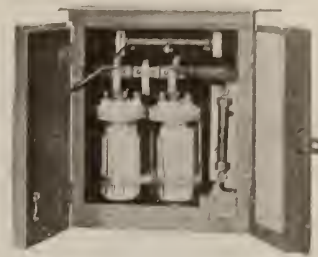
Bulletin 45601A.

MAGNETIC BLOW-OUT AND D. C. ALUMINUM ARRESTER—For the protection of electric railway equipments from damage by lightning and the consequent repair expenses, interruption of service, and loss of traffic, the GENERAL ELECTRIC COMPANY offers two types of arresters—the magnetic blow-out and the aluminum arrester. The type to use depends upon the conditions to be met.

For average conditions, the magnetic blow-out type



MAGNETIC BLOW-OUT ARRESTER



D. C. ALUMINUM ARRESTER

of arrester will give the desired protection when placed on the cars and along the line at intervals of at least four per mile. Where lightning disturbances are especially severe so that the problem of lightning protection becomes of vital importance, the selection of the aluminum arrester is advisable.

Aluminum arresters are built to withstand the rigors of service on railway cars. They combine the advantages of a condenser and the safety valve effect of the aluminum cell. Having no gap in series, the aluminum arrester operates upon the slightest rise in potential.

Bulletin 44712.

GRADED SHUNT RESISTANCE MULTIGAP ARRESTER—Suitable for indoor or outdoor installation on circuits up to 15,000 volts. Should be installed in stations and substations, on feeders at receiving points for the protection of motor and transformers, and on lines for the protection of power and lighting transformers.

Essential feature is a row of metal cylinders, spaced with small air gap between them and connected between line and ground. Cylinders act as condensers and this gives arrester sensitiveness, causing it to discharge at much lower voltage than would an arrester having only a single gap of length equal to sum of small gaps to insure extinguishing of arc which follows discharge.

Bulletin 45603A.

COMPRESSION CHAMBER MULTIGAP ARRESTER—For the protection of power and lighting distribution pole transformers. Designed to meet the demands for an arrester which would give good protection and at such a cost that it could be placed at the terminals of even the smallest transformers.

This arrester is efficient because the multigap principle of design is carried out to the highest degree. Its construction and the materials used are such that the arrester is not only light and compact but also waterproof and fireproof, features which make inspection unnecessary. As long as the arrester is intact it is in operating condition.

Bulletin 45603A.

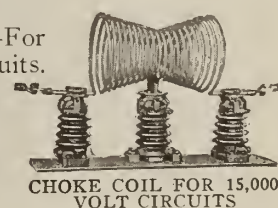
VACUUM TUBE ARRESTERS—For railway signal, police and fire alarm circuits.

Bulletin 45600A.

HORN GAP ARRESTERS—For series arc and incandescent circuits.

Bulletin 45602.

CHOKE COILS—For use with lightning arresters on A. C. circuits, described in Bulletin 45606.

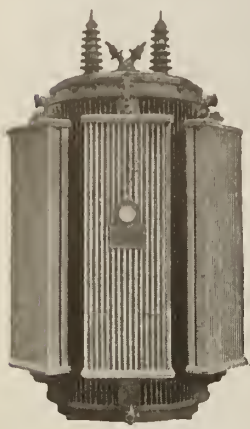


CHOKE COIL FOR 15,000-VOLT CIRCUITS

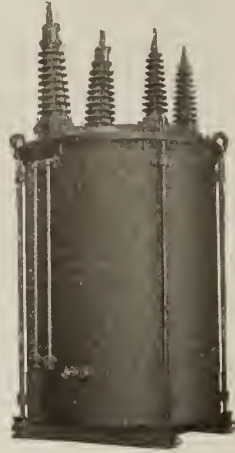
Transformers.

G-E transformers embody features which have

Their use is recommended where restrictions are imposed upon oil filled transformers, indoor service only.



AIR-COOLED TRANSFORMER WITH RADIATORS



WATER-COOLED TRANSFORMER

made them preferred by the great central stations of this country.

Reliability has always been the first consideration and the many thousands of kv-a. capacity now in service have proved their ability to operate continuously with minimum losses and maximum factor of safety.

G-E transformers may be broadly divided into two



TYPE H TRANSFORMER FOR POLE MOUNTING



3-PHASE AIR BLAST TRANSFORMER

classes—oil insulated and air blast. The latter are limited to use with potentials not exceeding 25,000 volts, while the former may be used for any voltage.

Information concerning the use of transformers should be requested from the nearest G-E district office.

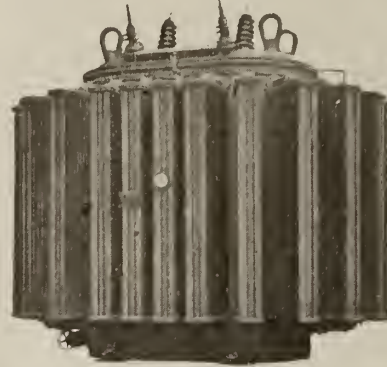
OIL INSULATED TRANSFORMERS—For indoor or outdoor service. Divided into two general types:

Self-cooled—Uses circular coil construction throughout, and known as Type H. May be obtained for any voltage and capacity.

Transformers of this type are placed in steel tanks generally with corrugated sides electrically welded or cast to the base and top rim. In large sizes external radiators are used to increase the cooling surface.

Water-cooled—Built in any size and for any voltage. Construction similar to the self-cooled Type H transformers. All welded steel plate tanks are used. Cooling is effected by the circulation of water through cooling coils in contact with the hot oil.

AIR BLAST TRANSFORMERS—Shell type construction, either in single phase or three phase units for all frequencies.



THE LARGEST SELF-COOLED TRANSFORMER IN AMERICA

Single-phase, 25-cycle, 8000 kv-a. The development of the separable radiator and the all-welded steel plate tank has made possible self-cooled transformers of this size

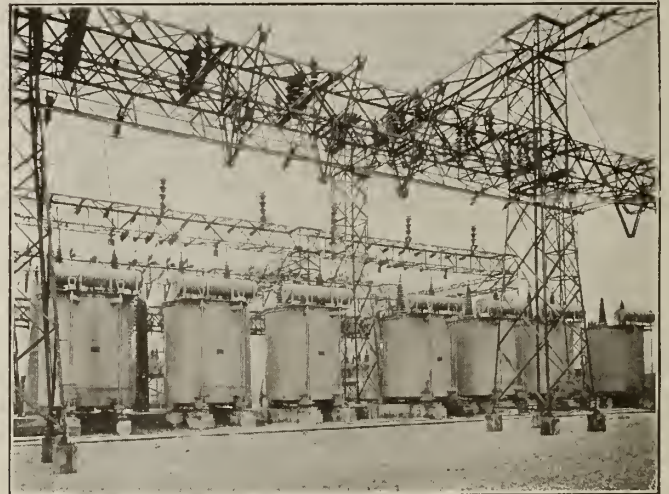


THE LARGEST WATER-COOLED TRANSFORMER IN AMERICA

3-phase auto transformer having an output of 50,000 kv-a.

This type is cooled by forcing a current of air through ducts provided between the coils and between sectionalized portions of the core. Mechanical parts are substantial and few in number.

CONSTANT CURRENT TRANSFORMERS—For information on transformers for street lighting see page 1084.



LARGE OUTDOOR SUBSTATION WITH WATER-COOLED TRANSFORMERS

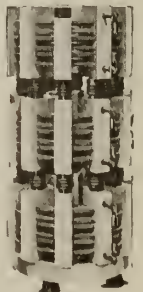
Current Limiting Reactors.

The GENERAL ELECTRIC COMPANY manufactures current limiting reactors which can be applied to all classes of service where it is desired to control short circuits or limit the current, as in generator-leads, bus bars, tie and feeder circuits, etc.

The necessity for reactors is due to the abnormal conditions which may occur in a system as the result of short circuits, either 3-phase or single-phase. Energy liberated under these conditions may be of such a magnitude as to exceed the safe rupturing capacity of oil switches and also the mechanical strength of generators, transformers, bus bars, etc.

A further use of reactors is to give greater continuity of service by limiting the larger part of the short circuit disturbances to the section of the system in which it originates.

Construction details of this device are given in Bulletin 45300.



3-PHASE REACTOR

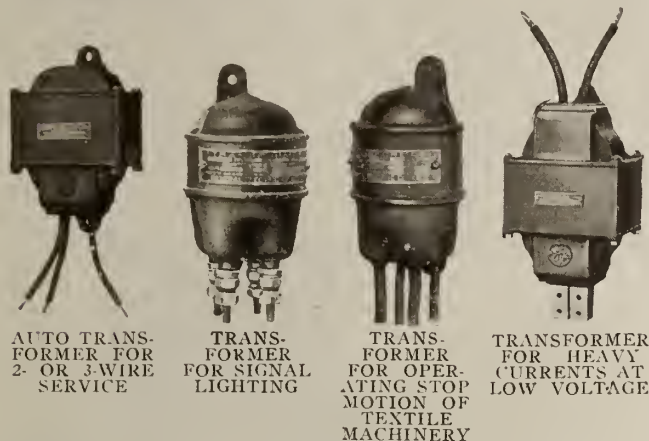
Small Transformers and Auto Transformers.

Type M miniature air-cooled transformers meet the demand for low voltage transformers for capacities of 500 volts and under; 15 to 5000 watts, 60 cycles, 11 to 3000 watts, 25 cycles.

They give perfect satisfaction in the following applications: electric welding, speed variations of motors, railway signal lighting, 2- to 3-phase transformation; operation of small low-voltage motors from high-voltage circuits, insulating lighting from power circuits, telephone circuits before rectification; loom stop mechanism.

By substituting these transformers for batteries or magneto generators, no maintenance or replacement charges, due to wear, are incurred, less space is required and cleanliness and reliability are assured.

Bulletin 45105.



Portable Instrument Transformers.

Made in 3 general types:

CURRENT TRANSFORMERS—Type P2—Standard ratings are 50, 100 and 200 amps. primary with 5 amps. secondary, also 25, 50 and 100 amps. primary with 5 amps. secondary.

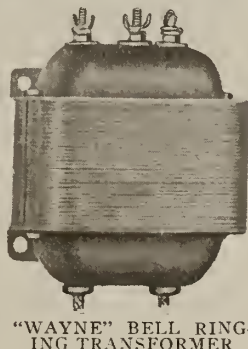
Type R2—Designed for 1000-amp. turns at full load rating. Standard transformer has 5-amp. secondary winding, giving a ratio with one primary turn passing through the core of 1000:5. Bulletin 46030.

CABLE TESTING TRANSFORMERS—Made in 125 and 250-amp. capacity. Bulletin 46030.

POTENTIAL TRANSFORMERS—Type E4—50 and 200-watt capacity.

Type E6—25-watt capacity and lighter in weight than Type E4. Bulletin 46030.

HEAVY DUTY BELL RINGING TRANSFORMERS—Made in 50- and 100-watt sizes for operating signal systems requiring considerable power. Designed and classed as air-cooled transformers for 300 volts or less and subject to code installation requirements accordingly. Equipped for 3-phase bell-circuit voltages.



Pyrotip Electric Burner.

The most modern method of burning terminals in place on storage batteries, removing old connections, cutting off or building up posts, or in fact almost any form of soldering work, is to do it electrically—by the electric welding process. The GENERAL ELECTRIC COMPANY has recently developed a lead burning transformer to meet this need.

This transformer is designed to be connected to the ordinary 110-volt A. C. lamp socket, a 10 ft. cord with plug being provided for this purpose. This attaching cord is protected by a special rubber covering against hard wear, dirt and acid.

Connection to transformer itself is made by means of a plug and socket connection, so that this plug can be used in place of the snap-switch in the lamp socket for turning on and off.

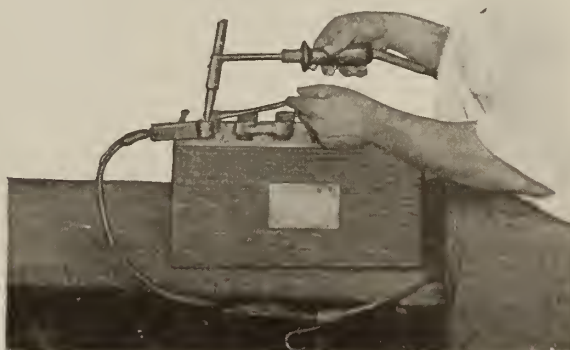
Two separate rubber covered terminal leads are used to convey the low voltage heat producing current to the parts of the battery to be welded (see illustration). The lead having the "Big Brute" clip is for fastening to the battery plates or posts which are to be worked on. The other lead has at its end a carbon holder which is arranged with a heavily insulated handle so that the operator's hand is guarded from the heat. The carbon holder takes any ordinary arc welding carbon, this carbon forming the second terminal.

When the pointed arc welding carbon is brought into contact with the lead, the pointed end of the carbon becomes so intensely hot that it melts over a restricted area quicker than with a pointed gas flame. The welding or operation is carried out by a sort of puddling process, the carbon terminal being manipulated to flow the lead where it is needed.

Some advantages are: repair work in remote corners easily done, as the heat is always at the point of the carbon; device is readily portable, weighing approximately 25 lbs.; joints do not have to be cleaned, as the dirt and slag automatically rise to the surface of the molten lead and surfaces are joined while cleansed; when properly used, there is no glare to injure operator's eyes, as he looks down on the cool end of the carbon in such a way that the bright point where the carbon touches the lead is hidden from view; there is no danger from electric shock because of the efficient insulation.

On the basis of 10 cents per kilowatt hour, it costs about 8 cents per hour for current when the device is operating steadily. The instant the carbon point is removed from the work, the current consumption practically ceases, as the device then takes only $4\frac{1}{2}$ watts from the line.

Bulletin B3549.

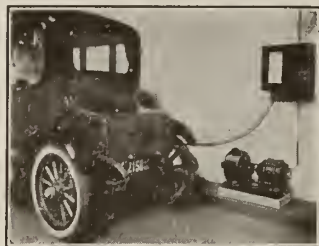


SHOWING USE OF PYROTIP ELECTRIC BURNER IN REPAIRING STORAGE BATTERY

Battery Charging Equipment.

The GENERAL ELECTRIC COMPANY is prepared to furnish charging equipment for all classes of service.

INDIVIDUAL VEHICLE BATTERY CHARGING M-G SETS—The individual vehicle charging sets can be furnished for the charging of either lead or Edison vehicle batteries. They can be furnished for service on various frequencies, either single phase or polyphase circuits of standard voltages, and in suitable capacities for charging lead batteries of 44 cells and under, or Edison batteries of 60 cells and under.



CHARGING SET IN OPERATION

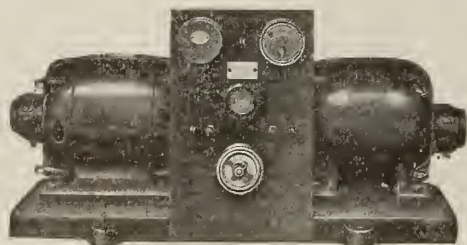
The selection of the proper set for any particular charging work depends upon the make of battery and type of cell, as well as the frequency, voltage and number of phases of the A. C. supply.

Bulletin 62558A.

CHARGING OUTFITS FOR LARGE GARAGES—The problems for selecting battery charging outfits for large garages present conditions so diversified in character that it is best to take each case up individually with the Supply Dept. of the GENERAL ELECTRIC COMPANY.

Bulletin 62557.

MOTOR GENERATOR STARTING AND LIGHTING BATTERY CHARGING OUTFITS—The motor generator charging outfits illustrated are for charging automobile starting and lighting batteries. They consist of a small, compact 4 bearing motor-generator set on which is mounted a small steel switchboard completely equipped.



MOTOR GENERATOR SET

These outfits are furnished in capacities of 250, 500 and 750 watts, giving a range of sizes, the smallest of which will charge any combination of one to four 6-volt batteries and the largest any combination of three to twelve 6-volt batteries.

Larger sets wound for 37½ volts, 20, 30, 50, 75 and 100 amperes, in 3 bearing construction with common base are also available.

Bulletin B3432A.

STANDARD MERCURY ARC RECTIFIER BATTERY CHARGING SETS—For charging automobile, signal or telephone batteries. Made in 3 standard sizes of 10, 30 and 50 amperes capacity, and in D. C. voltages ranging from 10 to 100 when operated at 110 volts A. C., and from 20 to 175 when operated from 220 volts A. C. Suitable for circuits of 60 cycles or more. Special rectifiers furnished for higher D. C. voltages than



SINGLE PHASE
MERCURY ARC
RECTIFIER

the foregoing from 220-volts A. C. and up to a maximum of 350 volts D. C. in capacities up to and including 50 amperes. Special rectifiers can be furnished for operation on 25, 30 or 40 cycles.

Bulletin 43950.

TUNGAR BATTERY CHARGERS—Another charging device for garage or service station use is the Tungar rectifier, operating on the principle of the emission of small particles of negative electricity from an incandescent filament in a bulb filled with inert gas.

This charger is simple in construction, light in weight, is self-starting, and requires no expert attendance. Its first cost and operating expense are very low. The smaller sizes connect with any A. C. lamp socket.

There are four sizes:

6-amp. 75-volt Size—Will charge any combination of 3, 4, 5, 6 up to 30 cells, at 6 or 7 amps. or less from A. C. Particularly adapted to the needs of garages and service stations.

Bulletin B3487.

5-amp. 30-volt Size—Will charge from one to four 3-cell batteries at 5 amp. rate or less. Particularly adapted for automobile dealers.

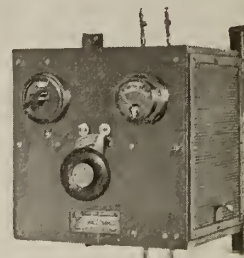
Bulletin B3529.

5-amp. 7.5-volt Size—Will charge one 3 cell battery at 5 amp. or a 6 cell battery at 3 amp. or 9 cells at 1.5 amp. Suitable for the private garage.

Bulletin B3532.

2-amp. 7.5-volt Size—Will charge 3 cells at 2 amps., 6 cells at about 1 amp. and 8 cells at about 0.75 amp. Suitable for charging small batteries.

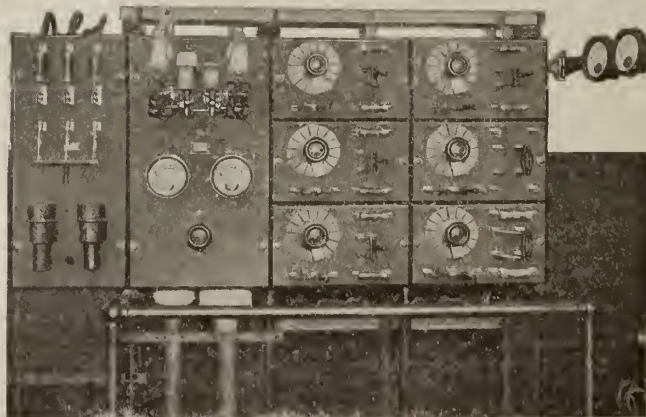
Bulletin B3532.



6-AMP. 75 VOLT
TUNGAR BATTERY
CHARGER



PORTABLE TUNGAR BATTERY
CHARGER



SWITCHBOARD FOR CONTROLLING GENERATOR AND SIX
CHARGING CIRCUITS

Arc Welding Apparatus.

The use of welding apparatus in foundries, steel mills, ship yards and repair shops, is rapidly increasing, due to the economies effected, and this company has developed a complete line of electric arc welding equipment

to meet all requirements. The principal advantages of the electric arc process is in concentration of heat (reducing expansion and contraction of metal worked upon) and high temperature.

Two methods are employed—metallic and carbon electrode. In the former method, the metal of electrode is added to the weld, producing greater strength and smoother appearance. This is the only method which will deposit metal successfully on overhead surfaces. The carbon electrode method used for building up metal, plugging holes in castings, welding and joining parts where strength and appearance are not so essential or where surface is to be planed off. Greater speed can be attained with carbon electrodes because of greater current capacity. The method of operation is similar to soldering process. The carbon electrode method is also used for cutting and melting away metal.

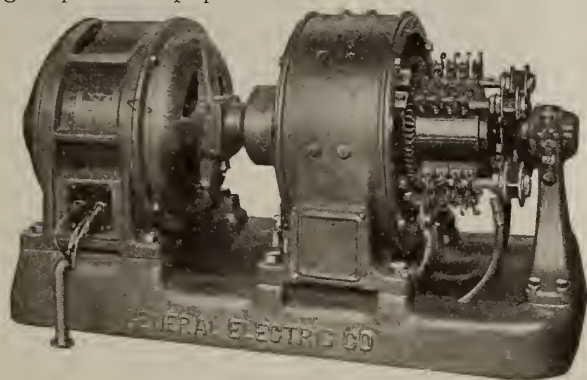
In some cases the tensile strength of metal in a weld may be as high as 55,000 to 60,000 lbs. A safe figure is 40,000 lbs. where work is done by experienced welders.

Approximate power input required for various systems ranges from 5 to 15 kw. or kv-a.

Principal types: Constant energy, self-excited generator; constant energy balancer sets; constant potential generator with auxiliary equipment; A. C. welder. All except constant potential type are primarily single-operator equipments suitable for bare metallic electrode welding only. Constant potential type may be used as a single operator equipment for either carbon or metallic



200 AMP. SELF-EXCITED WELDING GENERATOR
Constant energy type



ARC WELDING GENERATOR SET
Constant potential type

electrode welding or a number of operators may work from one machine. This type also permits use of carbon electrode for cutting.

Each outfit consists of following apparatus:

Constant energy, self-excited generator arranged for belt drive or direct connected to A. C. or D. C. motor, or engine, the maximum motor voltage being 550.

Constant energy balancer sets of 150 amperes capacity are suitable only when 110 to 125 volts D. C. is available. If circuit has positive side grounded, it is entirely satisfactory. If not, special precaution must be taken.

Constant potential generators can be direct connected to D. C. motor, A. C. motor or gas, oil or steam engines.

The GENERAL ELECTRIC COMPANY has developed

also an automatic welder which can be operated from any of the above D. C. welding generators.

A. C. welders may be used on 60-cycle circuits of 220, 440 or 550 volts maximum. The welder is single-phase, but where several are in use on a polyphase system, they may be distributed among the phases to partially balance the load.

Standard capacities of G-E arc welding outfits range from 150 to 1250 amps. Portable outfits are made in 3 sizes, 200, 300 and 400 amps.; stationary outfits in 9 sizes, 150, 200, 300, 400, 500, 600, 800, 1000 and 1250 amps. Outfits of 300 to 400 amps. portable can be arranged for 2 operators by adding an auxiliary switchboard panel, as in case of all stationary outfits.

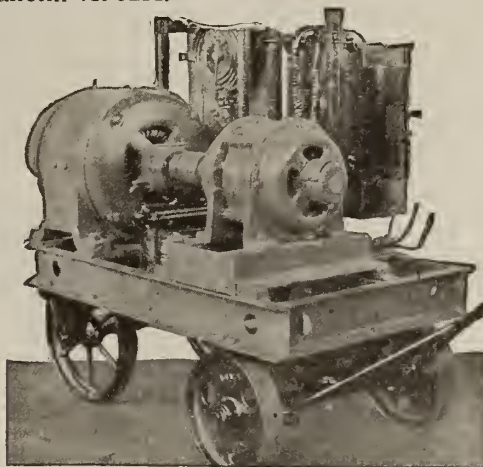
Current requirements vary with thickness of the metal to be welded. Maximum for metallic electrode welding is about 200 amps. Where several operators are working from one set under average conditions, it is safe to figure on 125 to 150 amps. per operator, taking advantage of intermittent nature of operation. For light work this value will be reduced.

With carbon electrode, light work can be welded with 150 to 250 amps. Medium welding with carbon electrode requires 250 to 350 amps. and heavy welding 350 to 500 amps. The capacity of a set used for cutting depends upon speed required. 300 amps. will cut light metal, but currents up to 1000 amps. are desirable for metal 2 in. thick or heavier. Cutting speed may be estimated on basis of $\frac{1}{2}$ sq. in. cross-section per minute per 100 amps. For heavy sections this figure is somewhat high and for thin sections low.

Bulletin 48932A.



CONTROL PANEL
WITH WELDING
CIRCUIT CONTROL



PORTABLE ARC WELDING OUTFIT

Industrial Heating Equipment.

The GENERAL ELECTRIC COMPANY has developed a very extensive line of industrial heating apparatus which is being successfully applied in many different processes requiring heat. The following are some of the numerous operations which have been improved by the adoption of electric heating with automatic temperature control:

Annealing copper, brass and carbon and nickel steels.

Baking japan, enamel, foundry cores, grinding wheels, insulation and furnace lining.

Drying chemicals, paints and varnishes, acid-washed metals, brake lining, crucibles and steel wire.

Drawing temper of carbon, nickel and high-speed steels.

Hardening carbon and nickel steels.

Heating rivets, glue, oils and compounds.

Melting brass, copper, aluminum, non-ferrous metals, lead and tin alloys, pitch, paraffin and compounds.

Vulcanizing tires.

Electrically Heated Ovens.

Nearly all industrial plants use ovens for some heat treating process. The principal problem is to secure the most efficient application of heat that will give the required quality of product.

Electrically heated ovens are economical, they permit close control of temperature, even distribution of heat and insure a uniform product and high quality of finish, results which cannot be attained in the same degree with other means of heating. Electric ovens are clean and easy to operate, and they reduce fire hazard materially.

G-E electrically heated ovens of several types are in commercial use.

Send for Bulletin 48021A.



BATTERY OF 15 ELECTRICALLY HEATED OVENS

Industrial Oven Heating Equipment.

Three types of heaters are made—wall, floor, and the universal for either floor or wall mounting. The heater consists of metallic resistor material carried on suitable insulation and assembled in steel frames for convenience in installing. Each heater is made up of units which consist of flat resistance ribbon wound on insulating blocks. The blocks are made of a compound which retains its insulating qualities at the temperature to which subjected and will not crack or break.

These heaters are furnished in capacities from 1.3 kw. to 12.3 kw. for voltage up to 600 volts. Temperature range extends to 950° Fahr. in the oven.

Bulletin 48709.



OVEN HEATER UNIT FOR WALL MOUNTING

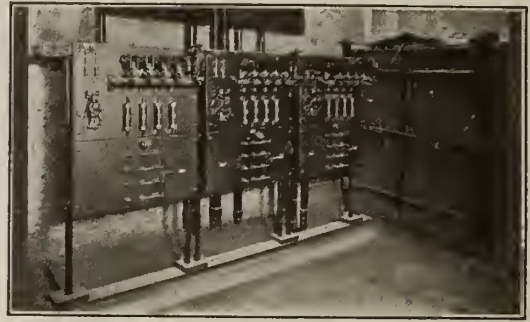
Oven Control Panels.

The three-phase automatic control panel consists of a slate base containing a double pole switch, with fuses for operating the contactor, a three pole contactor which opens and closes the heater circuit, three main fuses for protecting the heater circuit, and a pilot lamp, which lights when the current is on. The automatic control panel contains a reversing relay in the control circuit which is operated by the thermostat in the oven. The hand control panels are made up in the same way except that the reversing relay in the control circuit is omitted.

Panels for D. C. or single-phase, A. C. automatic control, are the same as three-phase panels except that the contactors are double pole. These panels can also be furnished for hand control by omitting the reversing relay in the control circuit for operating thermostat in the oven.

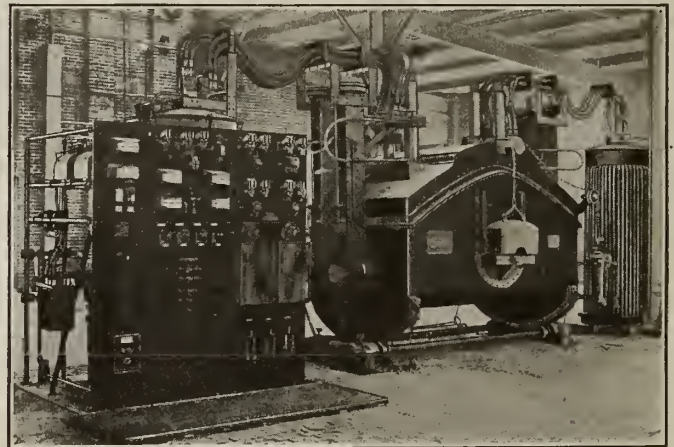
In cases where it is desired at times to operate the

oven at a lower temperature than ordinarily used or at less than normal load the control panel is provided with a series parallel switch for single-phase A-C. or D-C. circuits and with a "Y" delta switch for A-C. three-phase



CONTROL PANELS FOR DRYING OVENS

circuits which is placed in the heater circuit and by means of this switch the energy input can be reduced respectively to one-quarter or one-third of the normal input. This enables the operator to cut down the maximum demand at such times and reduces the current which is thrown on and off as the temperature in the oven falls or rises.



BRASS MELTING FURNACE WITH CONTROL PANEL AND TRANSFORMER

G-E Electric Furnace.

The principal characteristics of this electric furnace for melting non-ferrous metals and alloys are:

Temperature of heat generating source controllable at will.

Heat generated is of the "soaking" type, uniformly distributed, and any workable temperature gradient may be maintained, between charge and heat source.

The charge is heated from all sides.

Bath is shallow and large surfaces exposed to receive heat by conduction as well as radiation.

Has normally a reducing atmosphere, which may readily be made neutral or oxidizing.

Automatic control of power permits one man to operate several furnaces.

Furnace atmosphere free from contaminating gases.

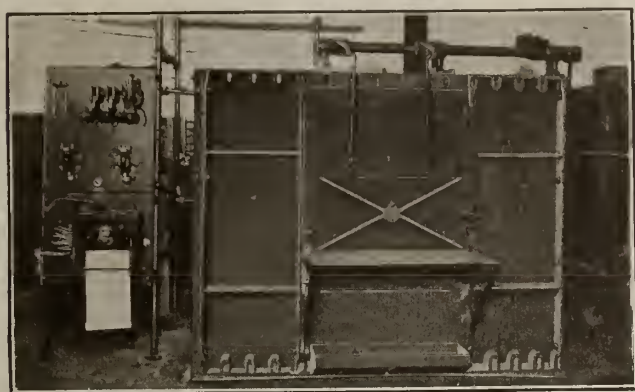
Dead atmosphere exists in furnace normally as there is practically no circulation of air through furnace.

Temperature controllable, prevents formation of slag cinders. Hence metal may be readily recovered without crushing operation.

Furnace may be "forced," i.e., heat may be fed to metal as fast as latter will absorb it, and a high rate of melting results, with many of the advantages and none of the disadvantages met in fuel-fired furnaces.

Electric Heat Treating Furnace.

For heat treating processes in the manufacturing industries requiring temperatures from 900° Fahr. to 1800° Fahr., chief among which are hardening, drawing and annealing of carbon steels, drawing high speed steels, annealing brass and copper, and baking vitreous enamels, the GENERAL ELECTRIC COMPANY has developed a type of electric heating unit which is adapted to either horizontal furnaces or vertical cylindrical furnaces. In conjunction with this design of heating unit, there has been developed an automatic temperature recording and controlling system.



ELECTRIC RESISTANCE FURNACE AND CONTROL

Some of the advantages of electric heat treating furnaces constructed and equipped with heating units and temperature control system are: automatic control of the temperature giving minimum temperature variation in the furnace; maximum rate of heating the charge; maximum efficiency in heat treating and elimination of scale due to oxidation.

Heat treating problems should be referred to the Industrial Heating Specialists located in our nearest office.

Muffle Furnace.

The Electric Muffle Furnace meets the demand for a convenient, economical and durable furnace for temperatures up to about 1550° Fahr. For heat treating carbon steel, baking vitreous enamel, experimental purposes, etc., this furnace is very economical.

Electric Sherardizing Machines.

Metal to be rendered non-corrosive is sherardized by being electrically heated in the presence of zinc. In order to secure the best results and obtain uniformity as well as durability of coating it is necessary to have unvarying quality of zinc dust and to maintain a certain correlation between the composition of this dust and the sherardizing temperature. Electric heat is ideal for this purpose as the temperature can be maintained with absolute certainty. Articles so coated may be bent, swaged or

otherwise deformed, at ordinary room temperature, without injury to the coating.

Bulletin 48926 gives other points regarding this process.

Oil Tempering Baths.

The oil tempering bath for tempering carbon steels is safe, efficient and easy to operate. It is made in different sizes, heats up very quickly and can be held at any temperature.

Bulletin 69700.

Electric Rivet Heater.

Industrial progress has created a demand for an efficient, portable and self-contained rivet heater. The objections to the old heating methods with the attendant expense of handling fuels or the installation and maintenance of piping together with the problem of disposing of waste gases, cinders and dust, are eliminated in the flexible G-E Electric Rivet Heater in all classes of work.

The standard sizes of G-E Electric Rivet Heaters are 5 kw., 2-jaw for rivets up to 1/2 in., and 15 kw., 2-jaw for rivets up to 1 1/4 in. These heaters are intended to supply the maximum requirements of one gang of riveters.

Bulletin 69701.



ELECTRIC RIVET HEATER

Electric Soldering Iron.

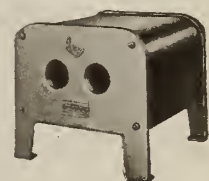
The Electric Soldering Iron is efficient and convenient. For light or intermittent work it is one of the most useful of the electrically heated devices for industrial purposes.

The soldering irons manufactured by the GENERAL ELECTRIC COMPANY have been on the market for a number of years and have given general satisfaction. Made in various sizes.

Bulletin B3514.



ELECTRIC SOLDERING IRON



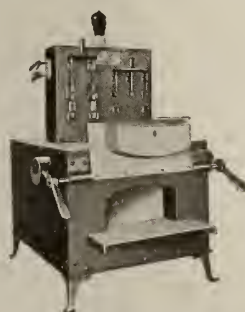
SOLDERING IRON FURNACE

Electric Muffle Furnace for Soldering Irons.

For light and intermittent service, the self-contained electric soldering iron is very satisfactory, but for moderate and heavy duty work it is frequently desirable to use the ordinary soldering copper which must be heated in a furnace or open flame. Appreciating that fuel-fired furnaces have many disadvantages such as noxious fumes, excessive heat, a high fire risk, etc., an electrically-heated two-compartment muffle furnace for this purpose has been developed.

The furnace consists of two special steel alloy muffles wound with nichrome wire on insulators made of a compound which retains its electrical resistance at high temperatures.

The 110-volt furnace, by means of a 3-way switch, provides three heats.



MUFFLE TYPE HEAT TREATING FURNACE



ELECTRICALLY HEATED SHERARDIZING MACHINE

The 220-volt furnaces can be operated only on one heat as both the muffles are in series.

Bulletin 69702.

Generally speaking, the 1500-watt furnace is suitable for irons up to 2½ lb. in weight per muffle. For heavier irons, the 2000-watt furnace should be used.

Cartridge Heating Units.

For concentrated or localized heating, the cartridge unit provides a more efficient method of heating than gas or steam.

The G-E cartridge unit can be furnished for operation on any commercial voltages from 100 to 250 volts.

These units are now being used extensively in shoe manufacturing and cigarette and paper box machinery, and for heating glue pots, soldering irons, small boilers, etc.

Metal Melting Pots.

The GENERAL ELECTRIC COMPANY has developed a new electrically operated device for melting lead, babbitt, and similar metals, called the Self-Regulating Metal Melter. The automatic regulation which is the principal feature of this new melting pot, has been obtained by making the heating element of wire with a positive temperature coefficient. That is, when the temperature of the heating element rises, its resistance rises proportionately and limits the current. When cold metal is put into the container it is melted quickly by the initial rise of current after which the current automatically decreases to a value just sufficient to keep the metal molten.



30 LB. ELECTRIC METAL MELTER

Electric Glue Pots.

Electric glue pots are being widely and successfully used in wood shops, binderies, etc. The water-jacketed type is recommended where glue is used intermittently as it permits the use of a high starting heat to melt the glue quickly.

The jacketless type for continuous service automatically maintains the correct working temperature and operates on about one-half the current required for the average jacketed pot.

Bulletin 69100.



WATER JACKETED ELECTRIC GLUE POT

Industrial Kettles.

The GENERAL ELECTRIC COMPANY is prepared to furnish heating equipment for kettles and tanks for heating various substances; such as oil, paraffin, solutions, compounds, etc., where the purchaser provides the tank and foundation and installs the heating equipment.

When requesting prices submit complete requirements.

Arc Furnace Equipment.

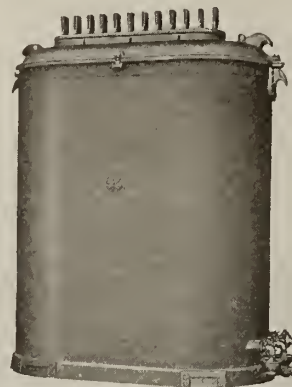
The GENERAL ELECTRIC COMPANY can supply all the electrical equipment needed in connection with any type of electrical arc furnace.

The company is constantly developing new types of equipment necessitated by the rapid advance going on in the utilization of electrical heat in industrial operations.

Designers of furnaces for reduction of ores, for production of abrasives, production of ferro-alloys, steel, electrolysis of fused salts, fused silica products, carbon bisulphide, calcium carbide, fixation of atmospheric nitro-

gen, and a multitude of other electrothermic developments, will find the GENERAL ELECTRIC COMPANY's experience in this line of value.

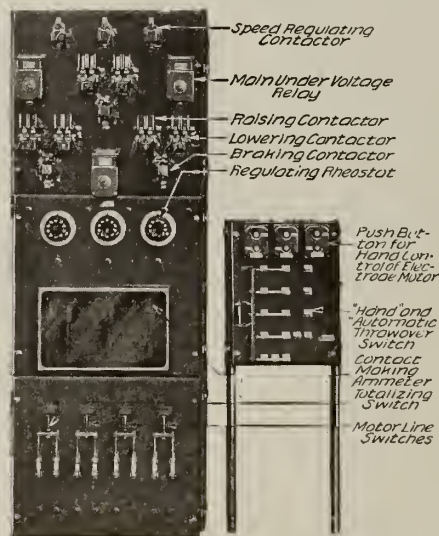
The equipment includes such specialties as automatic electrode regulators, motor-operated multiple-pole switches for controlling power supplied to the furnaces, voltage regulating devices, special transformers, such as



ELECTRIC FURNACE TRANSFORMER

the multi-tap transformers used in connection with graphite furnaces, which permit periodical change of voltage, special reactances for steel furnaces, etc.

The design of a proper electric furnace for an industrial chemical operation is a problem in electrical engineering as much as in chemistry or metallurgy. The furnace specialists of the GENERAL ELECTRIC COMPANY



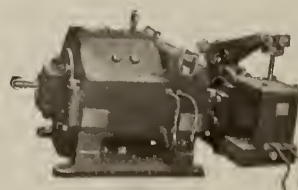
HAND AND AUTOMATIC PANELS FOR ELECTRODE CONTROL

will co-operate with you with regard to the proper design of your furnaces from the electrical engineering point of view, advising as to all the latest improvements in regulating devices, transformers, etc., and as to the best utilization of the sources of energy at your disposal.

Bulletin 48710A.



ELECTRODE MOTOR



TILTING MOTOR

Motors and Control.

The GENERAL ELECTRIC COMPANY has developed a complete line of motors suitable for every kind of service.

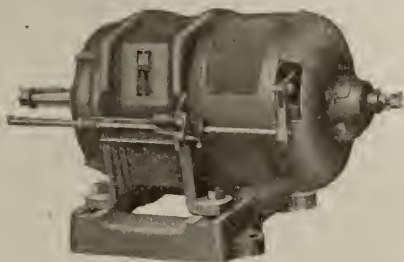
A few of the many types made by the company are described herein. For further information, consult the nearest office or send for bulletins referred to.

Reliable and efficient starting and controlling apparatus has also been developed for the successful operation of motor installations. Control devices recommended for the various motors are listed on the following pages together with brief descriptions. For further information our bulletins should be consulted.

A. C. Brush Shifting Motors.

BTS ALTERNATING CURRENT MOTORS—Give an infinite number of speeds and high efficiency at all of them. Speed changes, starting and stopping, are obtained in a simple manner by merely shifting the brushes.

Motors have been developed in 60 cycles from 10 to 100 h.p. inclusive. Slow speed 25-cycle motors can be furnished for 100, 125 and 150 h.p.



ALTERNATING CURRENT BRUSH SHIFTING MOTOR

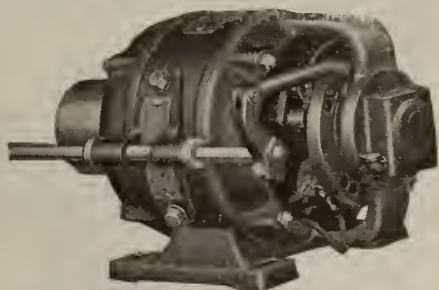
Control for BTS Motor—CR6055 brush shifting controller gives a variation of 50% below synchronous speed or any intermediate speed by shifting brushes.

Movement of controller handle, to which is attached a chain for moving brush rigging, also opens and closes the line circuit as required and can reverse direction of motor.

TYPE BSS BRUSH SHIFTING MOTOR—Single-phase, varying speed brush shifting motors are furnished in sizes $\frac{1}{4}$ to $7\frac{1}{2}$ h.p., 1200 to 1800 r.p.m., 60 cycles. Voltages, interchangeable on 110 or 220-volt circuits. Type BSS is suitable for constant torque, belt or chain drive (fans and blowers, printing presses, refrigerators and laundry machinery, etc.), and will permit 50% speed reduction against full load or three-quarters load torque.

Has the following leading characteristics:

Quick acceleration (2 to 5 seconds from start), no tendency to spark. Entirely automatic in action, no in-



SINGLE PHASE BRUSH SHIFTING MOTOR

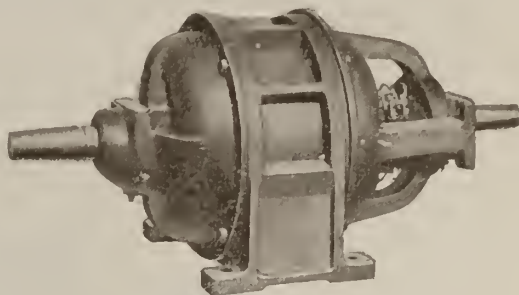
ternal clutches or starting devices. Power factor, full load 90 to 99%, no load 80%. Efficiency high at all loads. Overload capacity, 50% momentarily. Starting torque; will start and accelerate loads having two and one-half times full load torque.

Bulletin 61401.

Control for BSS Motor—Same as for BTS Motor, described above.

A. C. Hoist Variable Speed Motor.

MTC alternating current, 3-phase motors give a maximum torque for a given weight and are very strong mechanically.



A. C. VARIABLE SPEED HOIST MOTOR

They are used for hoists and similar service of an intermittent nature where the limiting feature depends upon the frequent starting and accelerating torque required. These motors are regularly furnished with open frames and taper shafts on each end for gear and solenoid brake. MTC motors are furnished in standard capacities of 1 to 300 h.p.; 60, 40 and 25 cycles. MQC and IQC designate 2-phase motors and cover same range as MTC and ITC motors.

CONTROL FOR ABOVE MOTORS—CR 3202 drum type controllers are regularly recommended for capacities up to 112 h.p.

Drum controllers are rated in current capacities owing to the wide range of secondary currents of slip ring motors of same horsepower. The CR 3221, CR 3223 and CR 3232 resistors ordinarily furnished with this control, consist of cast grid resistance units mounted in frames, and may be bolted together to form a single unit if desired.

Bulletins 68200B and 68205.

For motors of larger capacity, the magnetic type of control is used. Information obtained by addressing the nearest office.



DRUM CONTROLLER

A. C. Variable Speed Motor.

Form MT motors with phase wound rotors and external resistance are adapted for service requiring frequent starting under load, or starting of loads with high inertia. High starting torque is obtained with a comparatively small amount of current from the line.



FORM MT VARIABLE SPEED INDUCTION MOTOR

Standard rating, 60 and 25 cycles up to 200 h.p. Special rating to 6000 h.p.

High speed Form MT induction motors, ranging from 75 to 350 h.p., 1800 r.p.m. for direct connection can be furnished.

CONTROL FOR MT MOTOR—CR 1023 rheostats control the secondary circuit of Form MT or slip ring induction motors during the starting period, Bulletin 68331. They are intended for light service only, and where severe service is required, CR 3202 and CR 3204 drum type controllers with resistance are recommended. Both types of drum controllers are similar to control described for ITC motors.

Bulletins 68200B and 68205.

For automatic control of constant speed Form MT or slip ring motors, CR 2351 self-starters are advised. These starters are designed for use with motors driving pumps, air compressors, etc., where it is desired to automatically start and stop motor in order to control fluid level or pressure.

Bulletin 68406A.

Accessories for remote control can be supplied, such as CR 2931 float switch, Bulletin 68501; CR 2922 pressure governor, Bulletin 68411; CR 2925 pressure switch.

Bulletin 68502A. **SPEED REGULATOR AND AUTOMATIC SELF-STARTER**

Where it is desired to regulate speed of slip ring induction motors, CR 1260 and CR 1261 rheostats, Bulletin 68333, are available for the smaller sizes of motors. They are capable of reducing the speed 50% from normal at full load torque. For motors above 10 h.p., CR 3202 drum controller with resistance is recommended.

Bulletin 68200B.

See description under control of ITC motor.

For automatic control of variable speed motor, information will be furnished on request.

A. C. Constant Speed Motors.

TYPE RI—Constant speed, single-phase, induction motors furnished in sizes $\frac{1}{4}$ to 15 h. p. Frequencies, 25, 40 or 60 cycles. Voltages interchangeable for 110 or 220-volt circuit.

Bulletins 41507A, 61200.

Reversing service, Type RI motors furnished in sizes $\frac{1}{4}$ to 5 h.p. Standard RI non-reversible motors may be made reversible with reduced rating by simply adding 4 leads and re-setting brush yoke.

Reversible RI motors are especially useful for application to elevators, small cranes and hoists, laundry machinery, etc.

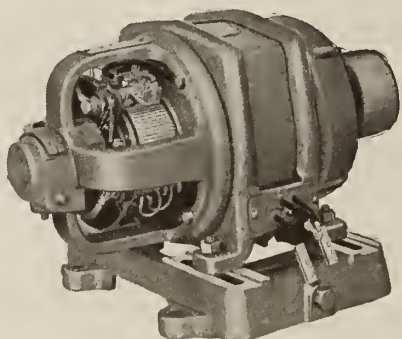
Have the following leading characteristics:

Quick acceleration (2 to 5 seconds from start), no tendency to spark. Entirely automatic in action, no internal clutches or starting devices. Power factor, full load, 90 to 99%; no load, 80%. Efficiency high at all loads. Overload capacity, 50% momentarily. Starting torque: will start and accelerate loads having two and one-half times full load torque.

Bulletin 61508.



TYPE RI SINGLE PHASE INDUCTION MOTOR



Control for Type RI Motors—Constant speed Type RI motors can be thrown directly on the line without injury to the motor. However, in sizes above 5 h.p. the use of a starting rheostat is usually recommended. The CR 1025 (built for all sizes of RI motors) will reduce starting current to approximately one-half normal. Bulletin 68328.

The following control devices are also available for Type RI motors:

CR 1038 totally enclosed knife switch for motors, 220-volt, 3 h.p. and smaller; 110-volt, $1\frac{1}{2}$ h.p. or smaller.

The C R 1038 switch is a quick make-and-break single throw switch and is provided with time limit protective plugs which guard the motor against overload. Accidental closure impossible—a push opens and a pull closes the switch. The switch is limited in capacity to 3 h.p., 110 volts, and 5 h.p., 220, 440 and 550 volts.

Bulletin 68305B.

The FP 3 and FP 6 oil circuit breakers are designed for starting and controlling induction motors of 25 h.p. or less at 600 volts or with normal current ratings not greater than 50 amps. at voltages less than 600.

Arranged for either open or conduit wiring.

Can be opened or closed by hand or mounted out of reach of operator and be operated from a distance by a shipper rod. Cannot be left in partly opened or closed position and contacts cannot be jarred open by vibration. Bulletin A4113.

See page on oil circuit breakers for references to other types for controlling induction motors.

TYPE KT MOTORS—Polyphase induction motor—Riveted or skeleton frames—Range $\frac{1}{4}$ to 750 h.p. Standard ratings: 110 volts, $\frac{1}{4}$ to 15 h.p.; 220 volts, $\frac{1}{4}$ to 100 h.p.; 440 and 550 volts, $\frac{1}{4}$ to 750 h.p. and 2200 volts, 20 to 750 h.p. Adaptable for driving all classes of machines requiring constant speed.

Bulletins 41302A, 61505B and 61300A.

High speed Type KT induction motors ranging from $\frac{3}{4}$ h.p., 3600 r.p.m. to 300 h.p., 1800 r.p.m. for direct connection can be furnished. These motors are especially adapted for driving centrifugal pumps or for similar service.

Type KT multispeed induction motors are wound for 60-cycle 3-phase service only. Standard voltages 220-440 and 550. These motors may be furnished up to 12

h.p. at four constant speeds—1800, 1200, 900, 600 r.p.m. Constant horsepower motors are suitable for machine tools, etc., and constant torque motors for operating fans, blowers, printing presses, etc.



TYPE KT CONSTANT SPEED INDUCTION MOTOR

Control for KT Motor—Many of the smaller sizes of squirrel cage induction motors can be thrown directly

Continued on next page

on line, and for such purposes motor starting switches CR 1038 and CR 1031 are recommended.

CR 1031 switch (4-pole, double throw) is provided with a low voltage release and time limit overload relays. Recommended for use with motors up to $7\frac{1}{2}$ h.p. on standard voltages.

Bulletin 48302A.

Both types of switches combine all the necessary features for protecting the operator.

CR 1034 compensators are recommended for type KT or squirrel cage induction motors. They are provided with inductive windings arranged with suitable taps. The switch is immersed in a tank of oil. Each compensator is equipped with low voltage release. In addition, fuses or overload relays can be furnished. The CR 1034 is ruggedly constructed, all parts being enclosed, protecting them from mechanical injury.

Bulletin 68304.

For remote or automatic control of Form KT or squirrel cage induction motors, CR 2361 automatic compensators are recommended. These compensators are particularly adapted for use with motors driving centrifugal and reciprocating pumps, air compressors, fans, blowers, punch presses, belt conveyors, shears, line shafting, woodworking machinery, etc., when automatic starting and stopping is required. Low voltage release is an inherent feature and overload relays can be furnished if desired.

Bulletin 68404.

The CR 7052 automatic starting compensator is designed for safe control of squirrel cage induction motors. Safe operation has been obtained by completely enclosing all live parts in a metal case with provision for padlock. Safety to the motor is assured through automatic acceleration and by effective overload and under voltage protection.

The enclosing case is hung from a detachable conduit box which is installed first and used as a pull box. Conduit may be run directly to this box from above, below, or either side.

The CR 7006 Enclosed Magnetic Switch for starting small alternating current motors is light in weight and can be readily mounted where convenient. Protection is afforded against excessive motor endangering overloads by inverse time element relays. The operation of these relays is such that during short peak overloads the motor will not be shut down.

When operated by push buttons, operators are protected against unexpected starting of motors. When operated by float switches or pressure governors, motors restart immediately upon return of power—if switch is closed.

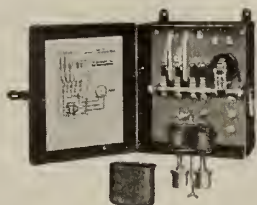
Bulletin 68415A.

Accessories for remote control can be supplied, such as CR 2931 float switch, Bulletin 68501; CR 2922 pressure governor, Bulletin 68411; CR 2925 pressure switch, Bulletin 68502A.



CR 1034 COMPENSATOR FOR INDUCTION MOTORS

CR 7052 AUTOMATIC COMPENSATOR



CR 7006 MAGNETIC STARTING SWITCH

A. C. Constant and Variable Speed Mine Type Induction Motors.

TYPE HI MOTORS—Specially designed for mining service. They have high starting effort and large capacity for severe overloads. End shields can be removed without disturbing back shaft. Built in standard sizes from 5 to 75 h.p., 3-phase, 60 cycles, 220, 440 and 550 volts, with or without back gearing.

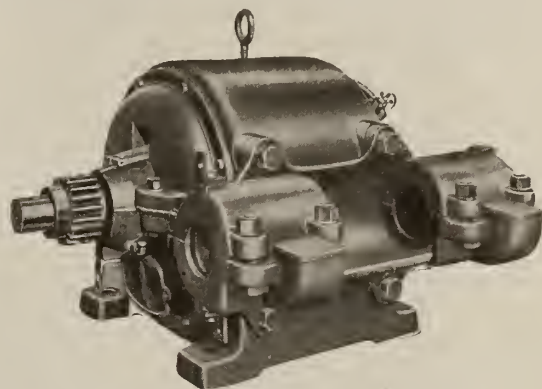
Control for HI Motor—CR 1034 compensator for ordinary starting of HI Form K squirrel cage motors is recommended and is described under control for Type HI motor.

Bulletin 68304.

CR 3202 drum controller is adaptable for starting HI Form M slip ring induction motors.

Bulletin 68200B.

Described under control for polyphase Form ITC induction motor.



INDUCTION MOTOR FOR MINE SERVICE

SYNCHRONOUS MOTORS—While the synchronous motor may be applied to most any industrial service, its greatest value is obtained when used on circuits with a need for power factor correction, indicated as follows:

(1) When the power factor is low and greater generator, transformer or feeder capacity is required.

(2) When power is purchased at a rate which is now, or shortly may be, dependent upon the power factor of the load.

(3) When the voltage regulation is poor on account of an existing induction motor load and production falls off in consequence.

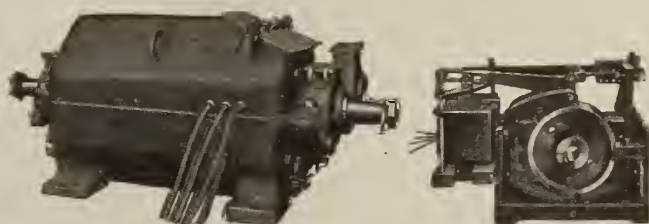
(4) When continuity of operation is imperative and dirty operating conditions make a small motor air gap inadvisable.

The GENERAL ELECTRIC COMPANY has designed complete lines of synchronous motors covering a wide range of speeds and capacities which are in extensive use throughout many industries driving rolls, compressors, pumps, grinders, crushers, blowers, fans, conveyors, etc.

Bulletin 41309. Our engineers will be pleased to supply additional information on request.

A. C. and D. C. Mill Type Constant Speed Motors.

MI and MD mill type motors, for severe steel mill service, require special designs. In addition to cranes



MILL TYPE MOTOR AND SOLENOID BRAKE

and reversing auxiliary machinery in steel plants, mill type motors can be applied with advantage as follows: Ore and coal bridges and unloaders; charging machines

of all types—for example, gas works, coke pushers, levelers, etc.; heavy duty fabricating shop and erecting shop cranes; high grade factory cranes, electric shovels, dipper dredges, capstans, gates, valves, etc.; on canal locks, draw and lift bridges; small heavy duty hoists.

Mill type motors furnished totally enclosed in sizes from 3 to 150 h.p. for 25-cycle, 220 and 440 volts A. C. and 230 and 550 volts D. C. Open type motors furnished from 25 to 150 h.p. A. C. and 6 to 200 h.p. D. C. for continuous duty.

CONTROL FOR MILL TYPE MOTORS—Drum controller CR 3202, described under control for MTC motors, is recommended for general application for controlling the type MI motor.

Bulletin 68200B.

MD Motor Control—CR 3100 drum controllers provide either for non-reversing or full reverse rheostatic control of series or compound wound MD motors. Dustproof covers protect moving and live parts from dust, dirt and accidental contact by operator.

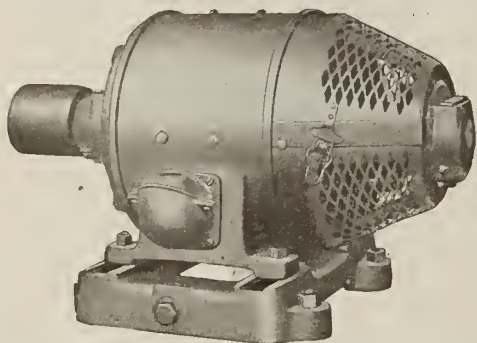
Bulletin 68202.

CR 9510 solenoid brake for either MI or MD motors is arranged for mounting either on floor or motor and possesses all the features demanded by modern practice. These brakes are self-contained, automatic or self-adjusting, and are designed to withstand the most severe service. Solenoid Brake.

Bulletins 48900 and 68010A.

D. C. Constant Speed Motor.

The Type RC motor may be classed as the universal D. C. motor. Furnished for constant speed, shunt wound for conditions requiring close speed regulation, compound wound for conditions demanding heavy starting torque or where violent power fluctuations occur, series wound where load either possesses fixed values or may be made subject to automatic or manual control.

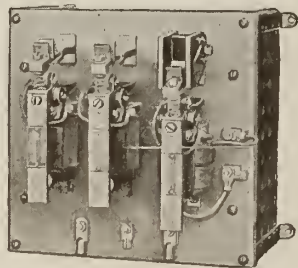


CONSTANT SPEED D. C. MOTOR, SEMI-ENCLOSED

All RC motors are shipped for floor installation. Readily arranged for wall or ceiling suspension.

Bulletins 41013, 61014.

CONTROL FOR RC MOTORS—CR 1000 dial type rheostat is recommended for ordinary starting service of RC motors, Bulletin 68332. Where the service is more severe, CR 3100 drum controller should be used. Bulletin 68202.



STARTING RHEOSTAT AND CURRENT LIMITING SELF-STARTER

SWEET'S CATALOGUE

tin 68202. Drum controller can be supplied for reversing or non-reversing service.

Where it is desired to start motor automatically or from remote points, there are several types of self-starters that can be used. Counter EMF self-starters, such as CR 2301-2-3-5-6, automatically close the line circuit through starting resistance, then automatically short circuit the resistance after the counter EMF has reached a predetermined value, Bulletin 68409. The current limiting type of self-starter—CR 2201-2-3-4-6—closes the line circuit through starting resistance, then automatically cuts out each step as the current falls to a predetermined value, Bulletin 68410. Accessories can be supplied, such as CR 2931 float switch, Bulletin 68501; CR 2922 pressure governor, Bulletin 68411; CR 2925 pressure switch.

Bulletin 68502A.

D. C. Crane and Hoist Variable Speed Motor.

CO 1800 CRANE AND HOIST MOTORS—CO 1800 crane and hoist motors are designed for intermittent service requiring a maximum torque motor of ample overload capacity, enclosed, reversible and series wound. Suitable for floor, wall or ceiling mounting. End shields, feet and shaft extensions same on both ends. Furnished with or without back gear. Top half of frame can be lifted off without disturbing back gearing. Shaft can be removed without disturbing windings or commutator. All parts arranged to facilitate repair and permit easy inspection.

Sizes range from 2 h.p. to 65 h.p., 115 and 230 volts, and to 50 h.p., 550 volts. Electric brakes of half or full torque capacity can be supplied to insure a quick, sure stop.

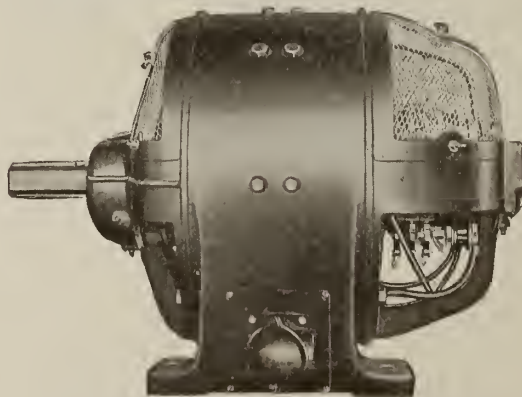
Bulletin 68100A.

Control for CO 1800 Motors—CR 3100 Drum Controller and CR 9510 Solenoid Brake. Described for control of MD Mill Type Motors.

D. C. Adjustable Speed Motor.

RF ADJUSTABLE SPEED MOTOR—RF adjustable speed, commutating pole motors have been designed for machine tool and similar service where wide variation and adjustment of speed independent of load is required. Built with removable shaft, split back end shield and bearings which facilitate repairs and changes. Conduit terminal bases protect connections and operator.

Bulletins 41021A and 48029.



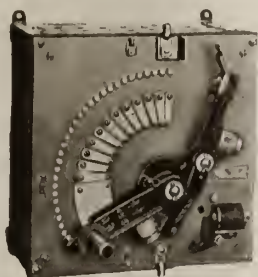
TYPE RF ADJUSTABLE SPEED D. C. MOTOR

Continued on next page

Made in sizes from 2 to 50 h.p., 230, and 550 volts. Speed adjustment by field 2 to 1, 3 to 1 or 4 to 1.

Type RA motors in sizes from $\frac{1}{2}$ to $1\frac{1}{2}$ h.p., 115 and 230 volts. Speed adjustment 2 to 1 or 3 to 1.

Control for RF Motor—CR 1200 dial speed regulator is recommended for light service. This regulator contains starting resistance which will allow a 2 to 1, 3 to 1 or 4 to 1 speed variation by weakening shunt field of motor. Bulletins 48320 and 68336.



SPEED CONTROLLING RHEOSTAT

Where service is severe, the CR 3105 drum type controller is recommended. On smaller sizes both armature and field resistance are mounted on back of controller; while on larger sizes field resistance only is mounted on back of controller, and the armature resistance being mounted as a separate unit. In case under voltage or overload protection is required, CR 3170 panel is recommended.

Bulletin 68204.

Fractional Horsepower Motors.

The GENERAL ELECTRIC COMPANY has studied extensively the problem of electric motor application to small tools, etc., and out of its familiarity thus gained, is in a position to help other manufacturers who have small tool power application problems.

Type SA, SD, SDA, RSA, RKT and RKQ. Fractional horsepower motors rating from $1/200$ to $3/4$ h.p. inclusive are available.

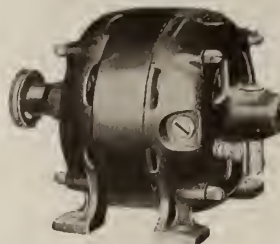
Alternating current Type SA and direct current Type SD motors are, for corresponding ratings, mechanically interchangeable.

Type SDA line are series wound motors, and the A. C. and D. C. motors of corresponding ratings, being built in the same frames, are therefore mechanically interchangeable.

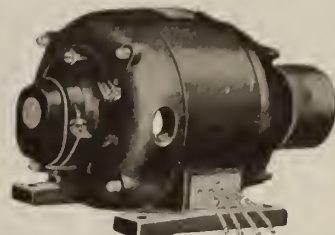
The Type SA and RSA are constant speed, single-phase motors, and can be furnished for standard frequencies.

Types RKT and RKQ are polyphase, constant speed motors, and can be furnished for standard frequencies.

All types with the exception of the Type SDA mo-



Type SD



Type RSA

FRACTIONAL HORSEPOWER MOTORS

tors can be furnished with back gearing equipment for slow speed service.

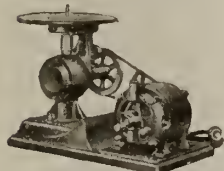
Control for fractional horsepower motors may be either push button, lever switch or rheostat.

Bulletins 61509 to 61512.

Following is a partial checking list of applications of fractional horsepower motors. These applications may in themselves not solve all problems but may suggest a means whereby they can be solved.

Air compressors	Weighing machines
Bag filling machines	Winding machines
Fans, blowers and exhausters	Centrifuges
Boiler tube cleaners	Screwdrivers
Conveyors	Vibrators
Drill presses	Boring machines
Portable drills	Drying drums
Flow surfacers	Valve operation
Buffers, grinders and polishers	Nailing machines
Lathe drive	Pipe cutters
Machine tools	Planers
Oscillators	Punch presses
Riveting machines	Shears
Saw setters or trimmers	Stone dressers
Spinning machines	Saws: hack, band, circular and jig
Automatic switches	Pumps: oil, water, gasoline, vacuum, etc.

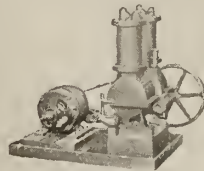
Some of these applications are illustrated below. The devices are not manufactured by the GENERAL ELECTRIC COMPANY but show uses for which the small G-E motor is admirably adapted.



Die Filing Machine



Bench Planer



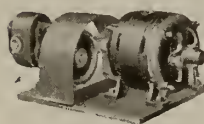
Air Compressor



Lectroflator



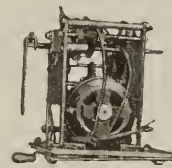
Portable Riveter



Rotary Oil Pump



Bench Riveter



Automatic Heat Regulator



Portable Electric Drill



Disk Grinding Machine



Water Wheel Governor



Water Pump



Power Saw



Automatic Buffing and Polishing Machine

A FEW APPLICATIONS OF G-E FRACTIONAL HORSEPOWER MOTORS

Fort Wayne Electric Rock Drills.

These drills are in extensive use in tunneling and mining operations.

They are of the rotary hammer type operated by a fully enclosed splashproof electric motor (A. C. or D. C., single-phase excepted), which can be removed and replaced in 1 minute. Motors are designed for 50% overload and can be mounted on drill so that an A. C. motor may be instantly substituted for a D. C. motor and vice versa.

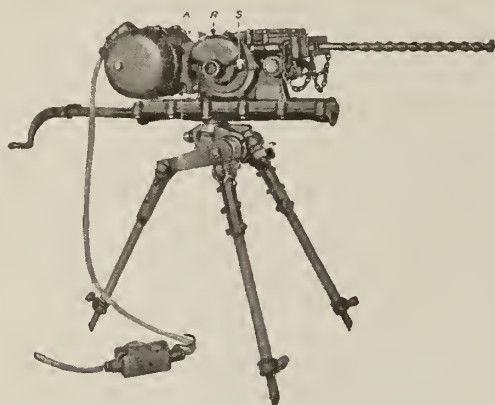
Any desired speed can be obtained by means of a belt tightener.

These drills strike 1700 blows per minute, each blow having maximum cutting effect. They will cut holes up to 12 ft. deep, finishing at 1½ in. diameter, and can be handled by 2 men.

Power consumption is 1½ to 2 h.p. as compared to 12 to 18 h.p. for air drills of equal capacity.

Drill steel can be changed without the use of wrenches or other tools.

Drills can be mounted on tripod, column, shaft bar, gadder post or quarry bar.



FORT WAYNE ROCK DRILL

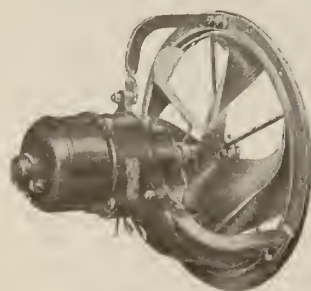
Motor Driven Exhaust Fan Outfits.

G-E exhaust fan outfits are self-contained units, adapted for ventilating shops, factories, office buildings, etc., or for use in dye houses, laundries, paper mills and other industrial establishments where it is desirable to remove steam, moist air, dust, smoke and odors, or to exhaust noxious gases and fumes which attend certain processes of manufacture.

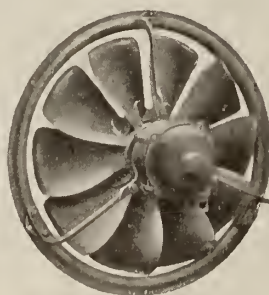
These outfits may be usefully employed to dry cloth, paper, wool, tobacco, asbestos, bricks, clay and many other articles of merchandise.

Made in disk and propeller types for both A. C. and D. C. standard voltages, ranging in sizes from 12½ to 48 inches, capacities from 750 to 25,900 cu. ft. of air per minute.

Bulletin 41801.



PROPELLER FAN



VENTURA DISK FAN

Fabroil Gears.

Fabroil gears are superior to other non-metallic gears by virtue of a measure of elasticity which allows meshing teeth to come to a good bearing across the full width of face, and absorbs shock of rapid variation of torque.

Because of their noiseless operation, long life and high tooth strength, Fabroil gears are applicable to lathes, planers, traveling cranes, drill presses, shears, punches, etc.; shafts of back-gear motors which drive machine tools; drive of spinning frames in silk, worsted, carpet and similar mills; heavy machinery of paper and pulp mills; intricate mechanism of printing plants; automobile and other gas engine ignition drives; timing gear-trains.

While in some instances they run with success at 4000 ft. per minute, maximum speed should be kept at 2000 ft. per minute, for all general applications.

ADVANTAGES—Strong as the best cast iron.

Not liable to damage from contact with oil.

Unaffected by atmospheric changes and neither shrink nor swell in extreme dryness or dampness.

Absolutely vermin-proof.

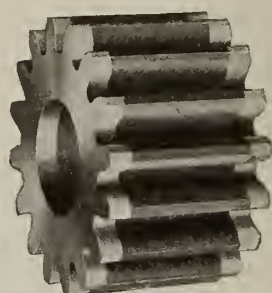
Elasticity of tooth sufficient to absorb shocks.

Long life.

Run equally well against cast iron, steel or bronze.

Can be run in cold or hot oil baths.

Bulletin 48703A.



FINISHED FABROIL GEAR

Portable Air Compressors.

The small G-E reciprocating compressors, such as are used to supply air brakes on electric street cars, are particularly applicable for blowing out machinery in industrial plants.

These compressors are built with either induction motors or D. C. motors of any commercial frequency or voltage.

The motor and compressor are so designed and built as to form one unit.

The compressors have 2 horizontal cylinders, single action, single stage, geared between cranks by herring-bone gear.

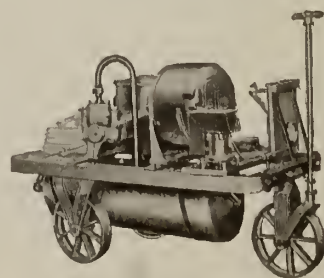
The lubrication of all bearings is entirely automatic and abundant, being carried up by the gear to distributing panels which supply all bearings.

Electrical design of the motors is best suited to the purpose, because it is not limited by the gear centers. No separate gear case is required, as all gearing is contained in the compressor frame.

G-E compressors are furnished either as portable sets or as stationary equipments complete with automatic pressure governor, reservoir, line switch and fuses and pressure gage.

For blowing out electrical apparatus or knitting machinery and the like, either machines of 15 or 25 cu. ft. displacement per minute are used at pressures of 50 or 60 lbs. per sq. in.

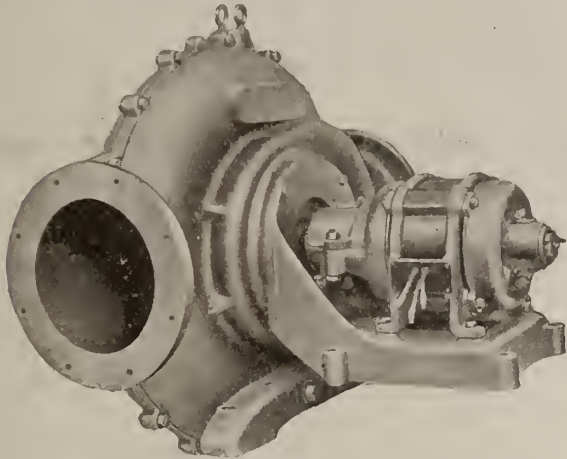
Bulletin 48610.



PORTABLE AIR COMPRESSOR

Centrifugal Blowers.

G-E centrifugal blowers or compressors are designed for large volumes and low pressures such as are required for the following classes of service: oil and gas burning furnaces, foundry cupola blowing, pneumatic mail and cash conveying systems, pneumatic coal and ash conveying systems, agitation of liquids, sewage treating plants, blowing water gas generators, etc.



STANDARD SINGLE-STAGE CENTRIFUGAL BLOWER DRIVEN BY DIRECT CONNECTED INDUCTION MOTOR

These blowers are similar in design to the well-known centrifugal pump. They may be driven by D. C. motors with auxiliary apparatus for starting and controlling speeds, 60-cycle induction motors for constant speed service or by Curtis steam turbines. Blower and driver are direct-connected, the complete unit requiring at most 3 bearings and usually only 2 bearings.

The G-E centrifugal blower differs from the ordinary fan blower in that it is provided with discharge or diffusion vanes which convert the otherwise lost energy of velocity into pressure energy, resulting in high overall efficiency. Blower is completely housed.

G-E centrifugal blowers will deliver practically constant pressure over a wide range of loads. The internal clearance is very large, thus there is no rubbing and no internal lubrication is required. Dimensions are small, thus minimum floor space is required. These blowers may be fitted with a constant volume governor which is simple in action, positive, accurate and safeguards machinery in case of breakdown.

Bulletins 48601, 48609, 42801.

STANDARD SINGLE-STAGE BLOWERS—Induction motor and D. C. motor driven, are furnished for varying speeds and pressures. Capacities of 350 to 10200 cu. ft. per min. Curtis steam turbine driven blowers are arranged for steam pressures of 80 lbs. per sq. in. and up, condensing or non-condensing. For varying speeds and pressures. Capacities of 600 to 10200 cu. ft. per min.

LARGE MULTISTAGE CENTRIFUGAL BLOWERS—Driven by Curtis Steam Turbines or 60-cycle induction motors. Capacities of 3000 to 55,000 cu. ft. per min.

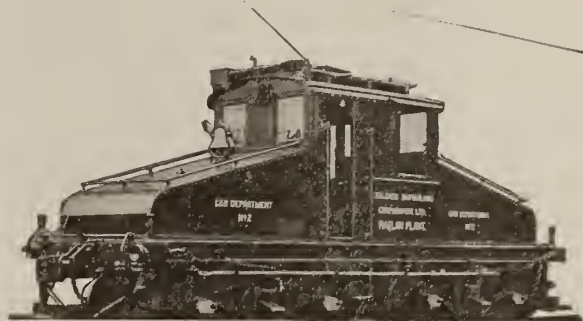
SMALL MULTISTAGE CENTRIFUGAL BLOWERS—Developed in three types to meet the demand for blowers of smaller volume capacity than the single-stage sets.

Electric Locomotives.

The GENERAL ELECTRIC COMPANY builds electric locomotives for moving all classes of rolling stock. A separate engineering organization is maintained for this class of work. The largest type for heavy freight service built by this company is a 280-ton locomotive.

A modern high speed gearless passenger locomotive weighing 265 tons is described in Bulletin 44102.

The GENERAL ELECTRIC COMPANY's standard type of 25-ton electric locomotive is designed to meet the service conditions where trains of medium weight have to be hauled over tracks which do not include excessive grades. Its weight may vary anywhere between 22 and 35 tons, according to the service requirements.



35-TON ELECTRIC SWITCHING LOCOMOTIVE

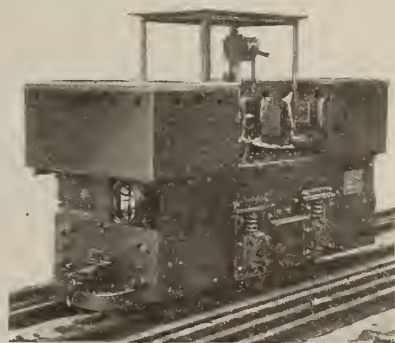
This type of locomotive has been extensively used as a switching unit in large industrial plants and for switching service in the terminals of interurban roads. The design is such as to give maximum economy in materials of construction and at the same time maximum strength and rigidity. In general the equipment comprises four 40 to 75 h.p. motors.

Almost every interurban road will find an electric locomotive a useful adjunct to its regular equipment. Two advantages are to be obtained by reserving a separate unit of this kind to switch freight at terminals and to haul trains. The regular motor cars are released from this class of duty and, secondly; the equipment of the locomotive, being specially designed for freight service, is capable of performing it in a more satisfactory and economical manner.

Industrial Electric Locomotives.

The electric locomotive is admirably adapted to fulfill the transportation requirements of all industries and possesses many advantages over steam locomotives, animal haulage, hand trucks, etc. Its advantages are:

Consumes power only when in actual operation. Can be operated by one man of ordinary intelligence. Ready for use at all times. Has large momentary overload capacity. Possesses an easy and perfect system of control. Has comparatively few wearing parts and consequently low maintenance cost. Requires attention only when actually in use. Can be run inside a building and in other localities where smoke and fire risk of a steam locomotive would forbid its use. The inter-factory transportation of large manufacturing plants that consist of buildings scattered over considerable areas, can be most satisfactorily and eco-



4-TON NARROW GAGE STORAGE BATTERY LOCOMOTIVE

nomically handled by small electric locomotives. It is equally well adapted for service in brickyards, stone quarries, cement plants, etc., in getting ore from mines to stamp mills, hauling log trains to saw mill, in large public works and in tunnel driving.

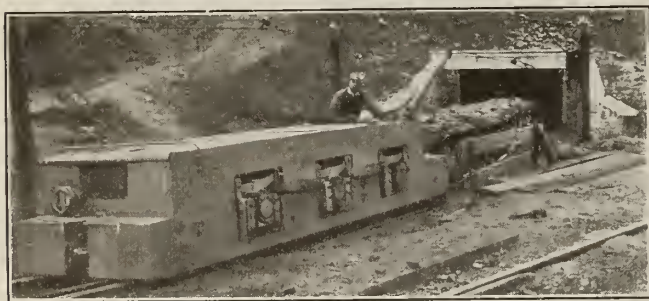
TYPE—Single truck with 2 motors, varying in weight from 2 to 25 tons. Built for gages from 18 to 56½ in. Fitted with motor equipments designed for operation on 250- and 500-volt D. C. circuits.

Bulletin 4936A.

Mine Locomotives.

G-E electric mine locomotives have been in active service for many years, which is proof of their rugged construction and of their ability to stand up under the most trying conditions.

The two-motor locomotive is recognized as the standard type for mine work. Sparkless commutation is assured by the use of special motor construction. Although this locomotive has long wheel base, it is easy on track. Weighs 20 tons, and will develop maximum drawbar pull of 12,000 lbs.



20-TON ELECTRIC MINE LOCOMOTIVE

Gathering locomotives for use for short haulages between the working face and entry of mines where the seam is thin. The locomotive is operated by simply hitching the cable to entry trolley, throwing in motor switch and operating locomotive forward and backward without danger of overrunning or kinking the cable. The reel of the motor is driven by a small vertical motor.

Storage Battery Locomotives.

Adapted for short distance hauls at low speeds handling material in and about factory buildings. By providing the elevators with tracks they can be effectively used to distribute material on different floors.



STORAGE BATTERY LOCOMOTIVE

Can be safely used in locations where sparks would involve danger.

Bulletins 64250 to 64257.

Line Material.

The GENERAL ELECTRIC COMPANY has developed a complete line of material used in the construction of overhead trolley systems and track return for electric railways in every service. This includes pole brackets,

suspensions and ears of many types, strain and feeder insulators, splicing sleeves, trolley frogs and crossings, section switches and insulators, turn buckles, rail bonds, bonding tools, etc. Special forms of these devices have been developed to meet the special conditions of mines and other industrial properties.

These devices have been designed to meet every possible condition and have been thoroughly tested. Sherardizing is the standard finish and protection for all iron and steel parts of G-E line devices. Japan finish can be furnished for use where devices are subject to the deteriorating effects of acids.



FORM N TROLLEY FROG WITH RENEWABLE PAN



CLAMPING EAR

TROLLEY FROGS—Furnished for any angle of divergence and in various forms suitable to meet all conditions. For mine work, the Type N is recommended on account of its low first cost and low cost of repairing. The worn-out pan can be easily replaced by loosening the two clamping bolts.

SECTION INSULATORS—The combined section insulator and automatic section switch, although designed especially for mine tramways, may be used to advantage in surface work.

The hand operated section insulator will permit several locomotives to enter the protected zone at one time. The switch, being located at the side of the insulator block, moves parallel to the track and is therefore easily operated from the moving locomotive. The runways are made of composition metal and overlap so that the current is not interrupted. The runway and switch contacts are easily renewable.



HAND OPERATED SECTION INSULATOR, BOTTOM VIEW

ADJUSTABLE CROSSINGS—These crossings manufactured by the GENERAL ELECTRIC COMPANY can be adjusted to any angle between 30° and 90°.

RAIL BONDS—Owing to the many types and the variation in dimensions of rails and joint plates in common use, a great variety of forms of bonds has been developed. Occasionally exceptional cases arise requiring some modification of one of the standard forms in order that the best results may be obtained. The GENERAL ELECTRIC COMPANY will gladly submit recommendations showing how best to meet any bonding conditions and its Engineering Department is always at the service of customers to give advice.



FORM G ADJUSTABLE CROSSING (UNINSULATED)



FORM II MINING SUSPENSION

Bulletins 44004A and 44005A will give detailed information regarding railway line material.

Wiring Devices.

Only a few of the G-E wiring devices are shown here.

For information on our complete line, send for G-E Specialties Catalogue Y1270.

Threaded Catch Sockets.

The G-E Threaded Catch Socket can not pull apart under many times the strain to which it will be subjected in service.

Its strength and rigidity are unequalled by any other design of metal lamp socket.

Lugs on the cap fit into the body of the shell, preventing twisting; and a threaded ring holds the two parts of the shell firmly together.

This improved design costs no more than the ordinary types. It is made in key, keyless and pull styles; also in the locking type both key and keyless. It is *not* designed for use in fixture husks.



SHELL OF
THREADED
CATCH SOCKET

Locking Sockets.

These afford a positive protection to lamps installed in public or semipublic places. They also prevent the theft of current through the surreptitious use of high wattage lamps and current consuming devices.

The principle of design is correct. When the key is removed the screw shell of the socket swivels freely, preventing injury either to the lamp base or socket if an attempt be made to remove the lamp without the use of the key. G-E locking sockets can be furnished in the following types: Key, keyless and pull, metal shell and porcelain, with all the usual styles of caps and bases.

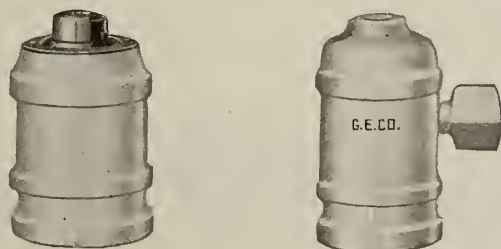


SHELL OF LOCK-
ING SOCKET

To install a lamp, the key is inserted in a horizontal position. The key should then be turned to a vertical position and pressed until it engages one of the notches in the fiber ring at the top of the screw shell. This holds the screw shell stationary while the lamp is being screwed in and firmly seated. When key is removed, the lamp and screw shell will swivel freely. The peculiar shape of the key prevents the substitution of a pin, nail or similar device.

Porcelain Sockets.

Where climatic conditions or peculiar surroundings



Keyless Sockets, $\frac{1}{8}$ -inch Cap Key Socket, Pendent Cap
PORCELAIN SOCKETS

are likely to corrode metal shell sockets, porcelain sockets should be used. They are anti-corrosive, and are especially adapted for chemical laboratories, bathrooms, cellars, laundries, storage plants, etc.

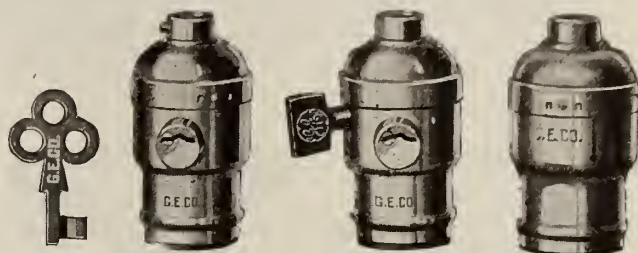
They are made N.E.C. standard in key, keyless and pull chain types.

Key and pull chain, 250 watts, 250 volts.

Keyless, 660 watts, 250 volts.

Metal Shell Sockets.

These sockets are standard and dependable. They are made in the usual key, keyless, push button and pull chain styles, and in the locking type, either key, keyless or pull.



Key for Lock-
ing Sockets Multi-catch
Locking Socket Fluted Catch, Lock-
ing Key Socket Multi-catch
Keyless Socket
METAL SHELL SOCKETS

Multi-catch, pull and key, 250 watts, 250 volts.
Keyless, fluted catch and push button, 660 watts, 250 volts.

Weatherproof Sockets.

For outdoor installations or where sockets are exposed to unusual dampness or other corrosive influence, G-E weatherproof sockets should be used.

Made N. E. C. standard and will take standard weatherproof shade holders.

Made in 660 watts, 250 volts.

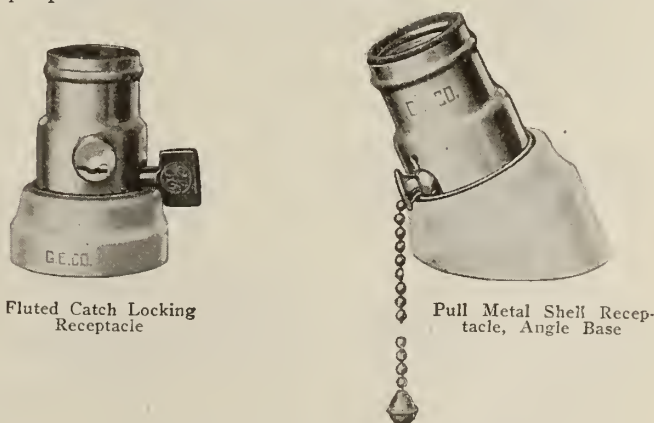


Porcelain Socket Socket with Wires In-
side of Pipe
WEATHERPROOF SOCKETS

Lamp Receptacles.

G-E metal shell receptacles are made sturdy, and electrically perfect, in key, keyless and pull; and in the same styles locking type, N. E. C. standard.

There are dozens of designs for every conceivable purpose.



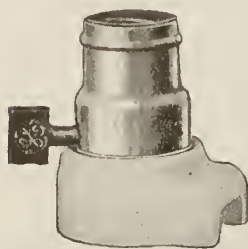
Fluted Catch Locking
Receptacle

Pull Metal Shell Recep-
tacle, Angle Base

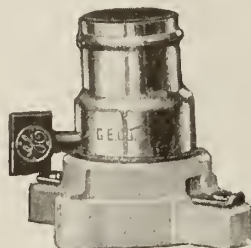
METAL SHELL LAMP RECEPTACLES

Moulding and Cleat Receptacles.

A neat appearing and thoroughly efficient G-E receptacle for moulding and cleat work. Made in all standard ratings in a large variety of types and sizes. Furnished key, keyless, locking and pull chain.



Key, Metal Shell Receptacle, One-way Base



Fluted Catch Key Receptacle for Cleat Wiring

MOULDING AND CLEAT RECEPTACLES

Ceiling Receptacles.

Like all other G-E fittings, these receptacles are substantially built and electrically perfect. Made N. E. C. standard, in keyless and pull chain types.



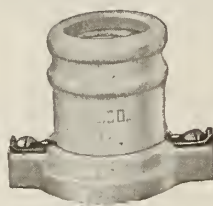
KEYLESS METAL SHELL CEILING RECEPTACLE
For use with 3/4 and 4-inch Outlet Boxes

Porcelain Cleat Receptacles.

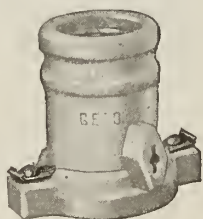
For good appearance, utility and dependability, these receptacles are unique. The mechanism is protected from dampness and dust. Made N. E. C. standard in key, and keyless type, solid and removable base.



Cleat Receptacle



Keyless Cleat Receptacle, Removable Base



Key Cleat Receptacle, Removable Base

PORCELAIN CLEAT RECEPTACLES

Porcelain Moulding and Conduit Box Receptacles.

A sturdy, neat-appearing porcelain receptacle, designed for National metal moulding, with 1-way or 2-way bases.

Made in key, and keyless types.

The conduit box receptacles are made to fit 3 1/4-in. and 4-in. conduit boxes.

Key, 250 watts, 250 volts.

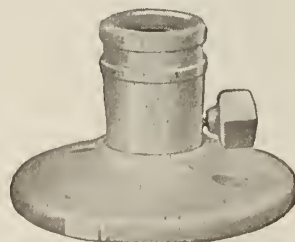
Keyless, 660 watts, 250 volts.



Key Moulding Receptacle, Removable Base



Keyless Receptacle for 4-inch Conduit Box

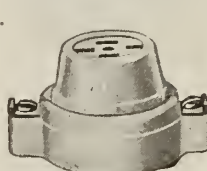


Key Receptacle for 3/4 inch Conduit Box

PORCELAIN MOULDING RECEPTACLES

"Standard" Separable Receptacles.

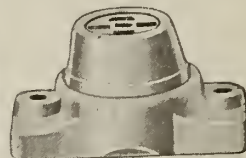
The G-E line includes this convenient type of receptacle, for use with portable electrical conveniences now so increasingly popular in household, commercial and industrial installations. Made for long wear. Adaptable to cleat, moulding and conduit work.



Cleat Receptacle



Receptacle for Conduit Boxes



Receptacle with Base for "Paiste" Taplets



Receptacle with Condulet Base



Receptacle for Concealed Work



Receptacle for Moulding Work

STANDARD SEPARABLE RECEPTACLES

"Standard" G-E Flush Receptacles.

G-E "Standard" type, 660 watts, 250 volts, is recommended for general use.

Any "Standard" plug will fit any "Standard" receptacle.

The double outlet type takes the same box as the single outlet receptacle.

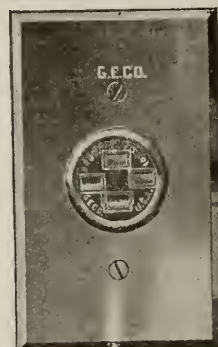
These receptacles take the same outlet boxes as flush push button switches.

Dimensions of porcelain, center to center of supporting screw holes:

Length	Width	Depth	Outside	Inside
2 5/8 in.	1 5/8 in.	1 3/8 in.	3 3/8 in.	2 13/16 in.



CAP



"STANDARD" FLUSH RECEPTACLE, SINGLE OUTLET

Heavy Duty Receptacles, 25 Amperes.

An extra heavy duty receptacle for use on heating circuits, etc.

Dimensions of porcelain, center to center of supporting screw holes:

Length	Width	Depth	Outside	Inside
2 1/2 in.	1 3/4 in.	1 3/8 in.	3 3/8 in.	2 13/16 in.



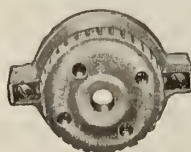
PLUG



FLUSH RECEPTACLE AND PLATE, 25 AMPERES

Ceiling Rosettes.

On open wire installations and



Geco Rosette, Cleat



Geco Rosette, Moulding



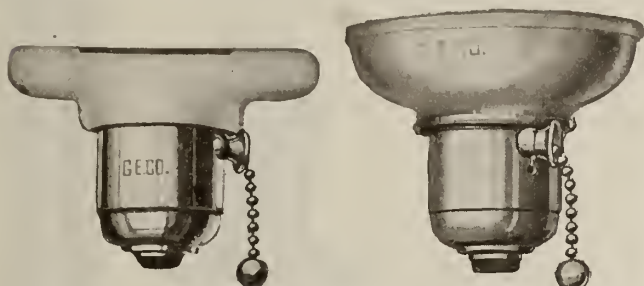
Standard Rosette, Concealed Work

PORCELAIN CEILING ROSETTES

concealed work the ceiling rosette is the important connecting device between pendant lamps and the circuit. G-E ceiling rosettes are made in all types and sizes. Furnished with or without fuses.

Pull Switches.

A necessary convenience where lights are inaccessible or remote from point of control. Ruggedly built and electrically perfect. Made for cleat, moulding and conduit work, and furnished with 1- or 2-way bases, with short chain and 10 ft. of cord.



Pull Switch Rosette, Conduit Base

Pull Switch Rosette, Side Outlet, Large Concealed Base, Porcelain Flange



Pull Switch Rosette, Side Outlet, Cleat Base

Side Outlet Pull Switch, Small Porcelain Base. Furnished also with Bottom Outlet

PULL SWITCHES

Pendent Switches.

The advantages of this type switch are obvious. They permit the convenient control of lights without running wires along the ceiling or down the side walls.



Pendent Switch, 1/8-inch Cap

Pendent Cap, Pendent Switch

Porcelain Pendent Switch

PENDENT SWITCHES

Snap Switches.

Admirably adapted for open wiring in attics, garages, cellars, barns, storehouses and in all installations demanding a low cost, yet thoroughly dependable switch.

Made with porcelain base and some types in all porcelain.

Made in all standard ratings, in a great variety of types and sizes and may be had in indicating or non-indicating forms. Porcelain switches are recommended for use in places subject to moisture, acid fumes or other corroding influences. Made for cleat, moulding and conduit work. Furnished single, 2-, 3-, and 4-way.



CEILING SNAP SWITCH, CONCEALED BASE



Single Pole Snap Switch for Condulets

Pony Type Tumbler Switch

Pony Type Snap Switch, Indicating

METAL SNAP SWITCHES



Porcelain Cleat Switch

Single Pole, Porcelain Switch

Porcelain Moulding Switch, Indicating

PORCELAIN SNAP SWITCHES

Door Switches.

These switches are of the flush type to be installed in door frames.

They are operated by opening and closing the door.

Recommended to control lights in closets, refrigerators, etc.

Furnished single pole, 6 amperes; in 2 types—to close circuit when door is open and to close circuit when door is closed.

Flush plate furnished with switch.

Dimensions of porcelain, center to center of supporting screw holes:

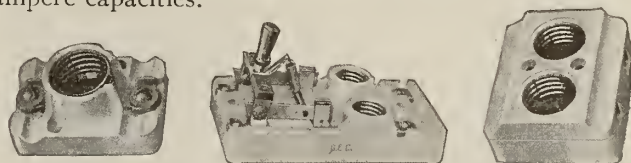
Length.	Width.	Depth.	Outside.	Inside.
3 1/8 in.	1 in.	1 1/8 in.	2 1/8 in.	2 1/8 in.



AUTOMATIC DOOR SWITCH

Plug Cut-outs.

Made with porcelain base, single, double and triple pole, two or three wire. Furnished in 30- and 60-ampere capacities.



Plug Cut-out Single-pole

Combined Switch and Plug Cut-out

Plug Cut-out Double-pole

PLUG CUT-OUTS

Fuses.

Where maximum protection under all operating conditions is desired, the use of N. E. C. S. fuses is strongly recommended.

Where it is considered desirable on account of frequent blow-outs to use fuses of the renewable type—G-E renewable enclosed fuses are offered with the assurance that they embody all the best features of this type of fuse.



FUSE PLUG New type



KNIFE FUSE

Floodlighting Projectors.

This company provides a line of projectors to meet all special requirements.

G-E projectors have been successfully used in lighting the following: arsenals, building fronts, chimneys, docks, freight unloading, grain elevators, manufactur-

ing plant exteriors, patrol duty, quarries, water tanks, theater fronts, railroad yards, etc.

FORM L-1—For lighting an object at 150 ft. or more; beam divergence 8° to 14° ; with medium-angle reflector, beam divergence 12° to 20° , suitable for objects at 75 to 200 ft.

FORM L-3—Beam divergence 50° , for objects at 25 to 75 ft. or more; similar to L-1 but provided with special silvered and copper-backed heat-resisting reflector.

FORM L-11—Meets the demand for a small flood-lighting unit mounted close to object.

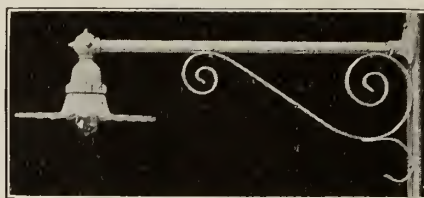
FORM L-15—Designed for large areas, lighting shipyards, construction work, etc. Beam divergence 20° to 30° . This projector is equipped with focusing mechanism to regulate divergence of beam.

Bulletin 43850B.



FLOOD
LIGHTING
PROJECTOR

streets and sidewalks, are designed to throw considerable light upward to illuminate the building fronts. By



Incandescent Bracket, Concealed Wiring



Pendent Unit
NOVALUX UNITS



Ornamental
Unit

combining illuminating efficiency with a dignified and distinctive appearance, they beautify their surroundings and are an asset by day, as well as by night.

The Novalux ornamental units are made for all standard lighting circuits and for all candle-powers.

Bulletins 43503, 43505.



CONSTRUCTION WORK ILLUMINATED BY FLOOD LIGHTING PROJECTORS

Headlights.

For electric railways, both traction service and mining locomotives, and also for steam roads. Either arc or incandescent types can be furnished.

Bulletins A4061 and 43800.

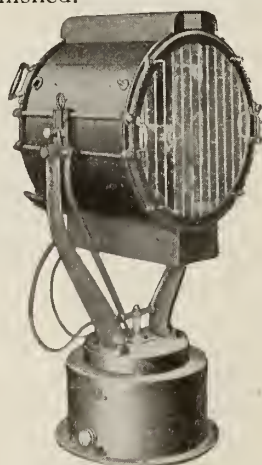
Searchlights.

Searchlights are suitable for night work in mines, railroads, marine and construction work.

The GENERAL ELECTRIC COMPANY makes 2 types: an 18-in. incandescent lamp, 1000-watt, 110-volt searchlight and the arc lamp type, in sizes 9, 13, 18 and 24 in. Larger projectors of 30, 36, 48 and 60 in. in diameter are manufactured and can be supplied.

Projectors arranged for hand and pilot house control are regularly kept in stock for immediate shipment; and for shaft, rope and electrical control can be provided when desired.

Bulletin 43856A.



ELECTRICALLY CON-
TROLLED SEARCHLIGHT

Blue Printing Lamp.

Economical blue printing and photographic work requires an intense light containing an excess of violet, ultra-violet or actinic rays.

The GENERAL ELECTRIC COMPANY manufactures a special enclosed-carbon arc lamp meeting these requirements. These are adjusted for 20 amps. at 110 volts A. C., 15 amps. at 220 volts A. C. and 10 amps. at 220 volts D. C. All are equipped with heat-resisting globes.

D. C. LAMPS—Form 12, 10 amps. 1100 watts; Form 6, 6 amps. 1320 watts; Form 20, 15 amps. 1650 watts; Form 14, 10 amps. 220 watts.

A. C. LAMPS—Form 6, 10 amps. 770 watts; Form 6, 6 amps. 950 watts; Form 14, 20 amps. 1600 watts; Form 14, 15 amps. 2300 watts. It is desirable to use an arc lamp having a high current adjustment.

Bulletin B-3293.



BLUE
PRINTING
LAMP

Constant Current Transformers.

The GENERAL ELECTRIC COMPANY builds a complete line of constant current transformers in capacities from 1 to 80 kw., inclusive. These may be supplied for any commercial voltage, frequency and current. Two types are manufactured: one for station use and the other for pole mounting for outdoor service.

Bulletins 65109 and 65110.

The Company manufactures also series luminous rectifier outfits for operating series magnetite arc lamps.

Bulletin 43253 and 43900.



OUTDOOR TYPE AND STATION
TYPE CONSTANT CURRENT
TRANSFORMERS

Novalux Units.

Novalux pendent and ornamental units are designed for use with the efficient Mazda "C" lamp. The pendent type is particularly suited for the economical illumination of streets, large interiors and exteriors, and the different light directing equipments produce such a variety of illuminating characteristics that a selection can be made to meet any individual requirement.

The ornamental units in addition to lighting the

EDISON LAMP WORKS

OF GENERAL ELECTRIC COMPANY

GENERAL SALES OFFICE
HARRISON, N. J.

DISTRICT SALES OFFICES

ATLANTA, GA.
BOSTON, MASS.

CHICAGO, ILL.
CINCINNATI, OHIO

DENVER, COLO.
NEW YORK, N. Y.

ST. LOUIS, MO.

PHILADELPHIA, PA.
SAN FRANCISCO, CAL.

DALLAS, TEX., SOUTHWEST GENERAL ELECTRIC CO.

For other Branch Offices see General Electric Company's Branch Offices on page 1050

Product.

EDISON MAZDA LAMPS.

Lamps of Known Quality.

Into every Edison MAZDA lamp is built the cumulative results of 40 years' experience in the manufacture of over one billion lamps. Each Edison MAZDA lamp is backed by MAZDA Service, the world wide scientific service of the Research Laboratories of the General Electric Company, to certain lamp manufacturers maintaining the MAZDA standard of quality.

New Era in Lighting.

It is indeed fortunate that the economical and reliable Edison MAZDA lamp is available, for all commercial interests are beginning to realize the tremendous importance of proper artificial illumination. We are at the beginning of a new era of lighting.

In the *industrial plant*, for example, manufacturers are realizing that with high intensity lighting of the proper quality as to diffusion and color, tremendous increases in production are possible. Carefully conducted and authentic tests have indicated that this statement is no mere theory, but is carried out in practice.

A slight expenditure over what has been made in the past for lighting will make available greater production; a most important question under the present economic conditions. With proper lighting in the industrial plant, safety is enhanced and far more comfortable working conditions produced. Much higher intensities than employed in the past are coming into use, and in planning the wiring for the industrial plants, due consideration must be taken of the additional demand for lighting likely to be encountered.

In connection with increased intensities of illumination special precaution must be taken to avoid glare. A reflector is a very important factor in this consideration, and the leading reflector manufacturers of America have standardized on new designs affording better eye protection than heretofore, and are marketing these under the name of RLM (Reflector and Lamp Manufacturers) standard reflectors.

The RLM standard reflectors are built to certain specifications as regards angle of cut-off (for proper eye protection), quality of enamel, workmanship, etc. Every designing engineer should be thoroughly posted on these new types of reflecting equipment.

To obtain higher intensity illumination larger lamps must be employed, and with the increase in size of lamp, special precautions must be taken to diffuse the light coming from the lamp itself.

A new finish of the lower end of the lamp bulb, known as *bowl enameling* has been developed. This resembles bowl frosting, but is applied by an entirely new process, which produces a pure white diffusing surface of considerably lower brilliancy than the older

style of diffusing bulb. It is especially serviceable with the RLM dome reflectors and similar equipment.

In order to obtain some idea of the present lighting conditions, a little instrument known as the *Foot-candle Meter* is now available at a very low cost. This is in reality a portable photometer, very simple in design and operation. An inexperienced man, with the aid of this instrument, can readily obtain reasonably accurate figures on the intensity of illumination. This instrument is a very important factor in improving lighting conditions. The designing engineer and architect should certainly have one of these available, to obtain records of the results which will form a basis of future design.

In the *office* there is now far more appreciation of the economic advantages of increased illumination properly diffused. Many new types of commercial lighting units and semidirect equipments are now standard. It is well in planning the layout of office buildings to be liberal in wiring capacity and in the spacing of outlets to take care of future requirements.

The *merchants* have become awakened to the possibilities in the way of increased sales and better working conditions through proper artificial illumination. The Foot-candle Meter gives them an instrument for checking the lighting, and it is useful throughout the various departments in determining the relation between light and sales.

In planning the lighting for the *show window* another instance is seen of the desirability of adequate wiring capacity. Within the last year a considerable number of high grade stores have employed colored mediums for modifying the light from show window lamps. Extremely artistic and pleasing effects are possible through the use of colored illumination in the show windows. This practice is spreading throughout the country. Instead of all window displays being illuminated in a standard manner with unmodified light, each picture erected by the display man will be painted with light.

In *residences* and other fields of *decorative lighting* a wider use will be made of tinted illumination. Pleasing touches of color throughout the home or decorative interior add wonderfully to the effect of the illumination. The MAZDA lamp is of such a character that its light can be readily modified by the application of color screens or mediums of various sorts.

Service Available.

The EDISON LAMP WORKS is desirous of securing the best practical application of its product and welcomes the opportunity of co-operating with engineers, architects and others responsible for lighting designs.

The publications of this company are designed to give up-to-date information on lamps, illumination and various appliances, and are obtainable on request.

SPRAGUE ELECTRIC WORKS

OF GENERAL ELECTRIC COMPANY

Electric Hoists and Monorails

TELEPHONE:
LONGACRE 900

527-531 West Thirty-fourth Street
NEW YORK, N. Y.

BRANCH OFFICES

CHICAGO, ILL., Fisher Building
PHILADELPHIA, PA., Witherspoon Building
BOSTON, MASS., 84 State Street
BALTIMORE, MD., American Building
PITTSBURGH, PA., Oliver Building
CLEVELAND, OHIO, Illuminating Building
CINCINNATI, OHIO, Provident Bank Building

ATLANTA, GA., Citizens & Southern Bank Building
ST. LOUIS, MO., Pierce Building
MILWAUKEE, WIS., Public Service Building
SAN FRANCISCO, CAL., Rialto Building
LOS ANGELES, CAL., Corporation Building
PORTLAND, ORE., Electric Building
SEATTLE, WASH., Colman Building
INDIANAPOLIS, IND., Traction Terminal Building

Products.

SPRAGUE ELECTRIC HOISTS and MONORAILS.

Also, Motors, Generators, Electric Dynamometers, Switchboards, Panelboards, Industrial and Portable Ozonators, Exhaust Fan Outfits, Electric Fans, Steel Armored Cable, Flexible Steel Conduit, Galvanized Rigid Conduit, Enameled Rigid Conduit Outlet Boxes, Armored Hose, Electric Freight Handling Machinery, Theatrical Devices.

Co-operative Service.

The SPRAGUE ELECTRIC WORKS of General Electric Company are prepared to furnish, through recognized trade channels, a complete line of apparatus and supplies for the electrical equipment of buildings, and offer the services of a specialized department to architects, consulting engineers, electrical contractors, plumbing contractors, heating and ventilating contractors, supply houses, and manufacturers of motor driven machinery used in the equipment for buildings.

General.

The SPRAGUE ELECTRIC WORKS for many years have manufactured a complete line of electric hoists and cranes in capacities from $\frac{1}{4}$ to 6 tons. They are designed to satisfy the demand for efficient lifting and carrying devices to fill the gap between the hand chain block and the large traveling cranes. The hoists and cranes are admirably suited for all industrial operations requiring the transportation of any class of material.

The hoists here described can all be equipped with cage for operator.

Complete information concerning any equipment described here will be gladly furnished on request to the nearest branch office.

S-1 Hoist.

This hoist is entirely enclosed and protected from dust and moisture. It is built both for direct current and polyphase alternating current circuits. Any one of a number of controllers and trolley carriages may be used in connection with it, so that a great variety of applications is possible. It is built for loads of $\frac{1}{2}$ and 1 ton.



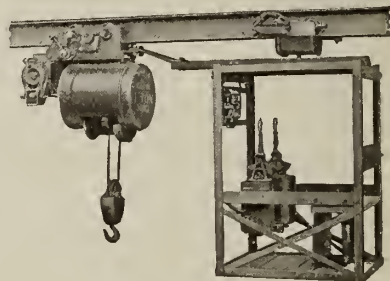
S-1 HOIST

This design is suitable for use out of doors, without additional protection.

The load brake with which this hoist is equipped in addition to the regular service brake, prevents excessive acceleration of the load in lowering.

Direct current machines may be equipped with a special controller to produce the slow speeds necessary for foundry service, or with ordinary rheostatic controller for moderate speed regulation.

For lifting small castings and forgings in a machinshop, an electric hoist with a plain or hand geared trolley is vastly superior to other methods. Also used for handling heavy stock, such as castings, bales and cases, which require some means of quick and economical handling.



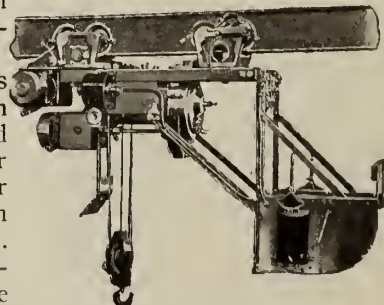
S-1 MONORAIL HOIST WITH OPEN TRAILING CAGE

S-2 and S-3 Hoists.

For loads of 2, 3, 4 or 6 tons. Both hoists are similar in design, the S-2 hoist having a maximum capacity of 8000 lbs., and the S-3 hoist a capacity of 12,000 lbs.

Motor is geared to drum through a triple reduction spur gearing, the gears being of cast steel, and pinions of steel forgings. The motor, gears, controller and resistance are entirely enclosed, and are protected from dust and moisture. Hoist can be used out of doors without being provided with housing or other protection.

S-2 and S-3 hoists can be supplied with any style of standard trolley carriage, either plain, hand geared or motor driven, with rigid or swivel trucks. They can also be furnished with separate controllers and magnetic brakes.



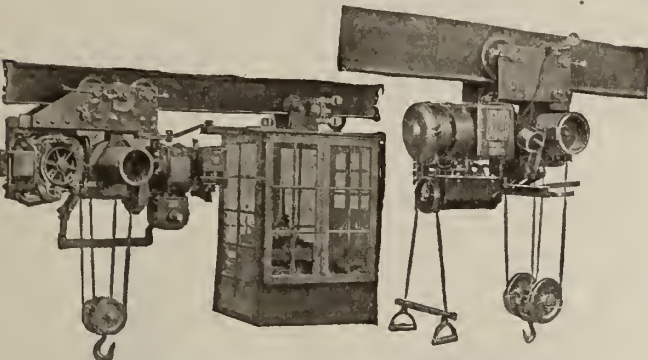
TYPE S-2 AND S-3 MONORAIL HOIST

W-1 and W-2 Hoists.

For loads of 1, 2, 3, 4 and 6 tons. Both hoists are similar in design, the W-1 built in capacities of from 2000 to 4000 lbs. and the W-2 in capacities of from 3000 to 12,000 lbs. They are worm geared, and can be attached to any style of standard trolley carriage, either plain, hand geared or motor driven. They can also be furnished with remote controllers and magnetic brakes.

Supplied with a traveling rope guide, designed to keep rope in drum grooves, regardless of side pull.

The gears are entirely enclosed, run in grease, and the machines are weatherproof. They can be used for hoisting work of any description within the limit of their capacity, and are especially applicable to foundry work and for use in exposed situations.



ALTERNATING CURRENT W-2 MONO-RAIL HOIST WITH ENCLOSED TRAILING CAGE

W-1 AND W-2 SPRAGUE ELECTRIC HOIST

RATINGS AND WEIGHTS, STANDARD MONORAIL HOISTS, CAGE CONTROLLED

Load, tons.	Hoist						Trolley carriage					Weight of monorail hoist complete, lbs.	
	Speed, ft. per min.	Lift, ft.	No. of ropes	Hoist type	Motor		Speed, ft. per min.	Motor		Minimum radius of curve, ft.	With open cage	With enclosed cage	
					Frame	H.P.		Frame	H.P.				
DIRECT CURRENT													
1 1/2	30	28	1	S1	H 1 1/2	1 1/2	350	M1	2	8	1835	1960	
1	15	13	2	S1	H 1 1/2	1 1/2	350	M1	2	8	1865	1990	
1	20	40	2	W1	M1	3	350	M1	2	8	1925	2050	
1 1/2	40	40	2	W1	M2	6	350	M1	2	8	2045	2170	
2	26	50	2	W2	M2	6	350	M2	4	8	2435	2560	
2	10	20	4	W1	M1	3	350	M2	4	8	1975	2100	
2	20	20	4	W1	M2	6	350	M2	4	8	2095	2220	
2	30	50	2	W2	M3	9	350	M2	4	8	2535	2660	
2	35	31	2	S2	M2	6	350	M2	4	6	2660	3370	
2	50	31	2	S2	M3	9	350	M2	4	6	2760	3470	
3	13	25	4	W2	M2	6	350	M2	4	8	2525	2650	
3	23	21	3	S2	M2	6	350	M3	6	6	2670	3380	
3	33	21	3	S2	M3	9	350	M3	6	6	2770	3480	
3	50	48	2	S3	M4	12	350	M3	6	6	4640	5300	
4	15	25	4	W2	M3	9	350	M3	6	8	2625	2750	
4	17	15	4	S2	M2	6	350	M3	6	6	2710	3420	
4	25	15	4	S2	M3	9	350	M3	6	6	2810	3520	
4 1/2	33	31	3	S3	M4	12	350	M4	8	6	4660	5320	
6	25	23	4	S3	M4	12	350	M5	10	6	4730	5390	
ALTERNATING CURRENT													
1	40	40	2	W1	5180	5	350	5160	2	8	2125	2250	
1 1/2	26	50	2	W2	5180	5	350	5180	3	8	2485	2610	
2	20	20	4	W1	5180	5	350	5180	3	8	2175	2300	
2	21	50	2	W2	5180	5	350	5180	3	8	2525	2650	
2	35	31	2	S2	5180	5	350	5180	3	6	2840	3550	
2	50	31	2	S2	5201	10	350	5180	3	6	2890	3600	
3	13	25	4	W2	5180	5	350	5180	3	6	2595	2720	
3	23	21	3	S2	5180	5	350	5200	5	6	2850	3560	
3	33	21	3	S2	5201	10	350	5200	5	6	2900	3610	
3	50	48	2	S3	5008	15	350	5201	6.5	6	4790	5450	
4	10	25	4	W2	5180	5	350	5201	6.5	8	2635	2760	
4	17	15	4	S2	5180	5	350	5201	6.5	6	2890	3600	
4	25	15	4	S2	5201	10	350	5201	6.5	6	2940	3650	
4 1/2	33	31	3	S3	5008	15	350	5008	10	6	5010	5670	
6	25	23	4	S3	5008	15	350	5008	10	6	5080	5740	

Vertical Electric Winch.

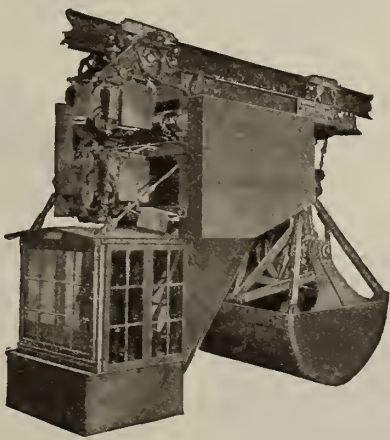
The entire mechanism is enclosed in the cast iron base, insuring complete protection from the elements or rough handling, but all parts are easily accessible for inspection by raising hinged covers on sides.

The motor is direct or alternating current, and is geared to winch head through a triple reduction gearing. The gears are steel castings, and pinions steel forgings, all teeth being cut from solid. All bearings are of best bearing bronze and are lubricated with grease by compression cups.

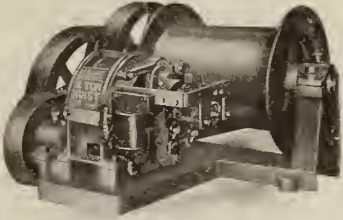
Built in capacities of from 2000 lbs. pull at 150 ft. per minute, to 12,000 lbs. pull at 25 ft. per minute. For pulling loads horizontally, a single speed cylinder type controller is used, which is operated by a foot lever. If the load has to be hauled up a grade, a rheostatic controller and a holding pawl are furnished, the latter for holding the load in case current is interrupted.



VERTICAL ELECTRIC WINCH



GB-7 GRAB BUCKET MONORAIL HOIST WITH ENCLOSED CAGE



D-11 SPUR GEARED WINDING DRUM

Built in capacities from 1000 to 8000 lbs. pull, at speed of 100 ft. per minute. Motor is direct or alternating current, geared to drum through triple reduction gearing

IVANHOE-REGENT WORKS

OF GENERAL ELECTRIC COMPANY

Manufacturers of Ivanhoe Metal Reflectors

5716 Euclid Avenue
CLEVELAND, OHIO

Products.

Manufacturers of IVANHOE METAL REFLECTORS; REFLECTO-CAP DIFFUSERS and FITTINGS for Industrial Plants.

Types of Reflectors.

Based upon wide experience in industrial lighting, the Ivanhoe line has been redesigned—the manufacturer standardizing on four essential types with an addition of a few special service reflectors.

Each type, scientifically designed, is made to produce certain characteristic results which can be applied to any class of industry.

These different types are shown on the following pages and the characteristic distribution of light is shown for each.

Finishes of Reflectors.

Ivanhoe reflectors are made of open hearth drawn steel with 3 standard finishes: porcelain enamel, aluminum, and paint enamel.

PORCELAIN ENAMEL—This finish is applied to the inside of the reflectors in 3 coats. The first is a binding coat, and it is covered by 2 coats of white porcelain enamel. The outside of the reflectors is treated with the same binding coat, and covered with 1 application of dark green porcelain enamel.

ALUMINUM—The aluminum finish is applied in 5 coats, 3 to the inside, and 2 to the outside. The final inside coat is transparent and washable, and the finishing coat on the outside is green paint. The metal form is thoroughly cleaned before the aluminum is applied, and the various coats are baked on separately. The finished reflector is well protected against rust; and although the reflecting surface does not collect dirt readily, it is easily cleaned by washing with a pure soap lather, or with a solution of 4 parts of warm water to 1 part ammonia.

PAINT ENAMEL—The inside of the reflector is covered with a binding coat, and 2 coats of glossy white paint enamel. A glossy green paint enamel is applied to the outer surface, and baked on to insure a tough and durable finish. The color is permanent.

Holders.

Ivanhoe reflectors are made with 3 distinct types of extension to conform to different systems of wiring and installing. These are the B-heel extension, the extension equipped with the D holder, and the R extension.

B-HEEL TYPE—The B-heel is the name applied to the fitter at the top of one type of extension. It



B-HEEL TYPE



TRADE-MARK

provides a convenient and practical method of attaching the reflector to a separable holder.

The B-heel is $2\frac{1}{4}$ ins. for medium base lamps and $3\frac{1}{4}$ ins. for reflectors used with mogul base lamps. B-heels of $2\frac{1}{4}$ ins. fit the standard form "O" holders or holders Nos. 902, 822, 824 or 884. B-heels of $3\frac{1}{4}$ ins. fit holders Nos. 622, 672 or 705.

D TYPE—A second type of extension is furnished with a brass clip ring reinforced by the D clamp strap, or holder, for attaching directly to brass shell sockets.

R TYPE—The R extension gives its reflectors the name of "solid top." This extension contains a porcelain socket which is held in place by a lock nut at the top of the extension. The socket is designed to fit a $\frac{1}{2}$ -in. conduit. Besides providing for easy wiring, all R type reflectors are weatherproof.



D REFLECTOR ON SOCKET
To hang a D reflector on a socket, loosen screw, snap socket in ring, and tighten screw



WIRING TYPE R REFLECTORS
Loosen lock nut at top of extension and raise reflector on pipe

RLM Standard Dome Reflectors.

For all sizes of Mazda C lamps. These reflectors are made in accordance with the specifications and design of the reflectors standardized by the Reflector and Lamp Manufacturers and therefore bear their standard designation RLM.

Recommended as the highest standard of the distributing type.

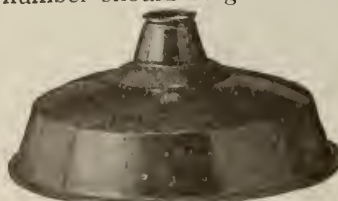
They are porcelain enameled, green outside and white inside.

For uniform illumination they should be spaced not to exceed one and two-thirds times their height above the work.

In ordering, the Ivanhoe number should be given.



METHOD OF WIRING HOLDER
Cover of holder raised on pipe in order to wire holder and clamp it to B-heel



STANDARD B-HEEL TYPE



CHARACTERISTIC DISTRIBUTION



D TYPE FOR ATTACHING TO BRASS SHELL SOCKETS R TYPE WITH SOLID TOP CONTAINING PORCELAIN SOCKET

STANDARD B-HEEL TYPE, FOR USE WITH IVANHOE SEPARABLE HOLDERS; D AND R TYPES, WITH HOLDERS ATTACHED

Ivanhoe No.	Mazda C lamp, watts	R L M Standard designation	Dimensions, inches		Packing		List price, each
			Diam.	Depth	No. in standard package	Approx. lbs. ship'g wt.	
BEDD- 75	75	Dome-75	12 $\frac{1}{8}$	5 $\frac{1}{2}$	15	40	\$2.00
BEDD- 100	100, 150	Dome-100	14 $\frac{1}{8}$	6 $\frac{1}{2}$	15	50	2.40
BEDD- 200	200	Dome-200	16 $\frac{3}{8}$	7 $\frac{3}{4}$	10	45	2.76
BEDD- 500	300, 400, 500	Dome-500	18 $\frac{3}{8}$	10 $\frac{1}{4}$	5	25	3.84
BEDD-1000	750, 1000	Dome-1000	20 $\frac{3}{4}$	10 $\frac{1}{4}$	3	25	5.70
DEDD- 75	75	Dome-75 (for D type reflectors)	12 $\frac{1}{8}$	5 $\frac{1}{2}$	15	40	2.12
DEDD- 100	100, 150	Dome-100 (for D type reflectors)	14 $\frac{1}{8}$	6 $\frac{1}{2}$	15	40	2.52
DEDD- 200	200	Dome-200 (for D type reflectors)	16 $\frac{3}{8}$	8 $\frac{1}{2}$	10	45	2.88
REDD- 75	75	Dome-75 (for solid top reflectors)	12 $\frac{1}{8}$	8 $\frac{1}{4}$	5	25	3.50
REDD- 100	100, 150	Dome-100 (for solid top reflectors)	14 $\frac{1}{8}$	9 $\frac{1}{4}$	5	30	3.80
REDD- 200	200	Dome-200 (for solid top reflectors)	16 $\frac{3}{8}$	10 $\frac{1}{2}$	3	25	4.60
REDD- 500	300, 400, 500	Dome-500 (for solid top reflectors)	18 $\frac{3}{8}$	12 $\frac{1}{4}$	2	20	5.70

Standard Bowl Reflectors.

These reflectors for 25-, 40-, 50-, 60-, 75-, 100-, 150-, 200-, 500- and 1000-watt Mazda lamps replace the two Ivanhoe lines formerly listed as "Extensive Enamel" and "Intensive Enamel" porcelain enameled, green outside and white inside; their bowl shape furnishes an effective shield against the glare of the lamp. Spaced not to exceed one and two-thirds times their height above the working-plane.



B-HEEL TYPE FOR USE WITH IVANHOE SEPARABLE HOLDERS D TYPE FOR ATTACHING TO BRASS SHELL SOCKETS CHARACTERISTIC DISTRIBUTION

STANDARD BOWL REFLECTORS, B-HEEL TYPE, FOR USE WITH IVANHOE SEPARABLE HOLDERS; AND D TYPE, WITH HOLDERS ATTACHED

Ivanhoe No.	Mazda lamp, watts	Dimensions, inches		Packing		List price, each
		Diam.	Depth	No. in standard package	Approx. lbs. ship'g wt.	
BEB- 60	25, 40, 50, 60	7 $\frac{1}{2}$	5	50	55	\$1.20
BEB- 75	75	8 $\frac{1}{2}$	6 $\frac{1}{2}$	40	55	1.44
BEB- 100	100-150	8 $\frac{1}{2}$	7	30	55	1.50
BEB- 200	200	10 $\frac{1}{2}$	8 $\frac{3}{8}$	15	35	2.26
BEB- 500	300, 400, 500	12 $\frac{1}{2}$	8 $\frac{3}{8}$	10	35	3.10
BEB-1000	750, 1000	15 $\frac{1}{4}$	11 $\frac{7}{8}$	10	55	4.40
DEB- 60	25, 40, 50, 60	7 $\frac{1}{2}$	5 $\frac{3}{4}$	50	55	1.32
DEB- 75	75	8 $\frac{1}{2}$	6 $\frac{1}{2}$	40	55	1.56
DEB- 100	100, 150	8 $\frac{1}{2}$	7 $\frac{3}{8}$	20	40	1.62
DEB- 200	200	10 $\frac{1}{2}$	8 $\frac{3}{4}$	10	25	2.38

Porcelain Enameled Angle Type.

These angle reflectors for 25-, 40-, 50-, 60-, 75-, 100-, 150-, 200-, 500- and 1000-watt Mazda lamps should be used in industrial plants where overhead lighting is impractical, requiring the outlets to be placed along the wall. The weatherproof, easy-wiring R type is especially adapted to billboard lighting.



B-HEEL TYPE ENAMELED OR ALUMINUM FINISH FOR USE WITH IVANHOE SEPARABLE HOLDERS



D TYPE FOR ATTACHING TO BRASS SHELL SOCKETS R TYPE WITH SOLID TOP CONTAINING PORCELAIN SOCKET CHARACTERISTIC DISTRIBUTION

DATA, STANDARD ANGLE REFLECTORS

Ivanhoe No.	Mazda lamp, watts	Dimensions, inches		Packing		List price, each
		Diam.	Depth	No. in stand-ard package	Approx. lbs. ship'g wt.	
ALUMINUM, B-BEEL TYPE, FOR USE WITH IVANHOE SEPARABLE HOLDERS; AND D TYPE, WITH HOLDERS ATTACHED						
BAL- 40	25, 40, 50	6¾	5½	50	40	\$0.62
BAL- 60	60	8¼	6¾	40	40	.90
BAL-100	75, 100, 150, 200	10½	9	20	35	1.50
DAL- 40	25, 40, 50	6¾	5⅞	50	40	.74
DAL- 60	60	8¼	7⅞	40	40	1.02
ENAMELED, B-BEEL TYPE, FOR USE WITH IVANHOE SEPARABLE HOLDERS						
BEL- 60	60	8¼	6¾	30	35	\$1.64
BEL- 100	75, 100, 150, 200	10½	9	20	40	2.40
BEL- 500	300, 400 500	12½	11½	5	30	4.40
BEL-1000	750, 1000	15¾	15¾	5	50	6.50
ENAMELED, D AND R TYPES, WITH HOLDERS ATTACHED						
DEL- 60	60	8¼	7⅞	30	35	\$1.76
DEL-100	75, 100, 150, 200	10½	9¾	20	40	2.52
REL- 60	25, 40, 50, 60	8¼	9½	20	40	3.20
REL-100	75, 100, 150, 200	10½	11¾	10	40	4.20
REL-500	300, 400, 500	12½	16	5	30	6.20

Holders for Medium and Mogul Base Lamps and Reflectors.

No. 822 is a porcelain socket holder, tapped at the top for 1/2-in. conduit. It is attached to the B-heel type by means of 3 clamps, which are locked into place by a ring.

No. 824 is No. 822 with top casting fitted to take a weatherproof green porcelain enameled canopy.

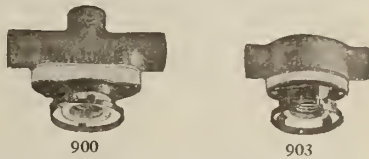
No. 884 is a green porcelain enameled set screw holder containing porcelain socket.

No. 902 is a steel holder finished in green paint and can be used with any 2 1/4-in. B-heel reflector with either porcelain or composition socket.

No. 622 is a porcelain socket holder, tapped at the top for 1/2-in. conduit. It is attached to the B-heel by means of 3 clamps, which are locked into place by a ring.

No. 672 is No. 622 with top casting fitted to take a weatherproof green porcelain enameled canopy.

No. 705 is a green porcelain enameled set screw holder contain-



FOR CROUSE-HINDS CONDULETTOS

No.	900	903
Standard quantity.	50	50
List price, each.	\$0.32	0.30

ing porcelain socket. Holders Nos. 900 and 903 are for use with Crouse-Hinds conduletts.

No. 900 is for use with 2¼-in. B-heel reflectors and Obround conduletts.

No. 903 is for use with 2¼-in. B-heel reflectors and elliptical conduletts.



FOR MOGUL-BASE LAMPS AND REFLECTORS WITH ¾-IN. FITTERS

No.	622	672	705
Standard quantity	15	10	20
List price, each	\$2.00	3.10	2.35



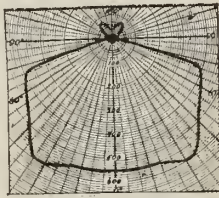
FOR MEDIUM BASE LAMPS AND REFLECTORS WITH 2¼-IN. FITTERS

No.	902	822	824	884
Standard quantity	50	50	30	20
List price, each	\$0.19	1.20	1.85	1.60

Ivanhoe Glass-top Reflector.

Metal part of reflector is one compact piece, the form and heel being connected by substantial legs rigidly welded at each end. RLM standard dome type or typical bowl type.

The glass section is of good quality, light density, diffusing opal, firmly held by clips. Light transmitted by glass top is not large in comparison with that in other directions, but is sufficient to brighten the ceiling.



Characteristic distribution, BEDD-200-G.T.

IVANHOE GLASS-TOP DOME TYPE REFLECTOR

DATA, IVANHOE GLASS-TOP DOME AND BOWL REFLECTORS, B-HEEL TYPE, FOR USE WITH IVANHOE SEPARABLE HOLDERS

Ivanhoe No.	Mazda C lamp, watts	Dimensions, in.		No. in standard package	List price, each
		Diam.	Depth		
DOME TYPE					
BEDD-75-G. T.	75	12½	5½	15	\$2.81
BEDD-100-G. T.	100	14½	6½	15	3.07
BEDD-200-G. T.	200	16¾	7¾	15	3.55
BOWL TYPE					
BEB-75-G. T.	75	8½	6½	40	\$2.21
BEB-100-G. T.	100	8½	7	40	2.34
BEB-200-G. T.	200	10½	8¾	15	2.74

Reflecto-Cap Diffuser.

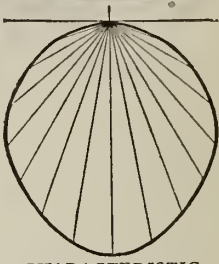
The Ivanhoe Reflecto-Cap Diffuser for 75-, 100-, 150-, 200- and 300-watt Mazda C lamps provides glareless illumination. It is particularly adapted to fine machine work, jewelry manufacturing, printing, cabinet work, pattern making, various operations in the textile industries, and fine finishing operations, as on furniture, pianos and automobiles. The unit is so constructed as to cut out all direct light from the lamp so that glaring reflections from bright surfaces are practically eliminated.

It consists of 3 parts: a green porcelain enameled set screw holder containing the socket, a porcelain enameled reflector, green on the outside and white inside, and a silvered cap, highly polished inside, which fits snugly over the bottom of the Mazda C lamp. The units should

be so installed that the space between them does not exceed one and one-half times their height above the work. Caps that have been in service for a long time may be refinished at 30¢ list each.



DETAILS REFLECTO-CAP DIFFUSER



CHARACTERISTIC DISTRIBUTION

DATA, REFLECTO-CAP DIFFUSER

	Ivanhoe No.	Description	Dimensions, inches		Packing		List price, each
			Diam.	Depth	No. in standard package	Approx. lbs. ship'g wt.	
For 75-watt Mazda C lamp	RC-75	Complete unit: Reflector, enameled holder, metal cap with spring wire.	17	8¾	10	50	\$6.60
	885	Enameled steel reflector.	17	5¾	10	30	3.80
	884	Enameled holder.	2¼ Fitter	3¾	20	20	1.60
	Cap-75	Lamp cap with spring wire holder.	2¾	1½	80		1.20
For 100-watt Mazda C lamp	RC-100	Complete unit: Reflector, enameled holder, metal cap with spring wire.	17	9¼	10	55	7.30
	885	Enameled steel reflector.	17	5¾	10	30	3.80
	884	Enameled holder.	2¼ Fitter	4½	20	30	2.20
	Cap-100	Lamp cap with spring wire holder.	3½	1½	80		1.30
For 150-watt Mazda C lamp	RC-150	Complete unit: Reflector, enameled holder, metal cap with spring wire.	21	9¼	4	45	9.20
	855	Enameled steel reflector.	21	6¾	4	35	5.80
	884	Enameled holder.	2¼ Fitter	3½	20	30	2.10
	Cap-100	Lamp cap with spring wire holder.	3½	1½	80		1.30
For 200-watt Mazda C Lamp	RC-200	Complete unit: Reflector, enameled holder, metal cap with spring wire.	21	10	4	45	9.35
	855	Enameled steel reflector.	21	6¾	4	35	5.80
	884	Enameled holder.	3¼ Fitter	4¾	20	30	2.15
	Cap-200	Lamp cap with spring wire holder.	3¾	1¾	80		1.40
For 300-watt Mazda C Lamp	RC-300	Complete unit: Reflector, enameled holder, metal cap with spring wire.	21	11¾	4	50	10.15
	855	Enameled steel reflector.	21	6¾	4	35	5.80
	706	Enameled holder.	3¼ Fitter	6½	20	45	2.60
	Cap-300	Lamp cap with spring wire holder.	4¾	2¼	80		1.75

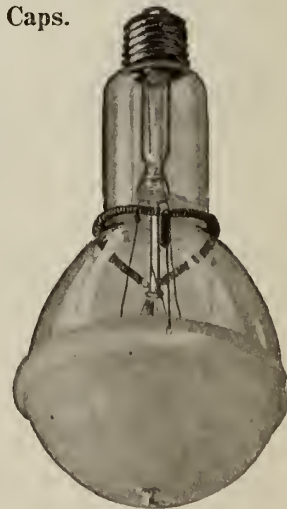
Ivanhoe-Regent Opal Lamp Caps.

The Ivanhoe-Regent opal lamp cap is made of Genco glass, which combines splendid diffusion with low absorption. This cap improves the illumination by hiding the filament and cutting down glare. It is designed particularly for use with reflectors, both glass and steel, which do not give sufficient eye protection.

DATA OPAL LAMP CAP

Ivanhoe-Regent No.	For use with Mazda C lamps	Standard quantity, dozen	List price, each
GC-75	75	4	\$0.85
GC-100	100, 150	4	.91
GC-200	200	4	.96
GC-300	300	3	1.12
GC-500	400, 500	3	1.32

The prices listed include cap and spring illustrated.



OPAL LAMP CAP ATTACHED TO MAZDA C LAMP WITH SPRING WIRE HOLDER

ANACONDA COPPER MINING CO.

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Manufacturers of Copper Rods, Wires and Cables

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BARE COPPER WIRES and CABLES for Telephone, Telegraph, Street Railway, Long Distance Power Transmission and all industrial uses.

COPPER RODS, Round and Flat.

PHYSICAL SPECIFICATIONS OF COPPER WIRE HARD DRAWN AND MEDIUM HARD

B. & S. Gage No.	Diam., in.	Area circular mils	Tensile strength, lb. per sq. in.	Elongation in 10 in. per cent.	Tensile strength, lb. per sq. in.		Elongation in 10 in. per cent.
					Minimum	Maximum	
0000	0.460	211,600	49,000	3.75	42,000	49,000	3.75
000	0.410	168,100	51,000	3.25	43,000	50,000	3.6
00	0.365	133,225	52,800	2.80	44,000	51,000	3.25
0	0.325	105,625	54,500	2.40	45,000	52,000	3.0
1	0.289	83,520	56,100	2.17	46,000	53,000	2.75
2	0.258	66,565	57,100	1.98	47,000	54,000	2.5
3	0.229	52,440	59,000	1.79	48,000	55,000	2.25
4	0.204	41,615	60,100	1.24	48,330	55,330	1.25
5	0.182	33,125	61,200	1.18	48,600	55,660	1.20
6	0.165	27,225	62,000	1.14	49,000	56,000	1.15
7	0.142	20,735	63,000	1.09	49,330	56,330	1.11
8	0.134	17,956	63,400	1.07			
9	0.128	16,385	63,700	1.06	49,660	56,660	1.08
10	0.114	12,995	64,300	1.02	50,000	57,000	1.06
11	0.104	10,815	64,800	1.00			
12	0.102	10,404	64,900	1.00	50,330	57,330	1.04
13	0.092	8,464	65,400	0.97			
14	0.091	8,281	65,400	0.97	50,660	57,660	1.02
15	0.081	6,561	65,700	0.95	51,000	58,000	1.00
16	0.080	6,400	65,700	0.94			
17	0.072	5,184	65,900	0.92	51,330	58,330	0.98
18	0.065	4,225	66,200	0.91			
19	0.064	4,096	66,200	0.90	51,660	58,660	0.96
20	0.057	3,249	66,400	0.89	52,000	59,000	0.94
21	0.051	2,601	66,600	0.87	52,330	59,330	0.92
22	0.045	2,025	66,800	0.86	52,660	59,660	0.90
23	0.040	1,600	67,000	0.85	53,000	60,000	0.88

PHYSICAL SPECIFICATIONS, SOFT OR ANNEALED COPPER WIRE

Diam., in.	Tensile strength lb. per sq. in.	Elongation in 10 in. per cent
0.460 to 0.290	36,000	35
0.289 to 0.103	37,000	30
0.102 to 0.021	38,500	25
0.020 to 0.003	40,000	20

DATA, BARE STRANDED COPPER CABLE

(U. S. Bureau of Standards)

Size of cable	Diam. in.	No. of wires	Diam. of wires	Weight per 1000 ft.	Weight per mile	Resistance at 77° Fahr., 25° C.		Feet per ohm
						Ohms per 1000 ft.	Ohms per mile	
250,000 c. m.	.575	37	.0822	772	4,076	.0432	.227	23,190
300,000 c. m.	.630	37	.0900	926	4,899	.0360	.188	37,020
400,000 c. m.	.728	37	.1040	1,240	6,647	.0270	.141	37,020
500,000 c. m.	.814	37	.1162	1,540	8,131	.0216	.113	46,270
750,000 c. m.	.998	61	.1109	2,320	12,260	.0144	.076	69,450
1,000,000 c. m.	1.152	61	.1280	3,090	16,315	.0108	.057	92,600
1,250,000 c. m.	1.290	91	.1173	3,860	20,381	.0086	.0454	116,250
1,500,000 c. m.	1.412	91	.1284	4,630	24,446	.00719	.0379	139,100
1,750,000 c. m.	1.526	127	.1173	5,400	28,520	.00615	.0324	162,750
2,000,000 c. m.	1.631	127	.1255	6,180	32,620	.00539	.0284	184,500

Ohms per 1000 ft. at 25° C. = 10787 ÷ c. m.

Pounds per 1000 ft. = 0.0030875 × c. m.

Special stranding supplied to order.

Copper Rods.

Round copper rods made in following diameters:

1/4, 5/16, 3/8, 1/2, 9/16, 5/8, 7/8, 1 and 1 1/4 in.

Flat copper rods made in sizes up to 3 in. wide and 1/4 in. thick.

"From Mine to Finished Product."

In 1918 the mills of the ANACONDA COPPER MINING Co., at Great Falls, Mont., were completed for the manufacture of copper rods, wires and cables, so that the consumer is now served direct. The products of the rolling mill are the first of their kind to be manufactured west of the Mississippi.

Hard Drawn Copper Wire.

RESISTIVITY SPECIFICATION (ADOPTED BY A.S.T.M., 1915)—Electric resistivity shall be determined upon fair samples by resistance measurements at a temperature of 20° C. (68° Fahr.).

The wire shall not exceed the following limits:

For diameters 0.460 in. to 0.325 in., 900.77 lb. per mile-ohm at 20° C.

For diameters 0.324 in. to 0.040 in., 910.15 lb. per mile-ohm at 20° C.

900.77 lb. per mile-ohm is equal to:

0.15775 ohms per meter-gram

1.7745 microhms per centimeter-cube

0.69863 microhms per inch-cube

10.674 ohms per mil-foot

910.15 lb. per mile-ohm is equal to:

0.15940 ohms per meter-gram

1.7930 microhms per centimeter-cube

0.70590 microhms per inch-cube

10.785 ohms per mil-foot

Medium Hard Wire.

RESISTIVITY SPECIFICATION (ADOPTED BY A.S.T.M., 1915)—Electric resistivity shall be determined upon fair samples by resistance measurements at a temperature of 20° C. (68° Fahr.).

The wire shall not exceed the following limits:

For diameters 0.460 in. to 0.325 in., 896.15 lb. per mile-ohm at 20° C.

For diameters 0.324 in. to 0.040 in., 905.44 lb. per mile-ohm at 20° C.

896.15 lb. per mile-ohm is equal to:

0.15694 ohms per meter-gram

1.7654 microhms per centimeter-cube

0.69504 microhms per inch-cube

10.619 ohms per mil-foot

905.44 lb. per mile-ohm is equal to:

0.15857 ohms per meter-gram

1.7837 microhms per centimeter-cube

0.70224 microhms per inch-cube

10.729 ohms per mil-foot

Soft or Annealed Copper Wire.

RESISTIVITY SPECIFICATION (ADOPTED BY A.S.T.M., 1915)—Electric resistivity shall be determined upon fair samples by resistance measurements at a temperature of 20° C. (68° Fahr.), and it shall not exceed 891.58 lbs. per mile-ohm.

891.58 lbs. per mile-ohm is equal to:

0.15614 ohms per meter-gram

1.7564 microhms per centimeter-cube

0.6915 microhms per inch-cube

10.565 ohms per mil-foot

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Facilities.

Reinforcing the extensive factory equipment, there are well equipped chemical, physical and electrical laboratories, wherein the problems incident to the solution of every difficulty encountered are handled by thoroughly reliable experts and up-to-date methods. All steel and copper used are rolled and drawn in our mills and under our supervision throughout every operation.

All raw materials are tested and inspected before being used, the manufacturing processes are constantly checked, and finally the finished material is subjected to an exhaustive series of tests that determine beyond question whether or not it is of proper quality. With such facilities we are enabled to manufacture electrical conductors of all kinds to the severest specifications, and to give to the users of our product a standard of quality that is unexcelled.

Bare Wires and Cables—Copper, Iron or Steel.

Copper wire for all purposes in any required shape or size; for telephone and telegraph, high voltage long distance transmission, and industrial purposes in general. Copper cables of all capacities and degrees of flexibility, hard drawn or annealed, bare or insulated. Galvanized iron and steel wire is also made in all shapes and sizes, bare or insulated, and for all purposes; telephone and telegraph wires, armor wires, strand and wire rope of all kinds.

COPPER TROLLEY WIRE
 —Generally made of hard drawn copper in three shapes: round, grooved and figure 8, the latter form not being extensively used.

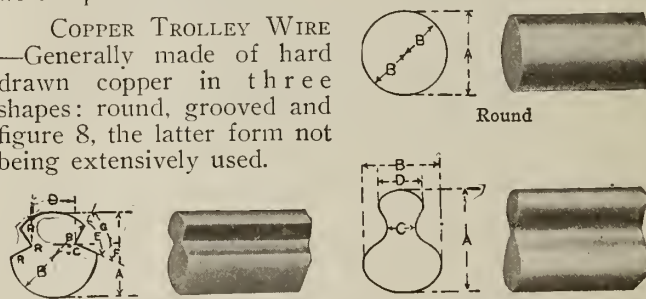


Figure 8
 TROLLEY WIRE, THREE SHAPES

DATA, HARD DRAWN COPPER TROLLEY WIRE

Section of trolley wire	Size, B. & S.	Sectional area in cir. mils.	Weight, lbs. per 1,000 ft.	Tensile str. gth., lbs.	Dimensions								
					A	B	C	D	E	F	G	R	
Round	0	105,600	319	4,522	.325	.1625	...	...	...	...	...	...	...
	00	133,200	404	5,550	.365	.1825	...	...	...	...	...	...	...
	000	168,100	509	6,735	.410	.2045	...	...	...	...	...	...	...
	0000	211,600	641	8,140	.460	.230	...	...	...	...	...	...	...
Groove-1 "American Standard"	00	133,200	404	...	.392	.196	$\frac{3}{8}$	.20	78°	27°	51°	.015	
	000	168,100	509	...	.430	.215	$\frac{7}{8}$	.22	78°	27°	51°	.015	
	0000	211,600	641	...	.482	.241	$\frac{1}{2}$	.25	78°	27°	51°	.015	
	0000	211,600	641	...	.480	.352	108	.196	...	...	...	...	...
Figure 8	00	133,200	404	...	.540	.400	130	.222	...	...	...	...	...
	000	168,100	509	...	.600	.450	150	.250	...	...	...	...	...
	0000	211,600	641	...	...	...	...	...	...	...	...	...	...

DATA, HARD DRAWN COPPER TELEGRAPH AND TELEPHONE WIRE

Size, B. & S.	Diam., in.	Weight per mile in lbs.	Size, B. & S.	Diam., in.	Weight per mile in lbs.
8	.1285	264	12	.0808	104
9	.1144	209	14	.0641	66
10	.1019	166			

EXTRA FLEXIBLE CABLES—Made up of a large number of small copper wires, and are for flexible connectors, commutator brushes, third rail shoes and similar purposes.

Made both concentric and rope lay.

RAIL BONDS—Made of any desired type, capacity or length to meet any requirements. All standard types of terminal stud bonds are made, from which any particular style of bond can be selected for any given set of track conditions. These bonds are distinguished by accurate workmanship, superior grade of material and simplicity of design, insuring lasting and economical service.

PROPERTIES OF HARD DRAWN COPPER WIRE
(Adopted by the A. S. T. M.)

Size, B. & S.	Diam., in.	Area cir. mils.	Tensile strength, lbs. per sq. in.	Per cent elongation in 10 in.	Size, B. & S.	Diam., in.	Area cir. mils.	Tensile strength, lbs. per sq. in.	Per cent elongation in 10 in.
0000	0.460	211,600	49,000	3.75	8	0.128	16,380	63,400	1.4
000	0.410	168,100	51,000	3.20	9	0.114	12,996	64,200	1.3
00	0.365	133,200	52,800	2.70	10	0.102	10,404	64,800	1.2
0	0.325	105,600	54,500	2.4	11	0.091	8,281	65,400	1.1
1	0.289	83,520	56,000	2.1	12	0.081	6,561	65,700	1.0
2	0.258	66,560	57,500	2.0	13	0.072	5,184	66,000	0.9
3	0.229	52,440	58,500	1.9	14	0.064	4,096	66,200	0.9
4	0.204	41,620	59,500	1.8	15	0.057	3,249	66,400	0.8
5	0.182	33,120	60,500	1.7	16	0.051	2,601	66,600	0.8
6	0.162	26,240	61,500	1.6	17	0.045	2,025	66,800	0.7
7	0.144	20,740	62,500	1.5	18	0.040	1,600	67,000	0.7

EXTRA GALVANIZED W. & M. TELEPHONE and TELEGRAPH WIRE—There are three standard grades, all made from the very best materials by improved processes: "extra best best" (E. B. B.), "best best" (B. B.), and "steel."

While these grades differ in physical characteristics, there is no difference in the standard as regards galvanizing.

PROPERTIES OF GALVANIZED TELEPHONE AND TELEGRAPH WIRES
Based on Standard Specifications

Size, B. & W. G.	Diam. in. = d	Area in cir. mils = d ²	Weight, lbs.		Breaking strain, lbs.			Resistance per mile (International Ohms) at 68° F. or 20° C.		
			Per 1000 ft.	Per mile	Ex. B. B.	B. B.	Steel	Ex. B. B.	B. B.	Steel
0	340	115,600	313	1,655	4,138	4,634	4,965	2.84	3.38	3.93
1	300	90,000	244	1,289	3,223	3,609	3,867	3.65	4.34	5.04
2	284	80,656	218	1,155	2,888	3,234	3,465	4.07	4.85	5.63
3	259	67,081	182	960	2,400	2,638	2,880	4.90	5.83	6.77
4	238	56,644	153	811	2,028	2,271	2,433	5.80	6.91	8.01
5	220	48,400	131	693	1,732	1,940	2,079	6.78	8.08	9.38
6	203	41,209	112	590	1,475	1,652	1,770	7.97	9.49	11.02
7	180	32,400	87	463	1,158	1,296	1,389	10.15	12.10	14.04
8	165	27,225	74	390	975	1,092	1,170	12.05	14.36	16.71
9	148	21,904	60	314	785	879	942	14.97	17.84	20.70
10	134	17,956	49	258	645	722	774	18.22	21.71	25.29
11	120	14,400	39	206	513	577	618	22.82	27.19	31.55
12	109	11,881	32	170	425	476	510	27.65	32.94	38.23
13	95	9,025	25	129	310	347	372	37.90	45.16	52.41
14	83	6,889	19	99	247	277	297	47.48	56.56	65.66
15	72	5,184	14	74	185	207	222	63.52	75.68	87.84
16	65	4,225	11	61	152	171	183	77.05	91.80	106.55

DATA, W. & M. TELEPHONE WIRE

Size, B. W. G.	Diam., in.	Bdls. per mile	Weight per 1000 ft., lbs.	Size, B. W. G.	Diam., in.	Bdls. per mile	Weight per 1000 ft., lbs.
4	0.238	4	153	10	0.134	2	49
6	0.203	3	112	11	0.120	2	39
8	0.165	2	74	12	0.109	2	32
9	0.148	2	60	14	0.083	2	19

EXTRA GALVANIZED BOND WIRE—For signal bonding on steam roads. Extra B. B. extra galvanized telephone wire is nearly always used for this purpose. Cut and straightened to lengths at small extra charge. Usually 3 to 5 ft. long, of any gage number desired.

EXTRA GALVANIZED STEEL SIGNAL WIRE—Used as

connection from lever or other pulling device to semaphore signal operated mechanically. The two sizes in common use are Nos. 8 and 9 B. W. G., with breaking strength of 2350 lbs. and 1900 lbs. respectively.

STANDARD STEEL STRAND—Galvanized or extra galvanized. Used chiefly for guying poles and smokestacks, supporting trolley wire, and operating railroad signals.

For fuller data, see our Wire Rope Catalogue in this volume.



STANDARD STEEL STRAND
7 steel wires twisted into single strand
GALVANIZED OR EXTRA GALVANIZED

Diam., in.	Weight per 1000 ft., lbs.	Strength, lbs.	Diam., in.	Weight per 1000 ft., lbs.	Strength, lbs.
3/4	1,200	18,000	1/4	125	2,300
5/8	800	14,000	3/8	95	1,800
3/8	650	11,000	1/2	75	1,400
1/2	510	8,500	5/8	55	900
5/8	415	6,500	3/4	40	700
3/4	295	5,000	7/8	32	500
7/8	210	3,800	1	20	400
1	160	2,800	1 1/8	13	300

EXTRA GALVANIZED SPECIAL STRANDS—Three special grades which meet all requirements for durability, strength, toughness and light weight: Extra galvanized Siemens-Martin strand, extra galvanized high strength (crucible steel) strand, and extra galvanized extra high strength (plow steel) strand. All three grades are composed of 7 wires each, and have very heavy coating of galvanizing, insuring long life.

Besides these three standard grades, we are in position to make strands to the most exacting specifications.

For fuller data, see our Wire Rope Catalogue in this volume.



EXTRA GALVANIZED SPECIAL STRAND

EXTRA GALVANIZED SIEMENS-MARTIN STRAND				EXTRA GALVANIZED HIGH STRENGTH STRAND				EXTRA GALVANIZED EXTRA HIGH STRENGTH STRAND			
Diam., in.	Actual breaking strength, lbs.	Elastic limit per cent	Per cent elongation in 24 ins.	Diam., in.	Actual breaking strength, lbs.	Elastic limit per cent	Per cent elongation in 24 ins.	Diam., in.	Actual breaking strength, lbs.	Elastic limit per cent	Per cent elongation in 24 ins.
5/8	19,000	50	10	5/8	25,000	55	6	5/8	42,500	60	4
15,000	50	10	21,500	55	6	15,000	55	6	35,000	60	4
11,000	50	10	18,000	55	6	9,000	50	10	27,000	60	4
8,000	50	10	15,000	55	6	6,800	50	10	22,500	60	4
4,860	50	10	8,100	55	6	4,380	50	10	17,250	60	4
3,060	50	10	5,100	55	6	2,000	50	10	12,100	60	4
1,500	50	10	3,300	55	6	900	50	10	7,600	60	4
									4,900	60	4
									2,250	60	4

Catenary Method of Supporting Trolley Wire—These three special grades of extra galvanized special strands are also used in the catenary method of supporting trolley wire.

Long Spans in High Tension Current Transmission Line—Where necessary to cross over rivers, lakes and bays with power transmission lines, the current may be conducted through an extra galvanized strand of one of the three special grades of steel previously described, of such size and strength as will show a safety factor of at least 5.

An entire power transmission line of very high

potential could be economically constructed with extra galvanized Siemens-Martin strand, reducing the number of supporting towers which are often the cause of energy loss and trouble.

PROPERTIES OF SPECIAL GRADES EXTRA GALVANIZED SPECIAL STRANDS					
Diam. strand, in.	Number of wires in strand	Strength S. M. strand, tons	Strength crucible strand, tons	Strength plow strand, tons	Weight per ft., lbs.
1½	61	55	91.5	121	4.75
1½	61	45.5	76	100	3.95
1½	37	38	63.5	85	3.30
1½	37	32.5	54	72	2.62
1	37	25.5	43.7	60	2.25
¾	19	19	32	45	1.70
¾	19	14.2	23.7	35	1.25
¾	19	10	16.5	23.5	.81

TICO RESISTANCE WIRE—A high grade nickel steel wire for purposes where a high specific and uniform resistance is required.

Used in some constant potential devices, such as electric heaters and rheostats for the purpose of transforming electrical energy into heat.

DATA, TICO RESISTANCE WIRE									
Size, B. & S.	Diam. in. mils.	Area cir. mils.	Area, sq. in.	Weight, lbs. per 1000 ft.	Ft. per lb.	Resistance			
						Ohms per ft.	Ohms per lb.	Ft. per ohm	Lbs. per ohm
4	204.31	41743	.032784	110.5	9.05	.0124	.112	80.9	8.94
5	181.94	33102	.025999	87.7	11.40	.0156	.178	64.2	5.63
6	162.02	26250	.020618	69.54	14.4	.0197	.283	50.8	3.53
7	144.29	20820	.016351	55.14	18.1	.0248	.450	40.3	2.22
8	128.49	16510	.012967	43.73	22.9	.0313	.715	32.0	1.40
9	114.42	13092	.010283	34.68	28.8	.0394	1.14	25.4	.879
10	101.90	10384	.008155	27.50	36.4	.0497	1.81	20.1	.553
11	90.74	8234	.006467	21.81	45.8	.0627	2.88	16.0	.348
12	80.81	6530	.005129	17.70	57.8	.0791	4.57	12.6	.219
13	71.95	5179	.004067	13.72	72.9	.0997	7.29	10.0	.137
14	64.08	4107	.003225	10.88	92	.1257	11.6	7.95	.0865
15	57.07	3257	.002558	8.625	116	.1585	18.4	6.31	.0544
16	50.82	2583	.002029	6.842	146	.2000	29.2	5.00	.0342
17	45.26	2048	.001609	5.425	184	.252	46.5	3.97	.0215
18	40.30	1624	.001276	4.302	232	.318	73.9	3.15	.0135
19	35.89	1288	.001012	3.411	293	.401	117	2.49	.00851
20	31.96	1022	.000823	2.707	369	.505	187	1.98	.00535
21	28.46	810.1	.0006363	2.146	466	.638	297	1.57	.00337
22	25.35	642.5	.0005046	1.702	588	.804	473	1.24	.00212
23	22.57	509.5	.0004002	1.350	741	1.014	751	.986	.00133
24	20.10	404.1	.0003173	1.070	934	1.278	1194	.782	.000837

ARMATURE BINDING WIRE—Tinned steel armature wire is manufactured in four grades: A, B, C1 and C2, which vary in tensile strength.

Grade A—Used to bind armatures of small motors and dynamos.

Grade B—Commercial grade. Used on motors and dynamos of ordinary commercial size and speed.

Grade C1—Made of high grade piano wire and used where great strength is required.

Grade C2—Used when very high tensile strength is required, as on motors and dynamos of unusual size and high speed.

POLE STEPS—For use of electric light, street railway and telephone companies. Have our regular spike and button heads, each step carefully threaded with screw thread. Special shapes or lengths to order.

DATA, POLE STEPS					
Size, in.	Weight per 100 pole steps, lbs.		Size, in.	Weight per 100 pole steps, lbs.	
	Plain	Galvanized		Plain	Galvanized
8 x 5/8	73	75	8½ x 7/8	58	61
9 x 5/8	78	81	9 x 7/8	62	65
10 x 5/8	85	88	10½ x 7/8	71	74
10½ x 5/8	89	93	9 x 1½	51	54

A keg of pole steps weighs about 200 lbs.

Magnet Wire.

All magnet wire is thoroughly annealed by processes which insure uniform and extreme softness, high-

est conductivity and ease of handling. Before cover is applied all wire is carefully inspected for size, uniformity of dimensions, freedom from scale and all surface imperfections.

Large quantities of the ordinary commercial sizes of cotton covered magnet wire are produced, as well as fine and special work, silk and cotton. Magnet wire is covered with single, double or triple cotton or silk, asbestos, cotton and paper.



SINGLE COTTON COVERED MAGNET WIRE



DOUBLE COTTON COVERED MAGNET WIRE

DATA, COARSE SIZES ROUND COTTON COVERED MAGNET WIRE

Size, B. & S.	Diam., in.	Allowable variation either way in per cent	Rated area in cir. mils.	SINGLE COTTON COVERED Approx. values		DOUBLE COTTON COVERED Approx. values	
				Outside diam., in.	Ft. per lb.	Outside diam., in.	Ft. per lb.
0	0.3249	½ of 1	105.625	.333	3.1	.339	3.1
1	.2893	½ of 1	83.694	.297	3.9	.303	3.9
2	.2576	½ of 1	66.358	.266	5.	.272	4.9
3	.2294	¾ of 1	52.624	.237	6.2	.243	6.2
4	.2043	¾ of 1	41.738	.212	7.8	.218	7.8
5	.1819	¾ of 1	33.088	.190	9.9	.196	9.9
6	.1620	¾ of 1	26.244	.170	12.5	.176	12.4
7	.1443	¾ of 1	20.822	.152	15.7	.158	15.6
8	.1285	1	16.512	.136	19.8	.142	19.6
9	.1144	1	13.087	.121	24.9	.125	24.7
10	.1019	1	10.384	.108	31.4	.113	31.1
11	.0907	1	8.226	.097	39.5	.102	39.1
12	.0808	1¼	6.528	.087	49.6	.092	49.2
13	.0720	1¼	5.184	.078	62.5	.083	61.7
14	.0641	1¼	4.108	.070	78.6	.075	77.5
15	.0571	1½	3.260	.063	98.9	.068	97
16	.0508	1½	2.580	.056	125	.060	122
17	.0453	1½	2.052	.050	157	.054	153
18	.0403	1½	1.624	.045	198	.050	192
19	.0359	1½	1.288	.041	248	.045	240

DATA, FINE SIZES SILK COVERED ROUND MAGNET WIRE

Size, B. & S.	Diam. in.	Area cir. mils.	SINGLE SILK			DOUBLE SILK		
			Max. outside diam., in.	Ft. per lb.	Lb. per 1000 ft.	Max. outside diam., in.	Ft. per lb.	Lb. per 1000 ft.
20	.0320	1.024	.0340	316	3.160	.0360	313	3.190
21	.0285	812.2	.0305	398	2.510	.0325	393	2.543
22	.0253	640.0	.0273	502	1.990	.0293	492	2.013
23	.0226	510.7	.0246	632	1.581	.0266	623	1.604
24	.0201	404	.0221	796	1.257	.0241	781	1.280
25	.0179	320.4	.0199	1000	1.000	.0219	977	1.023
26	.0159	252.8	.0179	1258	.794	.0199	1233	.811
27	.0142	201.6	.0162	1569	.637	.0182	1531	.653
28	.0126	158.7	.0146	1996	.501	.0166	1934	.517
29	.0113	127.6	.0133	2463	.406	.0153	2380	.420
30	.0100	100.0	.0120	3125	.320	.0140	3003	.333
31	.0089	79.70	.0109	3906	.256	.0129	3731	.268
32	.0080	63.20	.0100	4878	.205	.0120	4651	.215
33	.0071	50.13	.0091	6060	.165	.0111	5714	.175
34	.0063	39.69	.0083	7575	.132	.0103	7092	.141
35	.0056	31.47	.0076	9433	.106	.0096	8695	.115
36	.0050	25	.0070	11627	.086	.0090	10637	.094
37	.0045	19.80	.0065	14492	.069	.0085	12987	.077
38	.0040	15.68	.0060	17857	.056	.0080	15625	.064
39	.0035	12.46	.0055	22222	.045	.0075	18518	.054
40	.0031	9.860	.0051	27027	.037	.0071	22222	.045



ROUND ASBESTOS AND SINGLE COTTON COVERED MAGNET WIRE

DATA, ROUND ASBESTOS AND SINGLE COTTON COVERED
MAGNET WIRE

Size, B. & S.	List number, asbestos and single cotton covered	Lbs. per 1,000 ft.	Diam. over insulation, in.	Quantity on reels, lbs.	Shipped on reel number
0000	5440	656	.482	150	321
000	5430	522	.432	150	321
00	5420	415	.387	150	321
0	5400	325	.347	150	321
1	5401	258	.311	150	313
2	5402	205	.280	150	313
3	5403	163	.251	150	313
4	5404	130	.226	150	313
5	5405	103	.204	150	313
6	5406	82	.184	150	313
7	5407	66	.166	150	313
8	5408	52	.150	150	313
9	5409	42	.136	150	313



SQUARE MAGNET WIRE DOUBLE COTTON COVERED

Copper 98% conductivity and annealed extremely soft. Used largely in street railway motors

Size, B. & S.	List number	Radius of corners, in.	Diam. over insulation, double cotton covered, in.	Quantity on reels, lbs.	Shipped on reel number
0000	5540	$\frac{1}{16}$	.481	150	321
000	5530	$\frac{1}{16}$	.431	150	321
00	5520	$\frac{1}{16}$	.386	150	321
0	5500	$\frac{1}{16}$	.346	150	321
1	5501	$\frac{1}{16}$	.310	150	313
2	5502	$\frac{1}{16}$	.279	150	313
3	5503	$\frac{1}{16}$	.250	150	313
4	5504	$\frac{1}{16}$	.225	150	313
5	5505	$\frac{1}{16}$	.200	150	313
6	5506	$\frac{3}{32}$	.180	150	313
7	5507	$\frac{3}{32}$	.163	150	313
8	5508	$\frac{3}{32}$	.146	150	313
9	5509	.02	.130	150	313
10	5510	.02	.117	150	313
11	5511	.02	.106	150	313
12	5512	.02	.096	150	313
13	5513	.02	.087	150	313

PAPER COVERED MAGNET WIRE—The space required by paper insulation is less than half that required for a double cotton covering, thus allowing more ampere turns in a given space. Very best grade of manila rope paper is used, containing no particles of iron or wood pulp and no trace of alkali or acid.

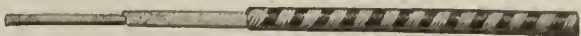


PAPER COVERED MAGNET WIRE

SPECIAL MAGNET WIRE—Special wire made for any unusual purpose, including the following: Round duplex magnet wire in which both conductors, bare or insulated, are laid parallel and covered with 1, 2 or 3 coverings of silk or cotton. Magnet wire also furnished with stranded conductor, if desired. Tinned magnet wire supplied in any shape.

Annunciator and Office Wire.

ANNUNCIATOR WIRE—Commercially pure, soft copper wire from No. 14 to No. 22 B. & S. is used. This is insulated with specially prepared paraffin wax compound. The outside wrap is made of any color or combination of colors, the most common being bright and fast red or blue with white. Put up in spools weighing about 7 lbs. net.



ANNUNCIATOR WIRE

Size, B. & S.	List number	Length in 1 lb., ft.	Size, B. & S.	List number	Length in 1 lb., ft.
14	3114	67	20	3120	221
16	3116	101	22	3122	311
18	3118	155			

“Black Core” or “Dampproof” Annunciator Wire—Finished in colors as above, shipped on spools of about 7 lbs. net. Made with the inside wind saturated with our weatherproof compound. This permits its use in damp places. Outside wind of cotton, which is made in colors, is saturated with special paraffin wax compound, and finished so as to present a smooth and highly polished surface that will not catch dust.

DATA, “BLACK CORE” OR “DAMPPROOF” ANNUNCIATOR WIRE

Size, B. & S.	List number	Length in 1 lb., ft.	Size, B. & S.	List number	Length in 1 lb., ft.
14	3214	60	20	3220	200
16	3216	90	22	3222	280
18	3218	130			

OFFICE WIRE—Standard grade consists of copper conductor from No. 14 to No. 20 B. & S., insulated with 1 wind and 1 braid of cotton, both applied tight and even and saturated with special paraffin wax compound. The outer braid is given high polish and is made in any color, or combination of colors, specified. Standard colors are red and white or blue and white. The wire is put up in coils of about 20 lbs. Used largely by telephone and telegraph companies for inside wiring, extending from the instruments to the junction where they connect with outside wires and cables as they enter building. Also used as high grade bell and annunciator wire.



OFFICE WIRE

Size, B. & S.	List number	Length in 1 lb., ft.	Size, B. & S.	List number	Length in 1 lb., ft.
14	3314	56	18	3318	115
16	3316	80	20	3320	154

“Black Core” or “Dampproof” Office Wire—Has 2 inside cotton winds applied in opposite directions which are thoroughly impregnated with black weatherproof compound. The outside braid is finished same as regular office wire. Used where higher grade of insulation is required. Packed same as regular office wire.



“BLACK CORE” OR “DAMPPROOF” OFFICE WIRE

Size, B. & S.	List number	Length in 1 lb., ft.	Size, B. & S.	List number	Length in 1 lb., ft.
14	3414	53	18	3418	98
16	3416	72	20	3420	135

SPECIAL ANNUNCIATOR AND OFFICE WIRE—Special kinds furnished as specified. Also conductors of other than standard sizes, either solid or stranded. Untinned copper wire is used in the regular product, but tinned wire will be furnished if required.

MULTIPLE CONDUCTORS—Any of these insulated wires can be supplied, 2 in parallel or twisted in pairs, in 3-conductor cables or in cables having any number of conductors. Same can be covered with 1 or more braids or with tape and braid and finished in any manner specified.

Weatherproof and Slow Burning Wires and Cables.

These have moderate degree of insulation and are less expensive than rubber insulated conductors. Double and triple braid. Reliance weatherproof wire meets every requirement for outdoor service, while Reliance slow burning wire is superior for indoor uses.

Wires and cables are made in strict accordance with all requirements of the National Board of Fire Underwriters, sizes varying from No. 20 B. & S. to the largest feeder cables used. Sizes No. 4/0 B. & S. and smaller are usually made of solid wires, while larger sizes have stranded conductors.

Unless hard drawn copper be specified, wires of purest grade of annealed copper, uniform in softness and having minimum conductivity of 98% Matthiessen's standard, will be used.

RELIANCE WEATHERPROOF INSULATION—For use outdoors where moisture is certain and where fireproof qualities are not necessary; also where, on account of small separation, bare wires would be liable to swing into contact with each other or with other low tension cables.

The wires are first covered by 2 or 3 closely and evenly woven braids of strong fibrous material, which is then completely saturated with weatherproof insulating compound. After drying thoroughly, the wire receives dressing of mineral wax, when the surface is thoroughly burnished and polished, reducing to a minimum trouble from sleet and ice.

The insulation will withstand all ordinary climatic conditions.

DATA, RELIANCE WEATHERPROOF WIRE
Solid Copper Wire, Triple Braid, Black Finish National Electrical Code Wire

Size, B. & S.	Minimum thickness of insulation, in.	List number	Weights		Standard packages, amounts, ft.	Shipped on reel number
			Lbs. per 1000 ft.	Lbs. per mile		
0000	.0781	2140	767	4,050	2,400	315
000	.0781	2130	629	3,320	2,500	315
00	.0781	2120	502	2,650	3,200	315
0	.0781	2100	407	2,150	4,300	315
1	.0781	2101	316	1,670	1,000	302
2	.0625	2102	260	1,370	1,300	302
3	.0625	2103	199	1,050	1,600	302
4	.0625	2104	164	865	2,100	302
5	.0625	2105	135	710	2,500	322
6	.0625	2106	112	590	3,400	322
8	.0469	2108	75	395	5,000	322
9	.0469	2109	62	325	6,000	322
10	.0469	2110	53	280	35 to 50	Coils
12	.0469	2112	35	185	25 to 40	Coils
14	.0469	2114	25	130	25 to 40	Coils
16	.0469	2116	20	105	20 to 30	Coils
18	.0469	2118	16	85	20 to 30	Coils

DATA, SOLID COPPER WEATHERPROOF COILS

Size, B. & S.	Weights per coil, lbs.		Outside diam. of coil, in.	Diam. of eye of coil, in.	Thickness of coil, in.	Covering of coil	How shipped
	2 braids	3 braids					
0000	360	383	30 to 34	19	7 1/2	Paper and burlap	Loose coils
000	352	377	30 to 34	19	7 1/2		
00	326	350	30 to 34	19	7 1/2		
0	301	325	30 to 34	19	7 1/2		
1	294	316	30 to 34	19	7 1/2		
2	310	338	30 to 34	19	7 1/2		
3	305	330	30 to 34	19	7 1/2		
4	317	344	30 to 34	19	7 1/2		
5	317	350	30 to 34	19	7 1/2		
6	320	180	30 to 34	19	6		
8	171	195	30 to 34	19	6	Paper	Coils packed in barrels
10	50	50	18 to 20	12	5		
12	40	40	18 to 20	12	5		
14	40	40	18 to 20	12	5		
16	30	30	18 to 20	12	5		
18	30	30	18 to 20	12	5		



RELIANCE WEATHERPROOF CABLE
Stranded copper conductors, double braid, black finish
National Electrical Code Standard

Size	No. and diam. of wires in strand, in.	Diam. bare strand, in.	List number	Weights	
				Lbs. per 1000 ft.	Lbs. per mile
2,000,000	91 x .1482	1.6302	2250	6690	35,323
1,750,000	91 x .1386	1.5246	2251	5894	31,119
1,500,000	91 x .1284	1.4124	2252	5098	26,915
1,250,000	91 x .1172	1.2892	2253	4264	22,516
1,000,000	61 x .1280	1.1520	2254	3456	18,246
900,000	61 x .1215	1.0935	2257	3137	16,513
800,000	61 x .1145	1.0305	2259	2799	14,779
750,000	61 x .1109	.9981	2260	2635	13,913
700,000	61 x .1071	.9639	2261	2471	13,046
600,000	61 x .0992	.8928	2263	2093	11,052
500,000	37 x .1162	.8134	2265	1765	9,318
450,000	37 x .1103	.7721	2267	1601	8,452
400,000	37 x .1040	.7280	2268	1436	7,584
350,000	37 x .0973	.6811	2269	1248	6,589
300,000	19 x .1257	.6285	2270	1083	5,721
250,000	19 x .1147	.5735	2271	907	4,788
0000	19 x .1055	.5275	2240	745	3,935
000	19 x .0940	.4700	2230	604	3,190
00	7 x .1378	.4134	2220	482	2,544
0	7 x .1228	.3684	2200	388	2,051
1	7 x .1093	.3279	2201	303	1,599
2	7 x .0973	.2919	2202	246	1,301
3	7 x .0867	.2601	2203	190	1,004
4	7 x .0772	.2316	2204	155	820
5	7 x .0687	.2061	2205	126	668
6	7 x .0612	.1836	2206	103	544
8	7 x .0485	.1455	2208	68	359

RELIANCE WEATHERPROOF WIRE
Solid copper wire, double braid, black finish
National Electrical Code Standard

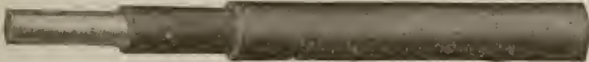
Size Wgts., B. & S.	Diam., in., bare wire	Area cir., mils.	List number	Weights		Standard packages, amounts, ft.	Shipped on reel number
				Lbs. per 1000 ft	Lbs. per mile		
0000	460.0	211600	2040	723	3,817	2,400	315
000	409.6	167772	2030	587	3,098	2,500	315
00	364.8	133079	2020	467	2,467	3,200	315
0	325.0	105625	2000	377	1,989	4,300	315
1	289.3	83694	2001	294	1,553	1,000	302
2	257.6	66358	2002	239	1,264	1,300	302
3	229.4	52624	2003	185	977	1,600	302
4	204.3	41738	2004	151	795	2,100	302
5	181.9	33088	2005	122	646	2,500	322
6	162.0	26244	2006	100	529	3,400	322
8	128.5	16512	2008	66	349	5,000	322
9	114.4	13087	2009	54	283	6,000	322
10	101.9	10384	2010	46	241	35 to 50	Coils
12	80.8	6528.6	2012	30	158	25 to 40	Coils
14	64.1	4108.8	2014	20	107	25 to 40	Coils
16	50.8	2580.6	2016	16	83	20 to 30	Coils
18	40.3	1624.1	2018	12	64	20 to 30	Coils

RELIANCE WEATHERPROOF WIRE
Solid copper wire, triple braid, black finish
National Electrical Code Wire

RELIANCE WEATHERPROOF CABLE
Stranded copper conductors, triple braid, black finish
National Electrical Code Wire

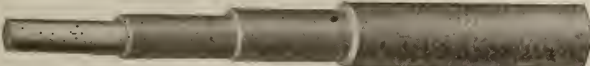
DATA, RELIANCE WEATHERPROOF CABLE
Stranded Copper Conductors, Triple Braid, Black Finish National
Electrical Code Wire

Size	Minimum thickness of insulation, in.	List number	Weights		Standard packages, amounts, ft.	Shipped on reel number
			Lbs. per 1000 ft.	Lbs. per mile		
2,000,000	.1250	2350	7008	37,000	600	324
1,750,000	.1250	2351	6193	32,700	700	324
1,500,000	.1250	2352	5380	28,400	850	324
1,250,000	.1250	2353	4508	23,800	1000	324
1,000,000	.1250	2354	3674	19,400	1320	324
900,000	.1094	2357	3332	17,600	1320	324
800,000	.1094	2359	2992	15,800	1320	324
750,000	.1094	2360	2822	14,900	1320	333
700,000	.1094	2361	2650	14,000	1320	333
600,000	.1094	2363	2235	11,800	1320	333
500,000	.1094	2365	1894	10,000	1320	333
450,000	.0938	2367	1724	9,100	1320	333
400,000	.0938	2368	1553	8,200	1320	333
350,000	.0938	2369	1345	7,100	2640	333
300,000	.0938	2370	1174	6,200	2640	333
250,000	.0938	2371	985	5,200	2640	315
0000	.0781	2340	800	4,220	2000	315
000	.0781	2330	653	3,450	2000	315
00	.0781	2320	522	2,760	2640	315
0	.0781	2300	424	2,240	2640	315
1	.0781	2301	328	1,735	1000	302
2	.0625	2302	270	1,425	1300	302
3	.0625	2303	206	1,090	1600	302
4	.0625	2304	170	900	2100	302
5	.0625	2305	140	740	3000	322
6	.0625	2306	115	610	3400	322
8	.0469	2308	78	410	4000	322



RELIANCE WEATHERPROOF IRON WIRE, DOUBLE BRAID

Size, B. W. G.	List numbers		Weights per mile, lbs.	Length of coil, ft.
	B. B. extra galvanized	Extra B. B. extra galvanized		
4	2704	2804	860	1320
6	2706	2806	665	1760
8	2708	2808	470	2640
9	2709	2809	400	2640
10	2710	2810	350	2640
12	2712	2812	225	2640
14	2714	2814	145	2640
16	2716	2816	100	5280
18	2718	2818	65	5280



RELIANCE WEATHERPROOF IRON WIRE, TRIPLE BRAID

For fire alarm, telephone, telegraph and burglar alarm construction where danger of short circuits with other wires or trees exists

Size, B. W. G.	List numbers		Weights per mile, lbs.	Length of coil, ft.
	B. B. extra galvanized	Extra B. B. extra galvanized		
4	2904	3004	940	1320
6	2906	3006	740	1760
8	2908	3008	525	2640
9	2909	3009	450	2640
10	2910	3010	400	2640
12	2912	3012	260	2640
14	2914	3014	175	2640
16	2916	3016	125	5280
18	2918	3018	85	5280

DATA, WEATHERPROOF IRON WIRE COILS

Size, B. W. G.	Weight per coil, lbs.		Outside diam. of coil, in.	Diam. of eye of coil, in.	Thickness of coil, ins.		Covering of coil	How shipped	Approx. length of coil, ft.
	2	3			2	3			
	braids	braids			braids	braids			
6	222	247	30 to 34	19	6	7 1/2	Paper and bur-lap	Loose coils	1760
8	235	263	30 to 34	19	6	7 1/2			2640
9	200	225	30 to 34	19	6	7 1/2			2640
10	175	200	30 to 34	19	6	7 1/2			2640
12	113	130	30 to 34	19	6	7 1/2			2640
14	.78	87	22 to 24	12	5	5			2640

RELIANCE, SLOW BURNING WIRES AND CABLES—Have insulation that will not carry flame. Especially useful in hot, dry places, and where wires are brought together, as on the back of a large switchboard or in a

wire tower. Each insulating braid completely saturated with white slow burning compound, and outside thoroughly slicked down and given a hard, smooth, white surface.



RELIANCE SLOW BURNING WIRE, NATIONAL CODE STANDARD

Solid conductor, 3 white braids

*Size	STRANDED		SOLID		Standard packages, amounts, ft.	Shipped on reel number		
	List number	Weights		List number			Weights	
		Lbs. per 1000 ft.	Lbs. per mile				Lbs. per 1000 ft.	Lbs. per mile
2000000	2400A	7540	39800	.....	600	.....	
1750000	2401A	6700	35400	.....	700	.....	
1500000	2402A	5830	30800	.....	850	.....	
1250000	2403A	4940	26100	.....	1000	.....	
1000000	2404A	3980	21000	.....	1320	324	
900000	2406A	3640	19200	.....	1320	324	
800000	2408A	3280	17300	.....	1320	324	
700000	2410A	2920	15400	.....	1320	333	
600000	2412A	2460	13000	.....	1320	333	
500000	2414A	2080	11000	.....	1320	333	
450000	2415A	1900	10000	.....	1320	333	
400000	2416A	1700	9000	.....	1320	333	
350000	2417A	1500	7900	.....	2640	333	
300000	2418A	1310	6900	.....	2640	333	
250000	2419A	1120	5900	.....	2640	333	
0000	2640	960	5070	2440 925 489C	2000	315		
000	2630	785	4150	2430 760 4020	2000	315		
00	2620	625	3300	2420 600 3170	2640	315		
0	2600	510	2700	2400 495 2610	2640	315		
1	2601	380	2000	2401 365 1930	1000	302		
2	2602	335	1770	2402 320 1690	1300	302		
3	2603	280	1480	2403 270 1425	1600	302		
4	2604	230	1220	2404 220 1160	2100	302		
5	2605	195	1030	2405 190 1000	2500	322		
6	2606	165	870	2406 160 845	3400	322		
8	2608	105	555	2408 100 530	40-60 lbs.	Coils		
10	.....	.....	.....	2410 80 420	35-50 lbs.	Coils
12	.....	.....	.....	2412 55 290	25-50 lbs.	Coils
14	.....	.....	.....	2414 40 210	40-40 lbs.	Coils
16	.....	.....	.....	2416 30 160	25-40 lbs.	Coils
18	.....	.....	.....	2418 24 130	20-30 lbs.	Coils

*Size and number of wires in strands same as in weatherproof cables



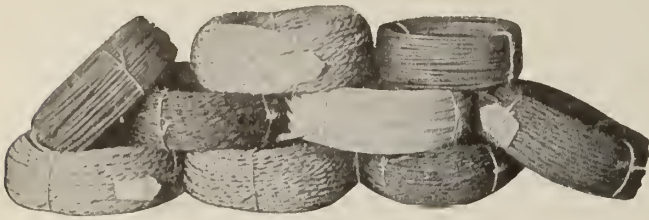
RELIANCE SLOW BURNING CABLE
Stranded copper conductor, 3 white braids

SPECIAL WEATHERPROOF AND SLOW BURNING WIRES—A combined insulation of black weatherproof and white slow burning coverings is often required. The wires may have a single coating of each kind of 3 coatings, 2 of slow burning and 1 of weatherproof, or conversely. When weatherproof covering is inside, the conductor is known as "white finish weatherproof," and when flameproof covering is inside, it is called "black finish slow burning." Outside surfaces are finished smooth and hard. The white finish weatherproof wire only is approved by National Electrical Code.

Any of these weatherproof or slow burning wires furnished twisted into pairs, or formed into cables having any number of conductors, the conductors so formed being incased in 1 or more finished braids or with tape.

Americore Lamp Cord and Reinforced Cord, National Electrical Code Standard.

The lamp cord shown on following page is used in short lengths for exposed wiring in offices and residences to connect the concealed wiring with drop lights, brackets and portables.



LAMP CORD OF ALL KINDS AND SIZES

Also used for automobile lighting, trouble lamps, spot light and many other purposes where a short flexible conductor is desired.



TWISTED LAMP CORD

SPECIFICATIONS—The following data is an extract from the National Board of Underwriters' Specifications dated 1911, and covers our Americore (new code) lamp cord and portable cord.

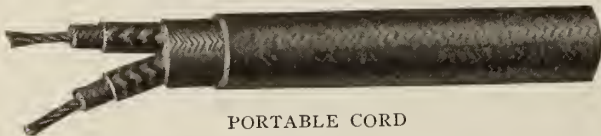
Type C, for Pendant Lamps—In this class is included all flexible cord, which, under usual conditions, hangs freely in the air and not likely to be moved sufficiently to come in contact with surrounding objects. Pendant lamps provided with long cords, so that they can be carried about or hung over nails or on machinery, etc., are not included in this class, even though they are usually allowed to hang freely. Each conductor must have an approved braided covering so put on and sealed in place that when cut it will not fray out.

This type is insulated with $\frac{3}{64}$ -in. rubber on sizes 8 to 14 and $\frac{1}{32}$ on 16 to 22.

Type C. W. P. for Pendant Lamps—Same as above, except must have saturated braid and $\frac{3}{64}$ -in. rubber. For use in damp places.

Type P. O., for Pendant Lamps—Parallel cord—each conductor type C, two such conductors laid parallel and covered with one silk or cotton braid.

Type P., for Portables—Flexible cord for portable use, except in offices, dwellings or similar places where cord is not liable to rough usage and where good appearance is an essential feature, must meet all the requirements for flexible cord for pendants, and in addition must have a tough braided cover over the whole. There must also be an extra layer of rubber between the outer cover and the flexible cord. All sizes (except No. 14 and larger) are insulated with $\frac{1}{32}$ -in. rubber; No. 14 and larger have $\frac{3}{64}$ -in. rubber.



PORTABLE CORD

Type P. W. P., for Portables in Damp Places—(Same as type P except must be furnished with a saturated braid.) For use in damp places, the insulation must be $\frac{3}{64}$ -in. thick on sizes No. 14 and larger, and $\frac{1}{32}$ -in. on sizes No. 16 and smaller, and the cord must have an outer covering saturated with a moistureproof preservative compound thoroughly slicked down, or must have a filler of approved material instead of an extra layer of rubber, and have two outer braids saturated with a moistureproof compound with an exterior surface thoroughly slicked down.

Type P. S., for Portables in Dwellings, Offices, etc.—In offices, dwellings or similar places where cords are not liable to rough usage and where good appearance is essential, flexible cord for portable use must meet all of the requirements for flexible or for pendant lamps, both as to construction and thickness of insulation, and in addition must have a tough braided cover over the whole; or providing there is an extra layer of rubber between the flexible cord and the outer cover, the insulation proper on each stranded conductor of cord may be $\frac{1}{64}$ in. in thickness instead of as required for pendant cords.

Note: This cord has only $\frac{1}{64}$ -in. rubber on each conductor, sizes 16 and 18, approved by underwriters. The supplementary insulation is same as on other portable cords.

DATA, AMERICORE LAMP CORD, TYPES C. AND P. O.

Size, AW. gauge B. & S.	No. wires	Rub- ber, in.	TWISTED PAIR (TYPE C)				DUPLEX PARALLEL (TYPE P. O.)			
			Cotton covered		Silk covered		Cotton covered		Silk covered	
			List num- ber	Weight per 1000 ft., lbs.	List num- ber	Weight per 1000 ft., lbs.	List num- ber	Weight per 1000 ft., lbs.	List num- ber	Weight per 1000 ft., lbs.
10	104	3-64	1100	122.00	1120	116.71	1400	120.0	1420	117.0
12	65	3-64	1102	89.36	1122	84.77	1402	88.9	1422	86.1
14	41	3-64	1104	65.49	1124	61.53	1404	66.1	1424	63.6
16	26	1-32	1106	37.70	1126	34.61	1406	38.7	1426	36.8
18	16	1-32	1108	29.33	1128	26.47	1408	30.2	1428	28.5
20	10	1-32	1110	23.44	1130	20.83	1410	24.5	1430	22.9
22	6	1-32	1112	20.15	1132	17.50	1412	20.9	1432	19.3

DATA, REINFORCED PORTABLE CORD, TYPES P. AND P. W. P.

Size	No. wires	Rubber, in.	DRY COTTON BRAID (TYPE P)		SILK BRAID (TYPE P)		SATURATED BRAID (TYPE P. W. P.)	
			List num- ber	Weight per 1000 ft., lbs.	List num- ber	Weight per 1000 ft., lbs.	List num- ber	Weight per 1000 ft., lbs.
10	104	3-64x1-64	.....	214.7	.....	204.0	.....	222.4
12	65	3-64x1-64	1162	169.2	1172	159.8	1182	175.6
14	41	3-64x1-64	1164	131.2	1174	125.9	1184	135.9
16	26	1-32x1-64	1166	77.9	1176	73.9	1186	81.4
18	16	1-32x1-64	1168	67.4	1178	62.7	1188	69.9
20	10	1-32x1-64	1170	58.2	1180	53.3	1190	59.8
22	6	1-32x1-64	.....	53.2	.....	48.5	.....	54.3

DATA, REINFORCED PORTABLE CORD, TYPE P. S.

Size	No. wires	Rubber, in.	DRY COTTON BRAID (TYPE P. S.)		SILK BRAID (TYPE P. S.)	
			List number	Weight per 1000 ft., lbs.	List number	Weight per 1000 ft., lbs.
10	104	1-64x1-64	.....	142.4	.....	135.1
12	65	1-64x1-64	1142	104.2	1152	98.0
14	41	1-64x1-64	1144	75.3	1154	70.2
16	26	1-64x1-64	1146	56.0	1156	51.7
18	16	1-64x1-64	1148	46.0	1158	41.9
20	10	1-64x1-64	1150	38.2	1160	34.5
22	6	1-64x1-64	.....	33.8	.....	30.3



AMERICAN (SPECIAL) BREWERY CORD

Size	No. wires	Rubber, in.	List number	Weight per 1000 ft., lbs.
10	104	3-64x1-64	.....	254.1
12	65	3-64x1-64	.....	202.4
14	41	3-64x1-64	.....	161.0
16	26	1-32x1-64	.....	98.0
18	16	1-32x1-64	.....	86.8
20	10	1-32x1-64	.....	76.5
22	6	1-32x1-64	.....	71.1

CONSTRUCTION OF CORD FOR PORTABLES—Made with regular National Electrical Code cotton covered lamp cord, over which is placed a supplementary insulation of vulcanized rubber. This is then covered with one strong braid of cotton, thoroughly saturated with a preservative compound, waxed and polished.

Reinforced portable cord is sometimes called for with the outside braid of dry, glazed cotton, either black or colored, and sometimes with a colored silk braid. Such cords take the same lists and are the same as our Reinforced portable cord.

Show window cord and cord for portables are the same as Reinforced portable cord. Orders should specify the kind of braid desired, i. e., whether weather-proof, dry cotton or silk, and the color.

1909 Code: This grade, also known as grade A, is insulated with $\frac{1}{32}$ -in. thickness of rubber, and was formerly the National Code Standard.

Commercial: Known as "old code," or grade C, is insulated with $\frac{1}{64}$ -in. thickness of rubber.

Both these grades are still in demand and can be furnished upon request in lamp cord or portable cord constructions.

The braiding can be either dry cotton or silk in any color or weatherproof saturated cotton.

Americore Brewery, Packing House and Canvasite Cords.

BREWERY CORD (TYPE C. B., CLASS A)—Each conductor is lamp cord strand, cotton wound, insulated with Americore rubber and covered with a weatherproof braid; 2 such conductors twisted together (no braid over all).



BREWERY CORD

List number	Construction of conductor	Thickness of rubber insulation, in.	Size, B. & S. gage	Weight per 1000 ft., lbs.
8930L	104-30 B. & S. wires	3-64	10	125
8932L	65-30 " "	3-64	12	95
8934L	41-30 " "	3-64	14	70
8936L	26-30 " "	1-32	16	40
8938L	16-30 " "	1-32	18	32
8940L	10-30 " "	1-32	20	25

CANVASITE CORD (TYPE C. C.)—Each conductor is lamp cord strand, cotton wound, insulated with Americore rubber and covered with a weatherproof braid; 2 such conductors twisted together with 1 weatherproof braid over all.

This is the same as brewery cord except that there is a weatherproof braid over both conductors.



CANVASITE CORD

List number	Construction of conductor	Thickness of rubber insulation, in.	Equal in capacity to	Weight per 1000 ft., lbs.
8910	104-30 B. & S. wires	3-64	10 B. & S.	140
8912	65-30 " "	3-64	12 " "	105
8914	41-30 " "	3-64	14 " "	85
8916	26-30 " "	1-32	16 " "	48
8918	16-30 " "	1-32	18 " "	39
8920	10-30 " "	1-32	20 " "	32

PACKING HOUSE CORD (TYPE P. K. W. P.)—Each conductor is lamp cord strand, cotton wound, insulated with Americore rubber and covered with a dry braid; 2 such conductors twisted together, jute filled, and covered with 2 weatherproof braids.



PACKING HOUSE CORD

List number	Construction of conductor	Thickness of rubber insulation, in.	Size, B. & S. gage	Weight per 1000 ft., lbs.
8950L	104-30 B. & S. wires	3-64	10	142
8952L	65-30 " "	3-64	12	107
8954L	41-30 " "	3-64	14	84
8956L	26-30 " "	1-32	16	52
8958L	16-30 " "	1-32	18	41
8960L	10-30 " "	1-32	20	33

Americore Deck Cables, Theater or Stage Cable.

DECK CABLES (CLASS A)—Each conductor is stranded, insulated with vulcanized rubber and braided; 2 such conductors twisted together with jute fillers, covered with a supplementary rubber insulation and 1 weatherproof braid.

DATA, DECK CABLES

Size, (B. & S.)	Number of wires in strand	Thickness of rubber insulation, in.	List number	Weight per 1000 ft., lbs.
10	7	3-64x1-32	9960	194
12	7	3-64x1-32	9962	158
14	7	3-64x1-32	9964	129
16	7	1-32x1-32	9966	82
18	7	1-32x1-32	9968	69

THEATER OR STAGE CABLE—Sizes 10 to 16, Type T: Each conductor regular lamp cord strand, cotton wrapped, insulated with code thickness of rubber and covered with single weatherproof braid; 2 or 3 such conductors twisted together with jute fillers and covered with two weatherproof braids.

Sizes 2 to 8, same as above, except have standard rubber covered tinned copper concentric strand and are not covered by type T.



THEATER OR STAGE CABLE

Size, B. & S.	Number of wires in strand	Thickness of rubber insulation, in.	List number	Weight per 1000 ft., lbs.
2	210	4-64	8972	...
3	151	4-64	8973	...
4	133	4-64	8974	...
6	49	4-64	8976	468
8	49	3-64	8978	286
10	104	3-64	8980L	196
12	65	3-64	8982L	153
14	41	3-64	8984L	118
15	26	3-64	8986L	70

BORDER LIGHT CABLES (TYPE B)—Same construction as theater and stage cable, but have not jute fillers, and may have more than 3 conductors.

Elevator Lighting and Control Cable.

Type E construction, 2 or more conductors, no smaller than No. 14 B. & S. for lighting, nor No. 16 B. & S. for control cables, insulated with code thickness of rubber and covered with a dry soft cotton braid; conductors twisted together and covered with a supplementary belt of rubber and 1 weatherproof braid, or with no supplementary belt and 3 weatherproof braids.

Automobile Cables.

We are manufacturing a large number of different styles of lighting, ignition and starting cables in various sizes of conductors; insulated with rubber or cambric or a combination of both, braided or armored over all.

These cables can be furnished in single or multiple conductors.



B-5. BRAIDED PRIMARY SINGLE LIGHTING CABLE; ENLARGED



RS-2-W. DUPLEX PRIMARY AND LIGHTING CABLE

Rubber Covered Copper Telephone Wire.

SPECIFICATIONS—The following are considered standard by the larger telephone companies:

No. 14 B. & S. Twisted Pair "Outside Distribution Wire"—Each conductor hard drawn tinned copper wire, insulated to a diameter of $\frac{5}{32}$ in. over rubber and covered with cotton braid, saturated with black weatherproof compound, wax finish, one conductor having a raised tracer to distinguish it from the other.



NO. 14 B. & S. TWISTED PAIR "OUTSIDE DISTRIBUTION WIRE"

No. 18 B. & S. Twisted Pair "Bridle Wire"—Each conductor soft drawn tinned copper wire, insulated to a diameter of $\frac{7}{64}$ in. over rubber and covered with cotton braid, saturated with black weatherproof compound, wax finish, 1 conductor having a raised tracer to distinguish it from the other.



NO. 18 B. & S. TWISTED PAIR "BRIDLE WIRE"

No. 19 B. & S. Single Conductor Twisted Pair and Triple Conductor "Inside" or "Substation" Wire—Conductors soft drawn tinned copper insulated to a diameter of $\frac{5}{32}$ in. over rubber, covered with single hard glazed cotton braid. Single conductors are braided with plain colored cotton, while in the twisted pair 1 conductor contains a differently colored tracer thread, and in triple conductor 2 of the 3 wires contain different colors or different design of tracer threads, thus making no two of conductor braids alike. Sometimes a differently colored cotton braid is used, 1 for each conductor, for purposes of distinction.



NO. 19 B. & S. SINGLE CONDUCTOR TWISTED PAIR, AND TRIPLE CONDUCTOR "INSIDE" OR "SUBSTATION" WIRE

"Pot Head" Wires, Plain Telephone Conductors—Furnished in the smaller sizes, Nos. 18, 19, 20 or 22 B. & S., either single conductor or twisted pair. Soft tinned copper conductors insulated to a diameter of $\frac{5}{32}$ in. over rubber without any outer braid or protection. In case of twisted pairs, 1 conductor is sometimes made of a differently colored rubber than the other to discriminate between them.



"POT HEAD" WIRE, PLAIN TELEPHONE CONDUCTOR

DATA, TELEPHONE WIRES, TWISTED PAIRS

Size, B. & S.	Finish	Diam. over rubber, in.	List numbers			Weight per 1000 ft., lbs.
			No test	100 megohms	Over 100 megohms	
14	Braided	11-64	9141	9040	9040A	75
14	Braided	5-32	9145	9045	9045A	68
16	Braided	5-32	9165	9065	9065A	72
16	Braided	9-64	9169	9069	9069A	55
16	Braided	4-32	9164	9064	9064A	40
18	Braided	4-32	9184	9084	9084A	35
18	Braided	7-64	9187	9087	9087A	32
19	Braided	7-64	9197	9097	9097A	30
19	Braided	3-32	9193	9093	9093A	28
20 or 22	Braided	3-32	9120 9122 9133P	9020 9022 9093P	9020A 9022A 9093B	26 20
19 20 or 22	Plain	3-32 3-32	9120P 9122P	9020P 9022P	9020B 9022B	24

TELEPHONE CABLES—Made to include any number of single conductors or twisted pairs of telephone wires either plain or braided, bunched together or laid up concentrically, with a tape or cotton braid or other fibrous covering over all. Frequently incased in lead sheath, or armored. These cables vary greatly in construction and are furnished to buyers' requirements and specifications.

struction and are furnished to buyers' requirements and specifications.

RUBBER COVERED IRON TELEPHONE WIRE, SINGLE CONDUCTOR—These conductors are generally No. 12 or 14 B. W. G. galvanized iron wire insulated with code thickness of vulcanized rubber, either single or double cotton braid, weatherproof, saturated and wax polished.



RUBBER COVERED IRON TELEPHONE WIRE, SINGLE CONDUCTOR

Size, B. W. G.	Thickness rubber, in.	SINGLE BRAID		DOUBLE BRAID	
		List number	Weight per 1000 ft., lbs.	List number	Weight per 1000 ft., lbs.
12	$\frac{3}{8}$	1512	100	1512A	140
14	$\frac{3}{8}$	1514	75	1514A	100

When furnished in twisted pairs, 1 conductor contains a raised tracer thread to distinguish it from the other conductor.

OTHER STYLES OF TELEPHONE WIRE—*Spider Wire*—The accepted interpretation of this term is synonymous with "bridle wire," except that it is used singly instead of in pairs. Braids and finish are the same.

Drop Wire—No. 14 B. & S. twisted pair, $\frac{5}{32}$ in. over insulation, with black saturated weatherproof braid, and raised marker in 1 conductor. Hard drawn copper. This service involves the drop from the pole terminal to the house bracket. No. 16 B. & S. insulated to $\frac{4}{32}$ in. is extensively used, but on account of the severe service to which this type of wire is put, necessitating great resistance to climatic conditions, No. 14 B. & S. is considered the standard, because of increased tensile strength.

Jumper Wire—This is often confused with spider and "bridle wire" in outside construction, but by the more general acceptance of the term, it applies to the wire used for cross connecting service on the main distributing frame. It is usually a No. 20 or No. 22 B. & S. wire insulated to $\frac{3}{32}$ in. with flameproof braids; if twisted pair, 1 is red and 1 is white.

Americore Rubber Covered Wires and Cables.

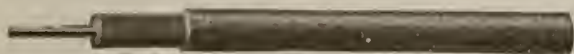
These wires and cables as used for general purposes must possess three essentials: the conductor, the wall of rubber insulation and the braid, tape and braid or other form of protection. The conductor consists of uniformly soft annealed commercially pure copper wire. It may be used in the solid form up to size 1/0 American wire gage (B. & S.), or in special cases even to 4/0, or in the stranded form. All conductors are thoroughly and evenly coated with tin to protect the copper from any injurious effect from the sulphur in the rubber insulation.

KINDS OF RUBBER INSULATION—We make two standard grades of rubber compound for rubber covered conductors: Americore compound, meeting the code requirements; and Amerite, a high grade 30% compound. In addition, wire is insulated to any specifications covering particular requirements, such as 20% or 40% rubber compounds. We also make a high grade compound for lead incased rubber covered cables.

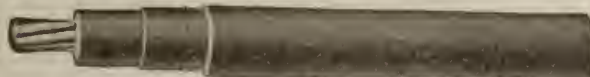
AMERICORE RUBBER—This rubber has all the desirable qualities of a new code wire. It is a high grade compound, meeting all National Electrical Code requirements and can be recommended for all service conditions in which the working pressure is 7000 volts or under.

AMERITE RUBBER—This brand contains only the best grade of pure Para rubber, and is used for high voltage circuits. This makes an unsurpassed dielectric for all high voltages and for exacting service conditions; it has great strength and elasticity, high insulation qualities and long life.

Every wire insulated with our standard compounds has a distinguishing woolen *tracer thread* placed lengthwise of the conductor between the rubber and the braid. In Americore this tracer thread is uncolored and in Amerite it is crimson.



AMERICORE WIRE, SOLID TINNED COPPER CONDUCTOR



AMERICORE CABLE, STRANDED TINNED COPPER CONDUCTOR

DATA, AMERICORE RUBBER COVERED WIRES AND CABLES

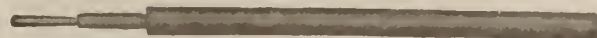
Size, B. & S.	Thickness of rubber, in.	SOLID		STRANDED		Standard packages, amounts., ft.	
		List number	Weight per 1000 ft., lbs.	Number wires in strand	List number		Weight per 1000 ft., lbs.
SINGLE BRAID							
4/0	5-64	810C	784	19	557	832	1000 Reels
3/0	5-64	810B	633	19	558	678	1000 Reels
2/0	5-64	810A	517	19	559	550	1000 Reels
1/0	5-64	810	423	19	560	454	1000 Reels
1	5-64	811	348	19	561	372	1000 Reels
2	4-64	812	268	7	562	289	1000 Reels
3	4-64	813	221	7	563	237	1000 Reels
4	4-64	814	183	7	564	197	1000 Reels
5	4-64	815	152	7	.....	.....	1000 Reels
6	4-64	816	127	7	566	137	1000 Reels
8	3-64	818	80	7	568	86	500 Coils
10	3-64	820	57	7	570	61	500 Coils
12	3-64	822	42	7	572	45	500 Coils
14	3-64	824	32	7	574	34	500 Coils
16	2-64	826	19	.....	.....	.....	500 Coils
18	2-64	828	15	.....	.....	.....	500 Coils
DOUBLE BRAID							
4/0	5-64	850C	820	19	867	871	1000 Reels
3/0	5-64	850B	666	19	868A	715	1000 Reels
2/0	5-64	850A	547	19	869	583	1000 Reels
1/0	5-64	850	450	19	870	485	1000 Reels
1	5-64	851	374	19	871	400	1000 Reels
2	4-64	852	291	7	872	314	1000 Reels
3	4-64	853	242	7	873	260	1000 Reels
4	4-64	854	201	7	874	218	1000 Reels
5	4-64	855	169	7	.....	.....	1000 Reels
6	4-64	856	144	7	876	155	1000 Reels
8	3-64	858	94	7	878	101	500 Coils
10	3-64	860	69	7	880	74	500 Coils
12	3-64	862	53	7	882	57	500 Coils
14	3-64	864	42.2	7	884	44.8	500 Coils
16	2-64	866	25	.....	.....	.....	500 Coils
18	2-64	868	20	.....	.....	.....	500 Coils



AMERICORE FEEDER CABLE

Capacity, in., cir. mils.	Number and diam. of wires in strand, in.	Thick- ness of rubber, in.	Diam. over tape and braid, in.	List number single braid	Weight per 1000 ft., lbs.	Shipped on reel number
250,000	37x.0822	3-32	56-64	340	1018	1013
300,000	37x.0901	3-32	59-64	341	1194	1013
350,000	37x.0973	3-32	62-64	342	1368	1013
400,000	37x.1040	3-32	65-64	343	1541	1013
450,000	37x.1103	3-32	68-64	344	1714	1020
500,000	37x.1162	3-32	72-64	345	1894	1020
600,000	61x.0992	7-64	79-64	346	2282	1020
750,000	61x.1109	7-64	86-64	347	2795	1020
1,000,000	61x.1280	7-64	96-64	348	3640	1021
1,250,000	91x.1172	8-64	107-64	348A	4534	1021
1,500,000	91x.1284	8-64	115-64	349	5406	1015
2,000,000	127x.1255	8-64	129-64	349A	7062	.....

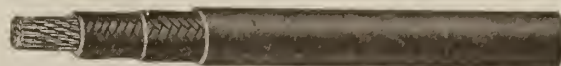
Shipped in reels containing 1000 ft. lengths.

AMERICORE LIGHT INSULATION FIXTURE WIRE
Solid tinned copper conductor, rubber insulation, single braid, black finish

Size, B. & S.	Thickness of rubber, in.	List number	Weight per 1000 ft., lbs.
14	1-64	8004	20
16	1-64	8006	14
18	1-64	8008	10

Americore Rubber Covered Switchboard Cables.

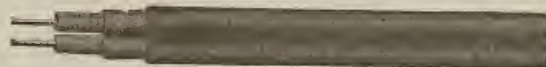
SPECIFICATIONS—Tinned annealed extra flexible strand of highest conductivity, insulated with code thickness of high grade vulcanized rubber, protected with 1 or 2 smooth closely woven cotton braids, saturated in black weatherproof compound and smoothly finished. For switchboard, brush holder and similar connections where very flexible cables are required.

AMERICORE RUBBER COVERED SWITCHBOARD CABLE
National Electrical Code Standard; low potential, 0-600 volts; Class A

Size, B. & S.	Number of wires in strand, in.	Thick- ness- of rubber, in.	Diam. over single braid, in.	Diam. over double braid, in.	List Number		Weight per 1000 ft.		Standard pack- ages, amounts, ft.
					Single braid	Double braid	Single braid	Double braid	
1	259	5-64	37-64	40-64	221	271	376	406	1000
2	210	4-64	33-64	36-64	222	272	302	329	1000
3	151	4-64	30-64	33-64	223	273	231	255	1000
4	133	4-64	27-64	30-64	224	274	210	231	1000
6	82	4-64	23-64	26-64	226	276	144	163	1000
6	49	4-64	23-64	26-64	226A	276A	145	164	1000
8	49	3-64	19-64	22-64	228	278	87	101	500
9	40	3-64	18-64	21-64	229	279	73	87	500
10	19	3-64	17-64	20-64	230	280	61	74	500
12	19	3-64	15-64	18-64	232	282	45	57	500
14	19	3-64	14-64	17-64	234	284	34	45	500

Americore Twin Rubber Covered Wire and Cable.

SPECIFICATIONS—Tinned annealed copper wires or strands of highest conductivity, each conductor insulated with code thickness of high grade vulcanized rubber, protected by saturated braid; 2 such finished conductors laid parallel and covered with heavy cotton braid over all, saturated in black weatherproof compound. Special finish for conduit work.



AMERICORE TWIN RUBBER COVERED WIRE



AMERICORE TWIN RUBBER COVERED CABLE

DATA, AMERICORE TWIN RUBBER COVERED WIRES AND CABLES

Size, B. & S.	Thickness of rubber, in.	SOLID CONDUCTOR		STRANDED CONDUCTOR		Shipped on reel number
		List number	Weight per 1000 ft., lbs.	Number wires	List number	Weight per 1000 ft., lbs.
0000	5-64	917	1653	19	687	1762
000	5-64	918	1328	19	688	1444
00	5-64	919	1091	19	689	1176
0	5-64	920	896	19	690	966
1	5-64	921	743	19	691	796
2	4-64	922	576	7	692	622
3	4-64	923	479	7	693	513
4	4-64	924	399	7	694	431
5	4-64	925	334	7	695	362
6	4-64	926	280	7	696	301
8	3-64	928	181	7	698	195
10	3-64	930	123	7	700	141
12	3-64	932	92	7	702	107
14	3-64	934	71	7	704	83
16	2-64	936	.....	.....	.....	.....
18	2-64	938	.....	.....	.....	.....

Underwriters' rules permit use of above in sizes No. 14 and larger. No. 6 and larger shipped on reels containing 100-ft. lengths; smaller sizes shipped in coils containing 500-ft. lengths.

Industrial Plant Wiring.

While factory wiring does not often have to be concealed, nor to be so neatly installed as in a residence, its installation is not on this account as simple as it seems.

TWO REQUIREMENTS—The primary requirement of factory wiring is to serve as the reliable means of furnishing energy to motors, lamps, heating devices, etc. Power is one of the chief requisites in modern manufacturing; having provided a reliable source of electric power, the wiring for distributing it about the plant must be at least as dependable. The second requirement of the wiring is that it must be safe and free from fire or accident hazards because of the large number of employes that may be at work in the plant and of whom only very few know much about electricity and how to guard against shock or fire from its use. It is in order to provide safety from these hazards that the rules governing factory wiring in the national and local electrical codes have steadily been made more stringent.

TWO PRINCIPAL SYSTEMS—There are two principal wiring systems used in factory buildings: (1) open wiring, in which the insulated wires are supported on porcelain knobs or cleats and are not enclosed in any protection except where exposed to probable injury, and (2) conduit wiring in which the wires are run in metal ducts that are either exposed on ceilings, walls or columns, or concealed in walls and floors, or partly exposed and partly concealed. Conduit wiring is obviously more expensive, but much safer and more reliable because wires are completely protected from mechanical injury, from accumulations of dust, etc. Because of its superior safety, conduit wiring is insisted on for factory buildings in the largest cities and is coming more and more into use everywhere.

SELECTION OF SYSTEM—Selection of the wiring system depends on nature of the building construction and on character of the manufacturing process carried on. In general, it may be said that the less expensive open wiring system may be used in any factory building where no special effort at fireproofing has been made and in which no hazardous materials or processes are used and, further, where wires may be so arranged that they will not be readily distributed. If building is of substantially fireproof construction, open wiring is entirely out of place because every feature of the wiring also should be practically fireproof. If so-called mill construction is used, open wiring may be used with slow burning insulation on wires. Conduit wiring may be used in almost any type of building; but is especially desirable in concrete or other fireproof buildings. In factories or mills where explosive or other hazardous materials are being handled conduit wiring is absolutely essential. Examples are flour mills, grain elevators, powder plants, certain chemical works, oil works, many textile mills, etc.

ECONOMY PRECAUTIONS—Several precautions should be observed in laying out the system in order to promote economy in first cost of installation and in making future additions; this is especially important in concealed conduit systems. Circuits should be run as direct and as free of bends as possible. All wires for a circuit should be run in the same conduit, especially if alternating current is used. Distribution, junction, cut-out and switch boxes or cabinets should be of ample size to accommodate additional feeders and branch circuits that it may be anticipated to add later, even if these are not installed for some time. This may be easily done by having these boxes of ample size, and provided with blank knockouts to permit ready addition of other

feeders or branches without interfering with existing service. If such provision is neglected, troublesome interference, delay and much extra expense may be involved when the additional circuits are needed. In the case of concealed conduit in a concrete building it pays to install ample conduit runs for any possible future demands because of the obvious cost and trouble to put in extra conduit unless the latter is exposed. Wire may be pulled into such extra conduit whenever needed.

SEPARATE FEEDERS FOR LIGHTING AND POWER—Separate feeders should always be installed for lighting and power. The first reason for this is that starting and stopping of motors causes serious fluctuation of the circuit voltage; large changes of load also produce such fluctuations, which are very noticeable in the light emitted by lamps. Flickering light is very annoying to the eye and may produce errors or accidents. The second reason is that motor circuits are more often overloaded or short circuited, and therefore interrupted by blowing of fuses, than lighting circuits. Any combination of lighting and power circuits on the same feeder is therefore liable to cause troublesome cutting off of the light that might lead to confusion, accidents or even panic, if many, or if easily terrified women employes were involved in a large shop.

ILLUMINATION REQUIREMENTS MUST BE DETERMINED—In laying out lighting circuits, the illumination requirements of different rooms must first be known. These depend on the kind of work done, size and light absorbing conditions of the room and on the nature of the lighting equipment selected. On account of these variables, power consumption for lighting ranges from 0.5 to 2.5 watts per sq. ft. in different departments of different plants. For any chosen lighting intensity and related conditions it is possible to find the corresponding unit watt consumption. Assume it to be 1.2 watts per sq. ft. the floor area in square feet multiplied by 1.2 will then give total wattage to be provided for the room in question. Not more than 660 watts is allowed on any ordinary lighting circuit. From these facts it is possible to lay out the requisite circuits, arrangement of which in a large room should usually permit switching on the lamps in rows parallel to the windows, so those farthest from the windows may be turned on first.

The following table shows capacity of different sizes of wires as lighting feeders. The second column gives capacity of the wire in amperes, the third column gives it in watts based on 220 volts between the outer wires. The last six columns give number of 25-, 40-, 50-, 60-, 75- and 100-watt lamps, respectively, that can be supplied by the particular size of wire. The neutral wire is not taken into account, serving chiefly as a means for overcoming unbalance. These capacities have nothing to do with the branch circuits, which are normally limited to 660 watts.

INDEPENDENT SYSTEM FOR EMERGENCY LIGHTING—Since failure of light at a critical time, as at the outbreak of a fire, might easily contribute to serious loss of life in a factory with many employes, because of the great difficulty in finding exits in a dark, smoke filled room, a number of communities require installation of an independent system for emergency lighting. This is an excellent provision in any medium size or large plant. Such a system should have separate circuits and be fed from a source separate from that normally supplying the lighting. If the plant has its own powerhouse, emergency lighting should be fed from a central station or other external source. If the plant uses central station supply, a separate service should furnish emergency lighting. This lighting should include all exit

CAPACITY OF WIRES FOR LIGHTING FEEDERS

Brown & Sharpe wire gage	Ampere capacity	3-Wire System, 220-110-220						
		Feeder wattage	Lamp Wattage					
			25	40	50	60	75	100
14	15	3,300	132	82	66	55	44	33
12	20	4,400	176	110	88	73	58	44
10	25	5,500	220	137	110	91	73	55
8	35	7,700	308	192	154	128	102	77
6	50	11,000	440	275	220	183	146	110
4	70	15,400	616	385	308	256	205	154
3	80	17,600	704	440	352	293	234	176
2	90	19,800	792	495	396	330	264	198
1	100	22,000	880	550	440	366	293	220
0	125	27,500	1,100	687	550	458	366	275
00	150	33,000	1,320	825	660	550	440	330
000	175	38,500	1,540	962	770	641	516	385
0000	225	49,500	1,980	1,237	990	825	660	495
250,000 C.M.	240	52,800	2,112	1,320	1,056	880	704	528
300,000	275	60,500	2,420	1,512	1,210	1,008	806	605
350,000	300	66,000	2,640	1,650	1,320	1,100	880	660
400,000	325	71,500	2,860	1,787	1,430	1,191	953	715
450,000	372	81,840	3,272	2,040	1,636	1,364	1,090	818
500,000	400	88,000	3,520	2,200	1,760	1,466	1,173	880
550,000	425	93,500	3,740	2,337	1,870	1,558	1,246	935
600,000	450	99,000	3,960	2,475	1,980	1,650	1,320	990
650,000	475	104,500	4,180	2,612	2,090	1,741	1,393	1,045
700,000	500	110,000	4,400	2,750	2,200	1,833	1,466	1,100
750,000	525	115,500	4,620	2,887	2,310	1,925	1,540	1,155
800,000	550	121,000	4,840	3,025	2,420	2,016	1,613	1,210
900,000	600	132,000	5,280	3,300	2,640	2,200	1,760	1,320
1,000,000	650	143,000	5,720	3,575	2,960	2,383	1,906	1,430
1,250,000	750	165,000	6,600	4,125	3,300	2,750	2,200	1,650

and stairway lights and enough special lights on each large floor to permit finding the way to the nearest exit.

LAYING OUT POWER CIRCUITS—Laying out power circuits where there are many motors and of different sizes is often a difficult problem. Since the power load is almost invariably many times greater than the lighting load in a factory, even greater care in laying out the power feeders and branch circuits is necessary than for the layout of the lighting, because not only would there be a waste in first cost of unnecessary length of heavy cable or wire but also in needless power loss in over-coming resistance.

Rules for finding the size of wire to run to any motor are quite well known and many tables have been published both for direct current and alternating current motors. It is usual to allow not only for efficiency of motor, but also for at least 10% over full load current because the starting current, though usually of brief duration, is frequently three times the full load current. Obviously, if motor is started at short intervals, or if it is subjected to frequent overloads, wire size has to be larger, else overheating of conductors would ensue. The kind of service motor is to render, type of motor and its rating must be taken into account in determining wire size.

There are conflicting rules and opinions about sizes of mains supplying more than one motor. Insurance inspectors are inclined to require a heavier size of main than many municipal or central station inspectors. Among the former a common rule is to have the main provide for 110% of full load for largest motor plus full load for the other motors of the group. Other inspectors are inclined to allow for the demand factor of motor group; this usually permits of smaller wire size and is legitimate, provided the prospective demand factor is definitely known and remains so after installation. On account of the uncertainty of this it is better to be on the safe side and provide mains of ample size to prevent overheating, which is not only dangerous, but represents needless power loss and reduced voltage and speed for the motors.

In some large plants motor mains are run on the ceiling to a junction box, from which branch circuits are dropped to individual motors. This is economical of wire, but requires fuses in the junction box, which is here located in a relatively inaccessible place, so that blowing of a fuse may represent much delay before

motor can be put back in service. It is preferable to run the mains as risers to distributing boxes or panels on wall or columns where fuses may be quickly replaced.

STARTING DEVICE—For all but small motors over a minimum that depends on the type of motor, kind of service it performs and source of supply, it is necessary to provide a starting rheostat, compensator or other starting device to permit motor to come up to speed gradually without drawing an excessive starting current. This starter should be placed as convenient to the control point as possible; if it is at some distance from a large motor, an automatic remote control system may save considerable heavy wiring. The starting device must have an automatic no-voltage release to prevent possible burnout of the motor if power is suddenly restored while motor switch and circuit is closed. Stopping of motor should preferably be by opening the main switch, which may be done by remote control from several stations about the driven machine.

INSTALLATION OF OPEN WIRING SYSTEM—Installation of an open wiring system is relatively simple. The wires must have either a rubber, slow burning, or slow burning weatherproof insulation; rubber covered wires smaller than No. 6 may have a single outer braid, but No. 6 or larger must have a double braid. In very moist rooms rubber insulation is required. In places where there are corrosive vapors, insulation may be either rubber or weatherproof; in the latter case a coating of shellac or varnish is sometimes applied over the wires after they have been put up. In all cases, wires must be properly supported and spaced. Where exposed to mechanical injury they must be protected by conduit, running boards of guard strips.

INSTALLATION OF CONDUIT WIRING SYSTEM—Installation of conduit wiring is not very difficult when done by a skilled wireman. Rubber covered wiring is used almost exclusively, unless temperature of room is quite high when slow burning insulation is required. In places where there is liability for condensation inside the conduits due to changes of temperature, as in cold storage or refrigerating rooms, conduit must be well drained or open wiring with suitable guard strips where necessary must be used. The growing use of conduit systems in industrial plants is causing electricians quite generally to gain the requisite experience and skill needed for its proper installation. Its almost universal use in the future is therefore to be expected.

Americore Car Cables.

This cable is used for both power and light circuits in electric cars and motor lead cables. It differs from the other rubber insulated conductors already described, in having a layer of fine cotton or paper wound on the conductor underneath the rubber which is easily removed and which leaves the conductor clean for jointing.

SPECIFICATIONS—Consist of tinned annealed copper strand of highest conductivity, over which is placed a wind of fine cotton or paper and a code thickness of vulcanized rubber insulation. This is protected by a closely woven cotton braid, thoroughly saturated with black weatherproof compound and finished smooth.



AMERICORE CAR CABLE
National Electrical Code Standard

Stranded tinned conductor, rubber insulation, single braid, black finish
For low potential, 0-600 volts

Size, B. & S.	Number and diam. of wires in strand, in.	Thickness of rubber, in.	Diam. over braid, in.	List number	Standard packages, amounts, ft.	Shipped on
2	19 x .0592	4-64	31-64	2502	1000	Reels
3	19 x .0526	4-64	29-64	2503	1000	Reels
4	49 x .0292	4-64	29-64	2504	1000	Reels
4	7 x .0772	4-64	27-64	2504A	1000	Reels
6	49 x .023	4-64	25-64	2506	1000	Reels
6	7 x .0612	4-64	24-64	2506A	1000	Reels
8	7 x .0485	3-64	20-64	2508	500	Coils
10	7 x .0385	3-64	18-64	2510	500	Coils
12	7 x .0305	3-64	17-64	2512	500	Coils
14	7 x .0243	3-64	16-64	2514	500	Coils

Americore Fireproof Cables.

This wire is placed before the public at the suggestion of many superintendents of electric light companies who are using it for wiring their stations. It is fireproof in the sense that the braid will not ignite or carry flame.

SPECIFICATIONS—Tinned annealed copper strand of highest conductivity, insulated with required thickness of high grade vulcanized rubber, protected with 2 smooth, closely woven strong heavy cotton braids, each of which is thoroughly saturated in white flameproof compound, smoothly finished.



AMERICORE FIREPROOF CABLE

Stranded tinned copper conductor, double braid, white finish. For high potential, exposed arc lighting and station wiring

Size B. & S.	Number and diam. of wires in strand, in.	For $\frac{3}{32}$ in. rubber		For $\frac{1}{16}$ in. rubber		Shipped on
		Approx- diam. over braid, in.	List number	Approx- diam. over braid, in.	List number	
0000	37 x .0756	59-64	887	63-64	987	Reels
000	19 x .0940	55-64	888	59-64	988	Reels
00	19 x .0836	52-64	889	56-64	899	Reels
0	19 x .0746	49-64	890	53-64	990	Reels
1	19 x .0663	46-64	891	50-64	991	Reels
2	19 x .0592	42-64	892	47-64	992	Reels
4	7 x .0772	39-64	894	43-64	994	Reels
6	7 x .0612	35-64	896	39-64	996	Reels
8	7 x .0485	33-64	898	37-64	998	Reels

Flat Steel Taped Park or Suburban Cables.

These are either rubber, cambric or paper insulated. This type of cable is becoming standard for lighting purposes in parks and boulevards, suburban ornamental lighting, private estates, service laterals and pole connections, and in places where installation is difficult or impossible owing to the absence of ducts. It is installed by being laid in trenches 15 to 30 ins. deep (depending on

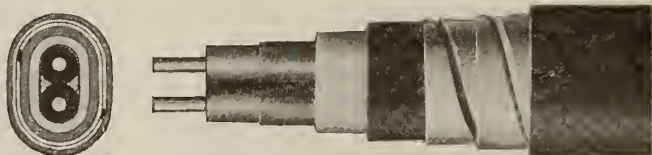
locations), and sufficient in width to permit cables being laid at this depth. This style of cable is not only economical and easy to install, but really makes a safe and reliable substitute for the more expensive conduit system.

Steel taped cables carry their own protection. Being lead covered, they are waterproof. A serving of saturated jute is placed over the lead covering and two steel tapes of suitable width are laid spirally in the same direction with an additional serving of saturated 2-ply jute on the outside. The cable is then drawn through a bath of hot preservative compound and compressed, giving it a smooth and hard finish. Note illustrations:



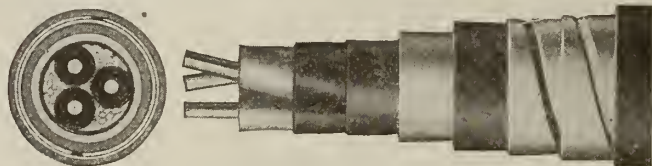
SINGLE CONDUCTOR

Stranded copper conductor, insulation, tape, lead, jute, first steel tape, second steel tape with jute over all



TWIN CONDUCTORS

Solid copper conductors both covered with insulation, taped separately, covered with lead over all, then jute, first steel tape, second steel tape and jute over all



THREE CONDUCTORS

Each conductor solid copper, insulated, taped; 3 such conductors twisted together, jute filled to make round and covered over all with tape, lead, jute, first steel tape, second steel tape and jute over all

The jute and steel armoring protect the cable against mechanical injury and thus permit of its being laid in the trenches, which are afterwards filled with sand and gravel. However, it is desirable to give such cables an additional protection, by putting a layer of sand beneath and over the cable as it is laid in the trench, tamping the sand tightly around the cable, and putting in place a covering of brick or plank before the trench is filled up with gravel. Such extra precaution protects the cable from damage from picks, etc., in case of future excavations.

These cables are usually shipped from the factory in long lengths on reels which, when received at destination, are mounted on a shaft with 2 wheels or on a truck alongside of trench and, as the reel is being pulled forward, the cable is unwound and laid into the open trench, thus avoiding the necessity of making many joints. Where joints are required, the same method is followed as in all other lead covered cables and, in addition to this, a split cast iron joint box (straightaway or branch—details covering jointing material on application) is put over the lead sleeve and protects it against injury.

Cables of this kind can be constructed with any desired number or size of conductors. Each conductor is insulated with a suitable thickness of rubber, cambric, or paper, to meet any standard commercial working voltage.

For low working potentials, the practice of using lead sleeves, solder wiped, can be eliminated, as the joint can be made within the split cast iron joint box, which, after the completion of the joint, is filled with hot insulating compound and, after cooling, makes the joint absolutely waterproof.

All our steel taped cables are subjected to a factory test equal to two and one-half times the working voltage, also high insulation resistance guaranteed.

STANDARD SHIPPING LENGTHS OF CABLES AND OUTSIDE DIAMETERS

Outside diam., in. . . . .	.75	1.00	1.25	1.50	1.75	2.00	2.25 and over
Length, ft.	2000	1750	1500	1200	1000	800	700

INQUIRIES—We make such a great variety of electric light and power cables, they are made in so many different sizes and with so many different thicknesses of insulation and finished in so many different ways that it would be impracticable to attempt to tabulate them all. This class of our product is making an enviable record and is well and favorably known in all parts of the country.

Inquiries containing full information are solicited. If desired, can furnish competent men to make installations at a reasonable charge.

Americore and Globe Mining and Machine Cables.

Specifications—Consist of 2 flexible strands of tinned annealed copper of highest conductivity, each of which is insulated with code thickness of vulcanized rubber and protected with a braid of cotton saturated with weatherproof compound. The 2 finished cables are then placed side by side and covered with 2 or 3 strong cotton braids, thoroughly saturated in weatherproof compound.



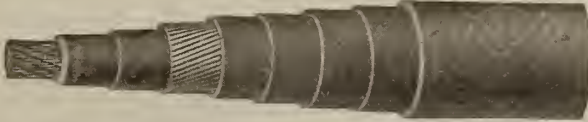
MINING MACHINE CABLE
For low potential, 0-600 volts

Size, B. & S.	Number wires in strand	Thickness of rubber, in.	Weight per 1000 ft., 2-braid, lbs.	Weight per 1000 ft., 3-braid, lbs.	List number			Shipped on reel number
					Americore insulation 2 outer braids	Americore insulation 3 outer braids	Globe insulation 3 outer braids	
2	49	4-64	687	721	1442	942	1342	1002
3	49	4-64	573	605	1443	943	1343	1002
4	49	4-64	478	510	1444	944	1344	335
5	49	4-64	407	437	1445	945	1344A	335
6	49	4-64	348	376	1446	946	1346	335
8	49	3-64	212	233	1448	948	1348	1004
9	49	3-64	191	212	....	949	1348A	1004
10	49	3-64	164	186	....	950	1350	1004

While this cable is commonly used in sizes from 2 to 10 B. & S., other sizes will be made to specifications. Hard spun cotton cord braids will be substituted for the regular cotton braid at a slightly advanced price, when same is required for extra hard usage.

AMERICORE CONCENTRIC MINING MACHINE CABLE—Specification A—Inner conductor is composed of 49 (7x7) tinned copper wires, insulated with rubber; this is finished with a tape or a braid; around this are placed tinned copper wires to equal in area the central conductor. A belt of rubber (code thickness) is then applied, and the whole finished with 3 braids or a tape and 2 braids—black finish.

Specification B—Same as A, without the outside belt of rubber.



DUPLEX CONCENTRIC STRANDED MINING MACHINE CABLE

DUPLEX CONCENTRIC STRANDED MINING MACHINE CABLE
For low potential, 0-600 volts

Size B. & S.	Number of wires in central conductor	Thickness of rubber, in.	Weight per 1000 ft., lbs.
CONSTRUCTION A			
2	49	$\frac{1}{64} \times \frac{1}{64}$	765
3	49	$\frac{1}{64} \times \frac{1}{64}$	615
4	49	$\frac{1}{64} \times \frac{1}{64}$	574
5	49	$\frac{1}{64} \times \frac{1}{64}$	500
6	49	$\frac{1}{64} \times \frac{1}{64}$	430
8	49	$\frac{1}{64} \times \frac{1}{64}$	266
CONSTRUCTION B			
2	49	$\frac{1}{64}$	634
3	49	$\frac{1}{64}$	520
4	49	$\frac{1}{64}$	458
5	49	$\frac{1}{64}$	380
6	49	$\frac{1}{64}$	313
8	49	$\frac{1}{64}$	200

Amerite High Grade 30% and Special Rubber Insulated Wires and Cables.

For station wiring, arc light and signal service, street railroad feeders and high voltage power transmission lines.

Rubber covered wires and cables made to the most exacting specifications; in any size or finish and for all services and voltages.

Insulated with rubber compounds containing only highest grades of Para rubber and other necessary preservative ingredients. The exact composition of rubber compound used and thickness of rubber insulation in every case determined by working voltage and by nature of service.

Conductors furnished solid, stranded or extra flexible as ordered, annealed and heavily tinned.

SIGNAL WIRES AND CABLES—Made to meet, in every respect, the rigid specifications of the Railway Signal Association. Insulated with 30% Para rubber or higher grade, as required by leading railroads.

These signal wires and cables may consist of single rubber covered conductors or of any number of such conductors stranded into a cable.



Solid Conductor, Insulated and Braided



Twin Wires, Insulated and Braided



Armored Torpedo Cable
SIGNAL WIRES AND CABLES

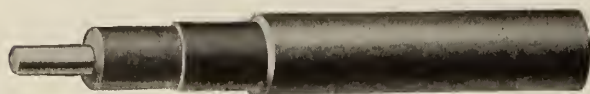
Electric Light and Power Cables, Lead Incased or Armored.

These are made in all types, aerial, underground and submarine. Made to the most rigid specifications, in any quantity, size or length, for any voltage, and finished for any service, single or multiple conductor or concentric laid.

Only the very best of materials enter into the construction of these cables.



AMERICORE LEAD INCASED CABLE
Stranded tinned copper conductor, rubber insulated, taped and lead incased



AMERICORE LEAD INCASED CABLE
Solid or stranded tinned copper conductor, rubber insulated, taped and lead incased

RUBBER INSULATED, LEAD COVERED CABLES—We make a specialty of heavy rubber cables, lead sheathed, armored, or lead incased and armored, for all services and voltages, and finished in any style.

These are made to meet the most exacting requirements, such as those specified for government and for railway signal service, underground, submarine, or aerial.

While taped and braided rubber wires and cables are used for inside and submarine service with entire satisfaction without any lead sheathing, experience has demonstrated the advisability of enclosing the cable in a sheath whenever it is to be used in conduits for underground work, or where it would be exposed to acids, gases, extreme temperature changes, or other destructive agencies.



AMERICORE LEAD INCASED CABLE
4-conductor, stranded, rubber, tape, jute and lead

Any number of rubber insulated conductors can be stranded into a core or cable, the interstices between the conductors usually being rounded out with jute fillers. In this condition the cable is ready for the application of the tape and lead sheath, or as sometimes required, a supplementary belt of rubber insulation, and then the tape and sheath or other protection.

All copper conductors are annealed thoroughly and heavily and evenly tinned, and have a guaranteed conductivity of 98% or better.

Rubber insulated cables may be finished in any one of the following ways, as may be specified:

Taped and leaded.

Taped, leaded and braided, weatherproof, soapstone or flameproof finish.

Taped, leaded and juted.

Taped, leaded, juted and armored.

Taped, leaded, juted, armored and juted.

Taped, juted and armored.

Taped, juted, armored and juted.

A tracer thread is always laid underneath the tape.

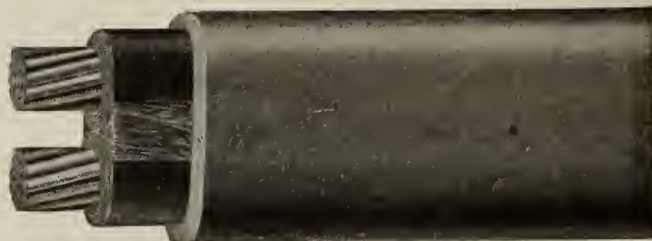
Cables may be taped and braided instead of taped, and in each case 1, 2 or 3 reverse layers of jute can be used.

Other combinations are sometimes required which can be made as specified.

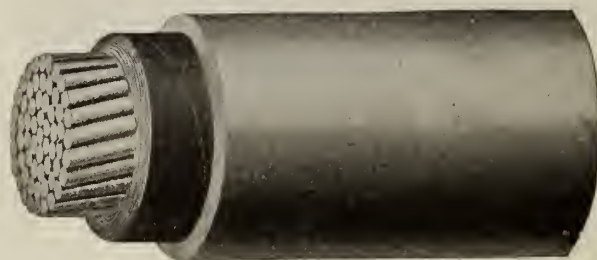
Paper Insulated Lead Sheathed Cables.

Used for electric light and power purposes. Made with single and multiple conductor, and to the most exacting specifications.

Narrow and very thin strips of pure manila paper are wound spirally about the conductor in sufficient number of layers for required dielectric strength. After paper covering is applied to single conductor, or core of conductors in the form of a belt, every trace of air and moisture is removed from cable by special processes, and while in this condition the core is thoroughly saturated and all interstices completely filled with hot insulating compounds.



TWIN LEAD INCASED PAPER CABLE



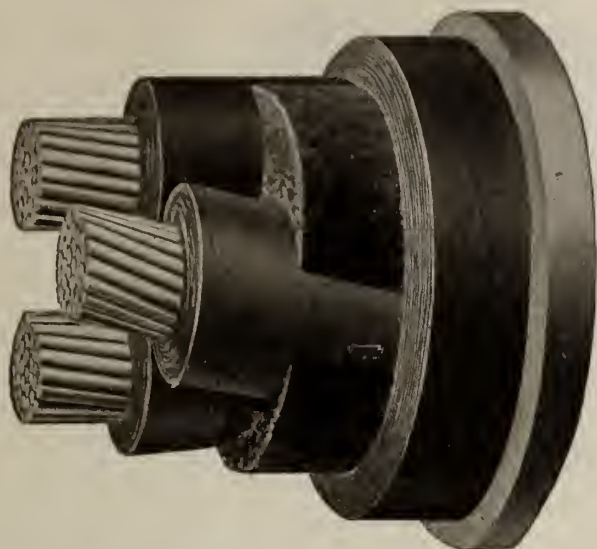
PAPER INSULATED AND LEAD COVERED CABLE

Cable is then put through a hydraulic press and covered with closely fitting lead sheathing so as to exclude all air and moisture and retain insulating compound. A tracer thread is placed lengthwise of all cables underneath the sheath.

Paper cables are generally cheaper and have lower electrostatic capacity than rubber or varnished cambric cables. Insulation is strong and uniform in quality, and except when frozen solid, is quite flexible.

Paper cables can be worked safely at higher temperature than can other kinds, and experience has demonstrated that their useful life is practically determined by the integrity of the sheathing. For this reason thickness of lead sheath should in general be greater than for corresponding sizes of rubber or cambric cables, by $\frac{1}{64}$ in. or $\frac{2}{64}$ in. Paper is less liable than rubber to deterioration from excessive electrostatic strains.

In short, paper insulated cable when properly constructed and sheathed can be recommended as one of the best for most conditions.



3-CONDUCTOR PAPER INSULATED LEAD INCASED CABLE

4/0 3-conductor, 37 wires each; diameter of each copper conductor, .53 in.; thickness of paper over each conductor, $\frac{5}{32}$ in.; thickness of supplementary paper, $\frac{9}{32}$ in.; thickness of lead, $\frac{1}{8}$ in.; diameter over lead, 2.281 ins.



NO. 6 B. & S. SOLID, 3-CONDUCTOR, PAPER INSULATED, LEAD INCASED CABLE

Varnished Cambric Cables.

A single conductor varnished cambric cable is made by winding tapes of thin varnished cotton or muslin cloth spirally about the conductor in a sufficient number of smooth, tightly drawn layers to make the required thickness of dielectric.

The cotton fabric is saturated with several applications of special non-hardening insulating varnish. The dielectric strength of this material is very high, as a single thickness of cotton well treated with this special varnish will withstand a stress of from 8,000 to 12,000 volts for 5 seconds, depending upon the number of coats of varnish.

The varnish prevents the tape from unwrapping when the cable is cut, and permits adjoining layers of varnished cambric to slide upon each other, thus insuring a concentric condition when the cable is bent. This compound of varnish prevents capillary absorption of moisture between the layers of tape, seals any possible skips in films and precludes air spaces.

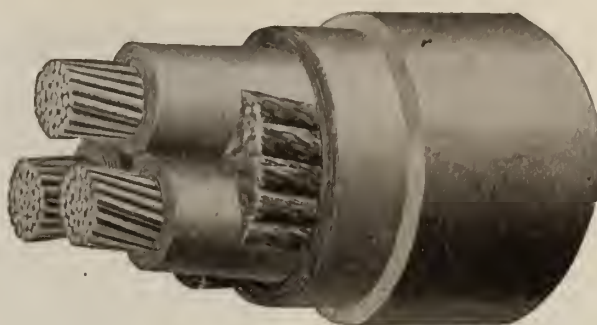
In multiple conductor cables, it is usual to place a portion of the required thickness of insulation in the form of a belt about the core of conductors, as in the case with paper cables.

This class of cables is in general more flexible than paper cables, more impervious to moisture, reasonable in cost, and can be used in dry places such as for station wiring without lead sheathing.

When no sheathing is required the cable is protected by a cotton braid, or with an asbestos braid for fire protection. These braids are saturated in weather-proof compounds or in slow burning compounds, as may be required.

These cables are made in any quantity, of any size or type and for any voltage or service condition, to the most rigid specifications.

Inquiries containing full information as to working conditions are solicited and prices will be quoted on application.



3-CONDUCTOR VARNISHED CAMBRIC LEAD CABLE

This class of material furnished to the most exacting specifications. Full information as to the purpose for which the cable is to be used, location, depth of water and working conditions should accompany requests for prices.

Installation of Underground Cables.

This company will furnish, install and guarantee its underground cables for almost any class of service. Rubber covered telephone or telegraph cables, electric light and power cables, single or multiple conductors insulated with rubber, paper or varnished cambric, made to carry current for any service at any pressure within practical working limits.

We maintain a fully equipped cable department, supervised by experienced and able engineers and manned by competent cable workmen, which has for many years and with marked success attended to all matters pertaining to underground and submarine cable installations.

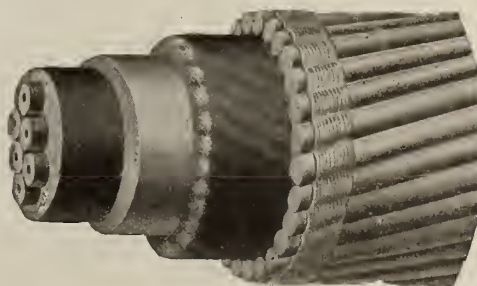
Through this department, we are at all times prepared to install cables, to make estimates or to advise customers regarding specifications, costs of installations and so on, or to furnish competent supervisors for installations made by the customer himself.

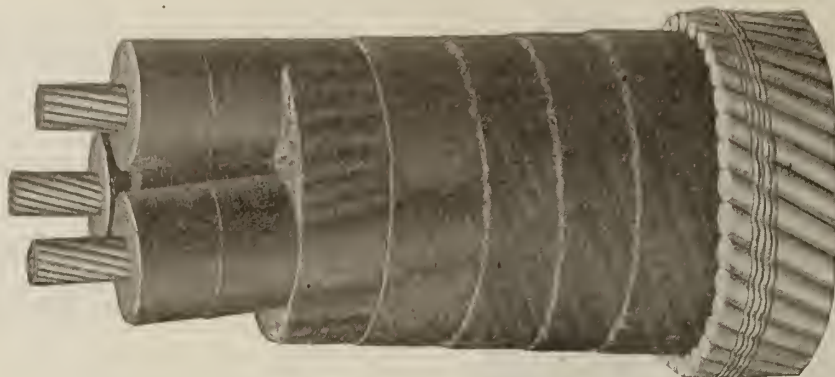
Submarine Cables.

Large quantities of submarine cables of every class are manufactured and installed for street railways, telegraph and telephone companies and electric light and power plants. These are used for crossing rivers, bays, ponds or lakes.



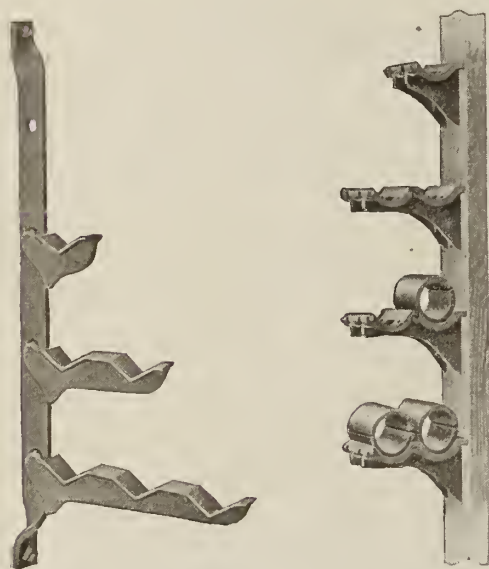
2-CONDUCTOR TWIN SUBMARINE CABLE, LEAD INCASED, JUTE SEWED AND ARMORED

SUBMARINE CABLE
Multiple conductor rubber insulated signal cable

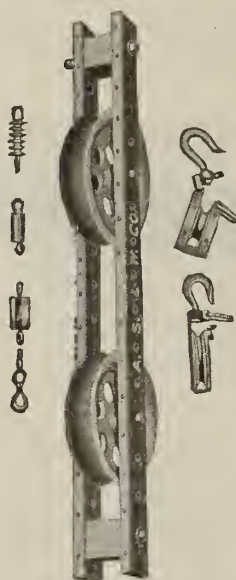


SUBMARINE CABLE FOR TRANSMITTING POWER AT 25,000 VOLTS

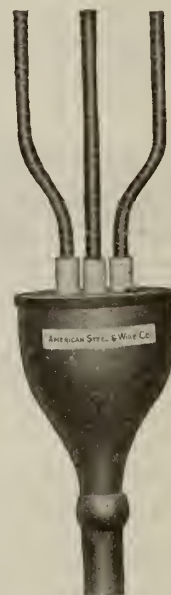
3-conductor, 2/0 cable, 19 wires in each strand; rubber insulation $\frac{19}{32}$ in. thick and taped. 3 conductors laid up with jute fillers and taped all over. Covered with 3 jute servings in reverse layers. 35 galvanized iron armor wires, each .25 in. in diameter. Outside diameter of cable, 3.41 ins. This particular cable, 7000 ft. long, has been in service under the St. Lawrence River for one year. A similar cable has been in service three years. Both are giving entire satisfaction.



TYPICAL MANHOLE RACKS FOR CABLES



APPLIANCES USED IN CONNECTION WITH INSTALLATION OF CABLES



END BELL FOR 3-CONDUCTOR CABLE



MAKING UNDERGROUND CABLE JOINTS IN STORMY WEATHER

CROUSE-HINDS COMPANY

Manufacturers of Electrical Appliances

SYRACUSE, N. Y.

BRANCH OFFICES

NEW YORK, N. Y., 30 Church Street

BOSTON, MASS., 201 Devonshire Street

CHICAGO, ILL., 417 South Dearborn Street

Products.

Manufacturers of ELECTRICAL APPLIANCES:

Panels; Distributing Boards; Panelboard Cabinets, Steel and Wood; Knife Switches; Iron Clad Safety First Switches; Condulets (Conduit Outlets); Condulet Covers and Fittings, including Receptacles (Plug and Lamp) and Cord and Fixture Rosettes.

Also, Flood Light Projectors, Voltmeter, Ammeter and End Cell Battery Switches; Receptacles for conduit boxes, moulding, cleat and temporary installations, as well as Heavy Duty Attachment Plug Receptacles, Plugs and Guy Anchors.

Panels.

Crouse-Hinds standard line of panelboards includes types for cartridge or plug fuses only in branches and, also, for either style of fuses in connection with knife, flush rotary or double push button switches; also dead front (safety first), metering and residence panels.

Special panels are designed for uncommon conditions and this service is free to customers. This company prides itself both on excellence of products and promptness of delivery.

Panelboard Cabinets.

Boxes and trim are of the same high excellence as the panelboards. Each steel box is formed from one piece of No. 10-gage sheet metal, although lighter gage metal is allowed.

Switches.

All current carrying parts of Crouse-Hinds switches are of hard drawn copper, 98% conductivity, with a current density rating of 1000 amperes per sq. in. of sectional area. Sliding contacts are rated at 75 amperes per sq. in. Blades are ground in contact. Parts can not work loose.

Condulets.

Condulets (conduit outlets) are made in hundreds of types and sizes, from single branch pull boxes for $\frac{3}{8}$ -in. conduit, to the massive, fused, surface entrance fitting (type FF) for 4-in. conduit. In fact, there is a condulet for every need. They are made of the best grade, gray cast iron and are designed to secure the maximum strength. They have threaded hubs to receive conduit, are well proportioned, and are no larger than their purpose demands.

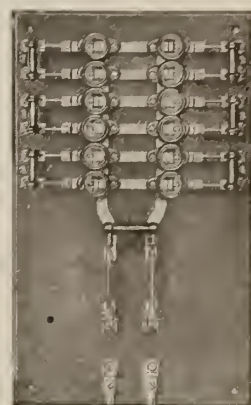
Catalogues.

Crouse-Hinds catalogues, giving complete illustrations, descriptions and listings, will be mailed free, on request, to any address.

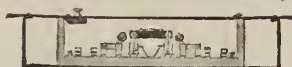
SWEET'S CATALOGUE



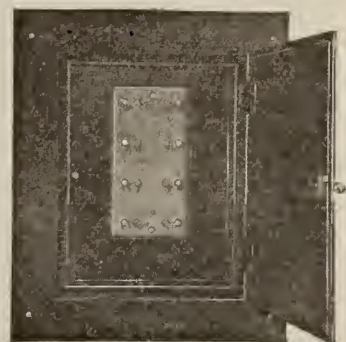
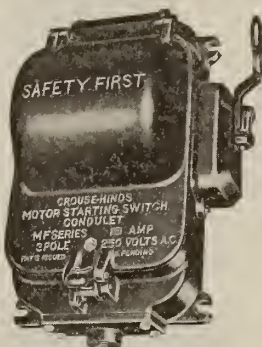
TYPE "BN" CABINET



TYPE "DK" PANEL
2 TO 2 WIRE



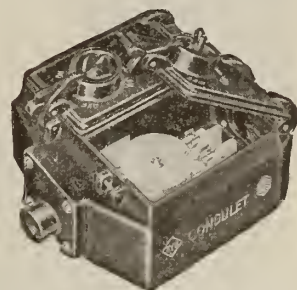
TYPE "MFA" MOTOR
STARTING SWITCH
CONDULET



DEAD FRONT PANEL IN TYPE
BMS2 CABINET
No live parts accessible while inner
door is closed



FUSED, IRON CLAD
AND FOOLPROOF
SWITCH CONDULET
(TYPE MKA)



TYPE ZYU SWITCH CONDULET
Live parts inaccessible while switch
is on



TYPE J
CONDULET
WITH NORBIT
CONDULETT
RECEPTACLE
AND SHADE
HOLDER GROOVE



TYPE DS108
COVER ON
TYPE FS CON-
DULET,
WEATHER-
PROOF AND
DAMAGE-
PROOF

THE TRUMBULL ELECTRIC MFG. CO.

PLAINVILLE, CONN.

SALES OFFICES

NEW YORK, N. Y., 114 Liberty Street
Telephone, Rector 5321
BOSTON, MASS.

CHICAGO, ILL., 40 South Clinton Street
PHILADELPHIA, PA.
SAN FRANCISCO, CAL., 595 Mission Street

Products.

SAFETY SWITCHES; DEAD FRONT PANELBOARDS and CABINETS; SWITCHBOARDS.

Knife Switches, Push and Snap Switches, Cutouts, Rosettes and various wiring devices.

"Circle T" "Safety" Switches.

This is the name under which our knife switches in externally operated boxes are classified.

Exposed knife switches present a great danger from inexperienced handling.

A switch in an ordinary iron or steel box is safe as long as box is closed, but should be opened only by an experienced person.

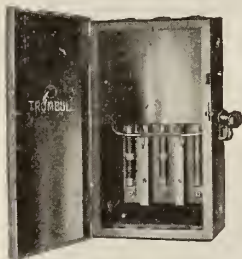
Externally operated switches can be opened and closed by any one; and when so constructed that the box can never be opened on a live closed switch, it is possible for any one to renew fuses without danger.



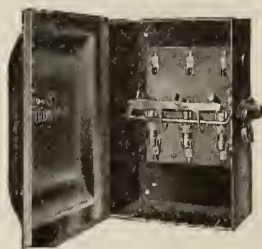
[TRADE-MARK]



EXTERNALLY OPERATED ENTRANCE SWITCH
Box closed



With 100% Safety Shield



Box Open

"CIRCLE T" "SAFETY SERVICE" EXTERNALLY OPERATED ENTRANCE SWITCH

"Circle T" Dead Front Panelboards and Cabinets.

Designed and produced to permit the unrestricted use of circuit switches without the possibility of the operator coming in contact with any of the live parts of the panel.

They meet the safety requirements of the United States Bureau of Standards, the Underwriters' Laboratories, Inc., and the Workmen's Compensation Laws of the various states.

TYPES OF DEAD FRONT PANELS—*Heavy Duty Type*—C T for N.E.C. cartridge fuses; P T for plug fuses—both with 30-ampere tumbler switches.

Light Duty Type—C P for N.E.C. cartridge fuses; P P for plug fuses—both with 20-ampere push button switches.

SAFETY CABINETS FOR DEAD FRONT PANELS—Cabinets are so designed that no live parts are exposed, and so that they can be opened and operated by the most inexperienced person without danger to the person or the service.

They are equipped with double doors (a door within a door).

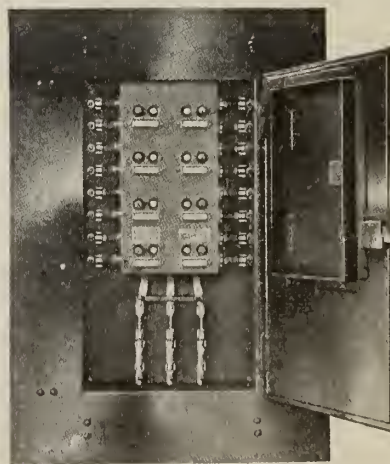
(a) The smaller door is secured by a catch and can be opened at will. It covers the switches only, and when open no live parts are exposed. This door may be omitted when so specified without reducing the safety value of the cabinet.

(b) The larger door is equipped with a combination lock and catch, and covers the branches and main switch or main fuses. This door may be opened only by an authorized person of experience for inspection or renewal of fuses.

(c) Single doors with spring catch are used to cover the entire panel of both types with plug fuses in branches where there are lugs only in mains, in which case a sectional plate covers these lugs and no live parts are exposed.

Cabinets are made either flush or surface type as hereinafter described.

USES—*Heavy Duty Types, C T and P T*—For use particularly in factories or elsewhere where glue pots, soldering irons or other electric heating devices are used in the processes of manufacture, or where unreliable or unskilled help are employed, and in stores, stockrooms, etc., using large wattage type C lamps.



TYPE OF "CIRCLE T" DEAD FRONT PANELBOARDS AND CABINETS FOR LIGHT DUTY REQUIREMENTS

Branch switches are 30-ampere, 125-volt, 2-pole or 3-pole tumbler type switch, quick make and quick break (moulded handle indicates type). These switches are the latest development in meeting the demand of enduring ruggedness under severe use.

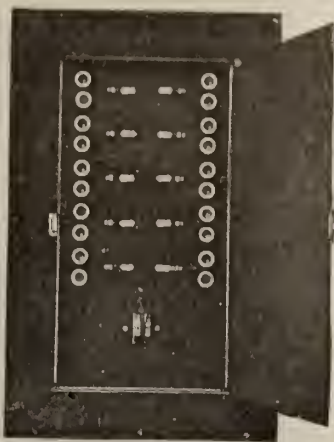
They are positive and reliable in action.

Steel supporting frames and the steel parts are nickelplated. The fuses are so placed that when the switch is open the fuses are dead.

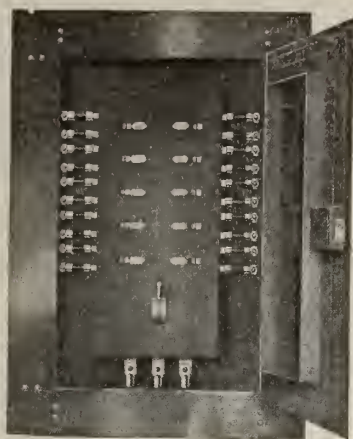
The base of the panels is natural black electrical slate, free from metallic veins.

Light Duty Types, C P and P P—These types are particularly adaptable for residential work, for churches, apartment houses, department stores and factories where the heavier types are not required.

Because of its narrow width (11 in. or 17 in. complete with cabinet) it can be installed in many locations otherwise impracticable for a panelboard, such as pilasters supporting columns and elsewhere, where the space is convenient, but limited.

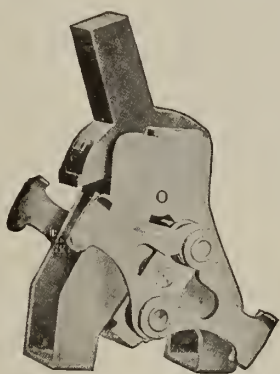


Type P T



Type C P

TYPES OF "CIRCLE T" DEAD FRONT PANELBOARDS AND CABINETS FOR HEAVY DUTY REQUIREMENTS



TUMBLER SWITCH

Used on Types C T and P T "Circle T" dead front panels

DESCRIPTION, TYPES P P AND C P—Type P P—(Plug fuses and push switches) is distinctly a sectional panel being built up of double branch units made of cold moulded, fireproof, impregnated insulation (Transit), with a much higher electrical resistance than marble or slate, and the unit base is grooved in the rear for bus and circuit bars. The individual units are mounted on a backing $\frac{1}{4}$ in. thick, of the same material which is also non-absorptive.



PUSH BUTTON SWITCH

Used on Type C P and P P "Circle T" dead front panels

Type C P—(Enclosed fuses and push switches) has a base of 1-in. natural black electrical slate and is not a sectional panel.

The switches and the fuse receptacles on both of these types are mounted upon the front, and may be removed (in type C P the switches only are removable) from the front for repairs or replacements.

Branch switches are 20-ampere, double-pole, push button type with a short push, designed especially for panelboard use.

OFFICIAL APPROVAL—All "Circle T" panels and cabinets are examined and labeled under direction of the Underwriters' Laboratories, Inc.

Switchboards.

Owing to the great diversity of design in switchboard construction, it is impracticable to present comprehensive data on the subject, further than the statement that this company is thoroughly equipped to design, build and erect any kind of switchboard desired for either direct or alternating current.

An efficient engineering department is maintained and the factory equipment is of the best.

Knife switches used are our regular type "A." Any make of indicating instruments, circuit breakers and oil switches can be supplied.

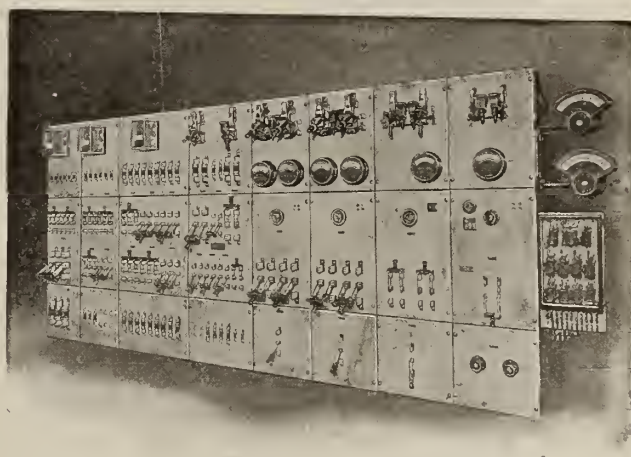
When drawings of switchboards are requested with quotations, they are charged for at actual cost and this charge is credited if the order is later placed with this company.

Publications.

Knife Switches, "Safety" Switches and Wiring Devices are listed in Catalogue 12.

Panelboards, Cabinets and Switchboard Accessories are listed in Bulletins 1, 2 and 3.

These will be gladly furnished by the home office or branch office upon application.



SWITCHBOARD AT CITY HALL ANNEX, BOSTON, MASS.
Built for Hixon Electric Co., Boston, Mass.

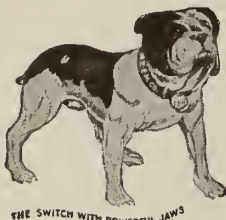
MUTUAL ELECTRIC & MACHINE CO.

Manufacturers of Electrical Controlling and Distributing Apparatus
DETROIT, MICH.

Products.

"BULL DOG" SYSTEM of MOTOR CONTROL.

"BULL DOG" KNIFE SWITCHES, SWITCHBOARDS, PANELBOARDS and CABINETS; "BULL DOG SUPER-SAFETY" APPARATUS.



THE SWITCH WITH POWERFUL JAWS

TRADE-MARK

"Bull Dog" System of Motor Control.

This system of motor control is particularly adapted for large industrial plants having a number of induction motors of capacities varying from 5 to 50 h. p., which may be controlled from one central point. The system is adaptable for use under various conditions, and accomplishes the following results:

(a) Reduces the maximum demand in current, because the number of motors that can be started up at one time is limited.

(b) The use of fuses is unnecessary throughout the system.

(c) Induction motors ranging from 5 to 50 h. p. may be started from one central point without the use of individual compensators for motors.

(d) Any of the motors may be individually tested and proper readings made without interfering with the wiring installation or shutting down the motor.

(e) No live metal parts are accessible from the front of the board, which feature appeals particularly to plants that are in step with the "Safety-First" movement.

(f) Full protection is provided for the motors.

(g) Any motor may be shut down from any or several locations as desired, by merely pushing a button.

(h) Only authorized or experienced persons can start the motors.

(i) Materially reduces the cost of large motor installations, and particularly reduces the cost of maintenance, which is usually required where compensators are used.

The system may also be provided with a lock-out, which is an additional "Safety-First" feature, that does not permit the starting of the motor until this lock-out button is released.

This "Motor Control System" is a switchboard or a group of boards similar to the cut shown above, consisting of double throw oil circuit breakers, which were particularly designed for this system, with a starting bus and running bus; special automatic compensator coils are provided in connection with the starting bus. A switch is first thrown in the starting position and then thrown on the running bus.

INDORSEMENTS—This system is not new, but has been in use for the past 10 years in the following plants: Dodge Bros., Detroit, Mich.; Ford Motor Plant, Canada; Chevrolet Motor Company, Flint, Mich.; Studebaker Corporation, South Bend, Ind.; General Motors Corporation, Saginaw, Mich.; Timken-Detroit Axle Co., Detroit, Mich. and other manufacturing plants throughout the country.

CO-OPERATIVE SERVICE—Detailed information will be given to engineers who are interested in this system.

The MUTUAL ELECTRIC & MACHINE CO. will gladly co-operate in the determination of the adaptability of this system for particular requirements.



"BULL DOG" MOTOR CONTROL SYSTEM INSTALLED IN A GOVERNMENT SHELL PLANT

Double unit; each unit arranged for 18 motors. The system is particularly adaptable for controlling from 10 to 30 motors to the unit

"Bull Dog" Switches.

"Bull Dog" switches are made of pure copper, 98% conductivity, milled and sweated type. "Multiple" (two or more) blades are used with each pole of the switch larger than 200 amperes.

Round studs are regularly furnished on all back connected switches, 30 to 2000 amperes, respectively. "Laminated" busbar studs are used on switches of larger capacity.

RANGE OF "BULL DOG" SWITCHES

Capacity, amperes	30, 60, 100, 200, 300, 400, 600, 800, 1,000, 1,200, 1,500, 2,000, 2,500, 3,000, 4,000, 5,000, 6,000, 8,000, 10,000
Voltage*	A.C.
	30, 125, 250, 440, 500, 600
D.C.	250, 600
No. of poles	Single, double, triple, four, five, six
Throw	Single or double
Fuse	With or without fuse holders
Connection	Front or back connected

* Switches of higher voltages are designed primarily for that installation.

"Dead Face" or "Super-Safety" Switchboards.

"Dead Face" switchboards are furnished for theaters, office buildings and industrial plants. There are no live metal parts on the face of the switchboards.

Switches are interlocking, and may be arranged so that a master shaft lever can operate the switches in groups.

"Dead Face" switches are double break type. Switches and fuses are dead when open.

"Bull Dog" Panelboards and Cabinets.

"Bull Dog" panelboards and cabinets are manufactured in all types to meet all conditions.

Mains may be 2, 3 or 4 wires, according to the system, with lugs only, fuse holders only, no fuse switch, or switch and fuse holders.

FAIRBANKS, MORSE & CO.

Manufacturers of Electric Motors
CHICAGO, ILL.

Products.

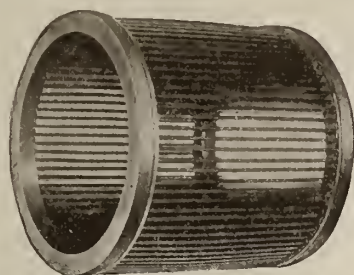
ELECTRIC MOTORS.

Electric Dynamos, Alternators, Lighting Plants, Starters, etc.

For Oil Engines, see page 699; for Centrifugal, Steam and Power Pumps, see page 737.

Solid Metal Rotor "Cage" Winding.

Used on all Fairbanks-Morse squirrel cage motors over 3 h.p. One piece of solid metal without joints, eliminating repairs occasioned by loose screws and rivets or resoldering joints. This is the original, jointless rotor winding, and insures maximum conductivity.

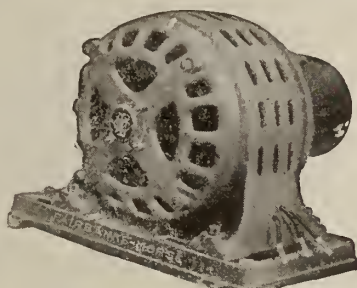


SOLID METAL ROTOR "CAGE" WINDING

Type "H" Squirrel "Cage" Ball Bearing Motor.

For alternating current. Ball bearings mean less friction, higher efficiency, proved reliability. Type "H" motors have grease lubrication, bearings are dustproof; no oil slop.

Bulletin 210.

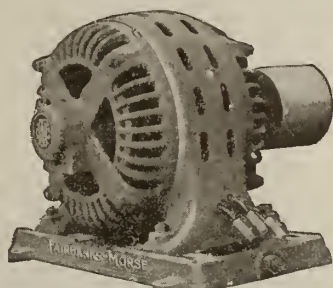


TYPE "H" SQUIRREL "CAGE" BALL BEARING MOTOR

Type "B" Squirrel "Cage" Induc- tion Motor.

For alternating current. Big sturdy ring oiling bearings with interchangeable phosphor bronze sleeves.

Bulletin 202.

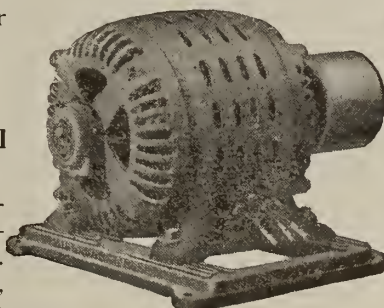


TYPE "B" SQUIRREL "CAGE" INDUCTION MOTOR

Type "KPV" Internal Starter Motor.

For alternating current. Especially adapted for remote control. Close a switch to start, open to stop. Switch may be located anywhere. Takes little starting current. May be used where squirrel "cage" motors would impair the lighting service.

Bulletin 210.

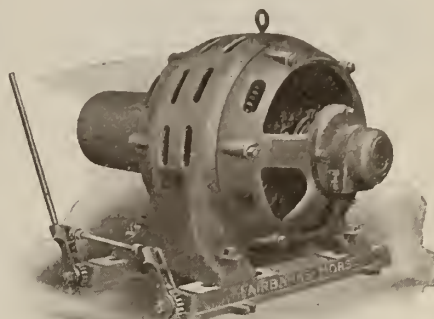


TYPE "KPV" INTERNAL STARTER MOTOR

Type "BV" Slip Ring or Wound Rotor Motor.

For use where speed control is desired, or high starting torque with small starting current. For alternating current.

Bulletin 29.

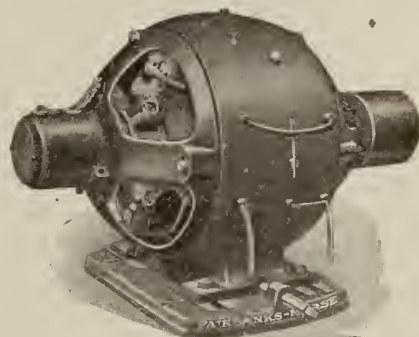


TYPE "BV" SLIP RING OR WOUND ROTOR MOTOR

Type "CP" Ring Oiling Sleeve Bearing Motor.

For direct current. Commutating pole or interpole type. Either constant speed or adjustable speed for machine tools.

Bulletin 27.

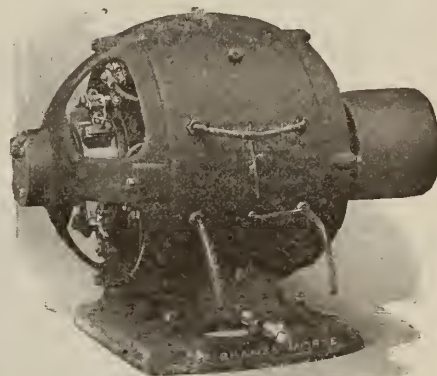


TYPE "CP" RING OILING SLEEVE BEARING MOTOR

Type "CPB" Ball Bearing Motor.

For direct current. Similar to the "CP" motor except that it has ball bearings. The grease packed ball bearings require little attention.

Bulletin 31.



TYPE "CPB" BALL BEARING MOTOR



"Y" OIL ENGINES

Furnished with either alternators or generators make most economical power plants for small cities or towns

ALLIS-CHALMERS MANUFACTURING COMPANY

Power and Electrical Equipment

MILWAUKEE, WIS.

DISTRICT OFFICES

ATLANTA
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SAN FRANCISCO
SEATTLE

FOREIGN DISTRICT OFFICES: LONDON, PARIS and SANTIAGO, CHILE
CANADIAN REPRESENTATIVES: CANADIAN ALLIS-CHALMERS, LTD., TORONTO

Products.

ELECTRICAL EQUIPMENT: Motors for all purposes, Alternating Current and Direct Current Generators, Motor Generator and Turbo Generator Sets, Transformers, Synchronous Converters, Frequency Changers, Balancers, Boosters, Synchronous Condensers, Switchboards.

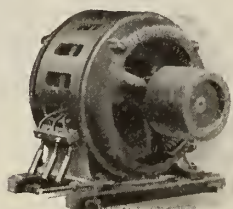
PRIME MOVERS: Steam Turbines; Steam, Gas and Oil Engines; Hydraulic Turbines.

INDUSTRIAL MACHINERY: Portable and Stationary Air Compressors, Crushing and Cement Machinery, Mining Machinery, Power Transmission Machinery, Flour Mill Machinery, Saw Mill Machinery, Rolling Mill Machinery, Timber Treating and Preserving Machinery, Sugar Machinery, Agricultural Machinery, Pumping Engines, Hydraulic Machinery, Steam and Electric Hoists, etc.

For Centrifugal Pumps, see pages 718-719.

Squirrel Cage Induction Motors.

Type "AN" are standard polyphase alternating current motors for constant speed service. They are of very rugged construction and therefore adapted to severe service conditions. The field frames are of the substantial box type, the shafts large and rigid, while the bearings, which are of liberal size, are provided with dust guards. Moisture-proof coils are used. Standard ratings are $\frac{1}{2}$ h. p. and larger.



SQUIRREL CAGE
INDUCTION MOTOR

Slip Ring Induction Motors.

Type "ANY" are polyphase alternating current motors for use where the starting conditions are severe, where the starting current must be kept low, and for varying speed requirements. Standard ratings, 5 h. p. and larger.

Alternating Current Synchronous Motors and Condensers.

Synchronous motors are especially suited for driving generators, large air compressors, pumps, line shafts and other constant speed apparatus where the starting conditions are not severe.

The corrective effect which they exert on the power system makes them particularly desirable for alternating



TRADE-MARK

systems where the power factor is low. Built for ratings of 50 h. p. and larger.

Direct Current Motors.

The new type "E" motors incorporate the latest and best features of direct current engineering practice; among which are the following:

Ratings and speeds corresponding to those of induction motors, a complete line of constant and adjustable speed ratings, rugged cast steel yokes, commutating poles, insuring sparkless commutation, dustproof bearings, windings treated to resist oil and moisture, thorough ventilation, conduit terminal boxes on all motors, standard enclosing covers, all parts easily accessible.

For ratings of 150 h. p. and larger, Type "HC" motors are built for constant or adjustable speed service. Having commutating poles and with pedestal bearings mounted on a substantial base, they are particularly rugged and adapted for heavy duty.



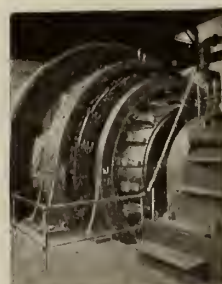
DIRECT CURRENT MOTOR,
TYPE "E"

Alternating and Direct Current Generators.

Allis-Chalmers generators are built in a number of forms and for ratings and speeds adapted to the various types of prime movers.

For belting or coupling, the smaller generators are of the self-contained bracket bearing type; while larger machines have pedestal bearings. Other complete lines are those for reciprocating engines, vertical and horizontal machines for hydraulic turbines and high speed steam turbine units.

Allis-Chalmers generating units can be furnished complete with any type of prime mover. This gives the purchaser the important advantage of a complete installation with undivided responsibility.



2000 KW. DIRECT
CURRENT ENGINE
DRIVEN UNIT

Synchronous or Rotary Converters.

Standard synchronous converters or "rotaries" for industrial or mining service deliver 250 or 275 volts direct current when operating from the alternating current supply system. They are built for ratings of 100 kw. and larger, in the commutating pole type, and for 60-cycle and 25-cycle systems.

Railway "rotaries" are supplied for voltages up to 1500 volts direct current.



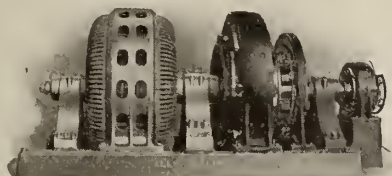
200 KW. INDUSTRIAL SYNCHRONOUS CONVERTER

Motor Generator Sets.

For transforming from alternating to direct current, standard sets are built for ratings of 2 kw. and larger. Ratings of 50 kw. and larger may be provided with synchronous motors suitable not only for driving the direct current generator, but for correcting the power factor of the alternating current system.

Sets operating from direct to alternating current, frequency changing sets, balancers, boosters and many other sets are built for particular service conditions.

Some of the largest sets in service are those built by the ALLIS-CHALMERS MANUFACTURING COMPANY.

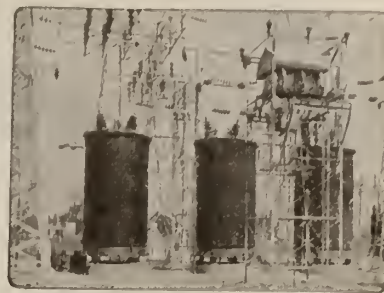


1500 KW. MOTOR GENERATOR SET

Transformers.

Distributing transformers are built for high and low tension power or lighting distribution. Standard ratings, up to 200 kv-a. are furnished in all commercial voltages.

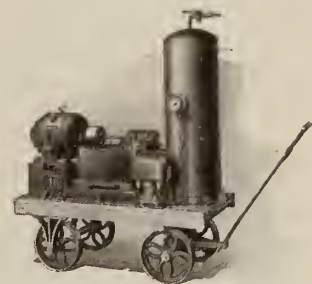
Allis-Chalmers power transformers are built for voltages up to the highest in transmission service, and are used on many of the largest transmission and distributing systems of the country. Information furnished on application.



THREE 4000 KVA, 150,000-VOLT TRANSFORMERS, OUTDOOR INSTALLATION

Stationary and Portable Air Compressors.

These compressors are extensively used for garage or industrial purposes. They are entirely automatic in operation, maintaining the air pressure practically constant at all times. Portable or stationary equipment are built in capacities from 11 to 150 cu. ft. for belt drive or in the motor driven type.



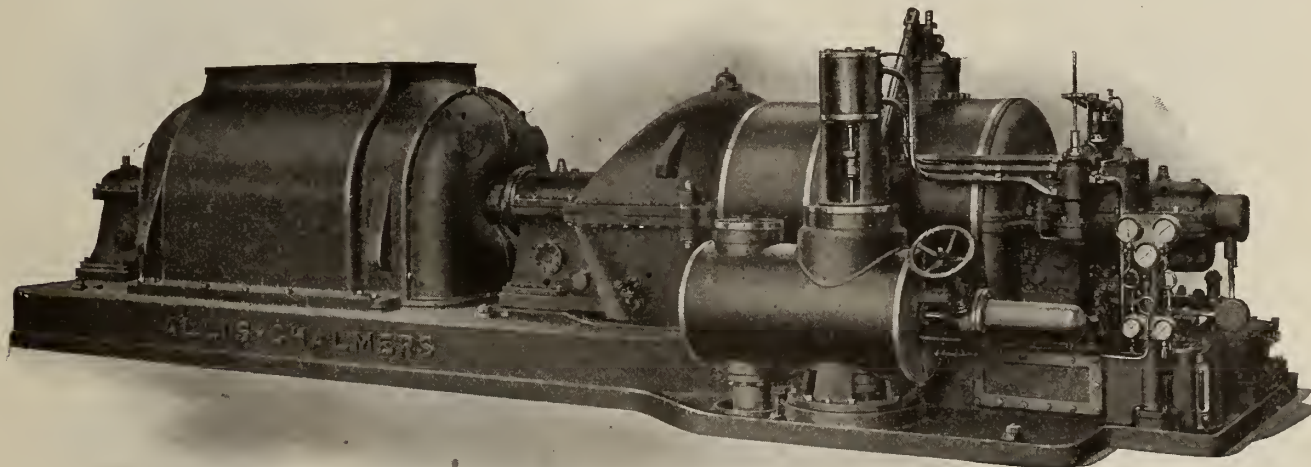
PORTABLE AIR COMPRESSOR

Steam Turbines.

Allis-Chalmers steam turbine and alternator units, condensing, non-condensing, mixed pressure and low pressure types, built in sizes from 200 kw. up.

Allis-Chalmers steam turbines are of the horizontal reaction type, highly efficient, simple in design, accessible for inspection and built for continuous service.

Full information will be furnished on application to the nearest district office.



STANDARD 4000 KW. MAXIMUM, 80 PER CENT. P.F., 3600 R.P.M., HIGH PRESSURE CONDENSING STEAM TURBINE AND ALTERNATOR UNIT

GEORGE CUTTER COMPANY

Industrial Lighting Reflectors and Fixtures
SOUTH BEND, IND.

BRANCH OFFICES

CHICAGO, ILL., 28 East Jackson Boulevard
NEW YORK, N. Y., 149 Broadway
LOS ANGELES, CAL., San Fernando Building

DETROIT, MICH., 426 Ford Building
SAN FRANCISCO, CAL., 583 Howard Street
SEATTLE, WASH., 522 First Avenue, South

Products.

SOL-LUX INDUSTRIAL LIGHTING REFLECTORS and FIXTURES; HOLDER-SOCKET-REFLECTORS; HOLDER-SOCKETS; REFLECTO-CAP DIFFUSERS; VAPORPROOF FIXTURES; AUTOMATIC CUT-OUT HANGERS for Multiple Circuits; PROTECTIVE LIGHTING FIXTURES; "UNIVERSAL" FLOOD LIGHTING PROJECTORS; ORNAMENTAL STREET LIGHTING STANDARDS and BRACKETS; PENDENT STREET LIGHTING UNITS; STREET HOODS; SWITCHBOARDS; PANEL-BOARDS and CABINETS; CUT-OUT BOXES.

Also, Plugs and Receptacles, Terminals and Connectors.

Engineering Service.

The Engineering Service Department will assist in making plans and estimates. Complete designs will be submitted when drawings and sketches are supplied with the following information: (1) Class of work to be performed in each building or department. (2) Dimensions of rooms, height of ceilings, location of windows, girders, shafting, etc. (3) Location of machinery, work benches, etc. (4) Color of walls. (5) Whether conduit or open wiring is to be installed.

Value of Good Industrial Lighting.

Cost of illumination is paid for if it saves 3 minutes daily of each man's time, or $\frac{1}{2}$ of 1% of wages and supervision. Yet good illumination, on an average, saves 30 minutes daily per man. It also gives other returns, including increased production for the same labor costs and overhead, reduction of spoilage and seconds, decrease in the number of accidents, less eye strain, and more cheerful and sanitary conditions for employees.

Elimination of Glare.

Glare causes eye strain, accidents, spoilage of materials and decreased production. Use reflectors which shield the lamp filament from the direct line of vision. In buildings where high mounting heights are possible, bowl type reflectors may be used. Where ceilings are low, units for general illumination should be installed as close as possible to the ceiling. The R L M standard dome type reflector is the latest and most efficient design available for general illumination in factories. Cutter holder-sockets possess a particular advantage for the latter purpose, because they allow lamps and reflectors to be installed directly to the conduit or outlet box. For localized lighting, bowl type reflectors are the most satisfactory.

Both direct and reflected glare may be reduced by the use of opal glass bowls with R L M standard dome type reflectors.

Write for complete details of units designed particularly for this purpose.

Keep Reflectors and Lamps Clean.

Reliable tests show that, on an average, the loss

SOLOLUX

TRADE-MARK

of light amounts to nearly 50% when reflectors are not kept clean. Automatic cut-out hangers should be used for this purpose. See following page.

Holder-socket-reflectors.

"Easy to wire. Guaranteed weatherproof." Holder-socket-reflectors are combinations of Cutter "easy-to-wire" holder-sockets and the standard types of high efficiency one-piece porcelain enameled steel reflectors—dome, bowl and angle.

They are designed primarily for economy and labor conservation. The holder-socket saves 75% of the time ordinarily required to install lighting fixtures of these types.

Holder-socket-reflectors are interchangeable. Reflectors of different types may be substituted at any time, and reflectors for medium base and mogul base lamps may be interchanged respectively with medium screw and mogul screw sockets.

Approved construction. Cutter holder-sockets are approved by the National Board of Fire Underwriters.

METHODS OF ATTACHMENT—Holder-socket-reflectors may be used in any type of installation and for either interior or exterior lighting purposes. They may be suspended:

(1) On $\frac{1}{2}$ -in. or $\frac{3}{4}$ -in. conduit. (2) Directly from the outlet box or conduit. (3) On chain or cord by using suspension eyes. (4) On reinforced drop cord by using porcelain bushings.



R L M STANDARD DOME TYPE
HOLDER-SOCKET-REFLECTOR



METHOD OF WIRING
HOLDER-SOCKET FOR
ATTACHMENT TO
OUTLET BOX



STANDARD BOWL TYPE
HOLDER-SOCKET-
REFLECTOR



ONE-PIECE ANGLE TYPE
HOLDER-SOCKET-
REFLECTOR

Continued on next page

DATA, HOLDER SOCKETS FOR ONE-PIECE REFLECTORS

Trade Numbers				Price, each
For 1/2" conduit*	For 3/4" conduit	With 4" outlet box cover	With cover for conduit	
30693	30694	30684	30685 Medium screw base	\$1.00
30772	30773	30980	30981 Mogul screw base	1.50

DATA, COMPLETE HOLDER-SOCKET-REFLECTORS
With Cap for 1/2-Inch or 3/4-Inch Conduit

Trade Numbers					For mazda lamp size	Diam. of refl., in.	Std. pkg.	Std. pkg. wt., lbs.	Price, each complete unit
Complete Unit	Consisting of								
	Holder-sockets	One-piece reflector							
For 1/2" conduit*	For 3/4" conduit	For 1 1/2" conduit	For 3 1/2" conduit						
R L M STANDARD DOME TYPE									
30668	30747	30693	30694	306075	75	12	10	50	\$2.70
30669	30748	30693	30694	306150	100-150	14	10	60	2.90
30670	30749	30693	30694	306200	200	16	5	40	3.60
30671	30750	30772	30773	306500	300-500	18	5	50	4.40
30672	30751	30772	30773	306000	750-1000	20	3	45	5.90

R L M STANDARD DOME TYPE

STANDARD DOME TYPE									
30668	30747	30693	30694	306075	75	12	10	50	\$2.70
30669	30748	30693	30694	306150	100-150	14	10	60	2.90
30670	30749	30693	30694	306200	200	16	5	40	3.60
30671	30750	30772	30773	306500	300-500	18	5	50	4.40
30672	30751	30772	30773	306000	750-1000	20	3	45	5.90
STANDARD BOWL TYPE									
30673	30752	30693	30694	307060	25-40-60	7½	20	40	2.20
30674	30753	30693	30694	307075	75	8½	10	35	2.35
30675	30754	30693	30694	307150	100-150	8½	10	40	2.40
30676	30755	30693	30694	307200	200	10½	10	45	2.90
30677	30756	30772	30773	307500	300-500	12½	5	40	3.60
30678	30757	30772	30773	307000	750-1000	15½	3	40	5.00

STANDARD BOWL TYPE

STANDARD ANGLE TYPE									
30679	30758	30693	30694	304040	25-40	6½	20	40	2.00
30680	30759	30693	30694	304060	60	8½	10	35	2.45
30681	30760	30693	30694	304200	75-150-200	10½	10	45	3.25
30682	30761	30772	30773	304500	300-500	12½	5	40	4.75
30683	30762	30772	30773	304000	750-1000	15½	3	40	6.40

*Furnished with porcelain bushing for reinforced drop cord suspension, when so ordered, without additional charge.

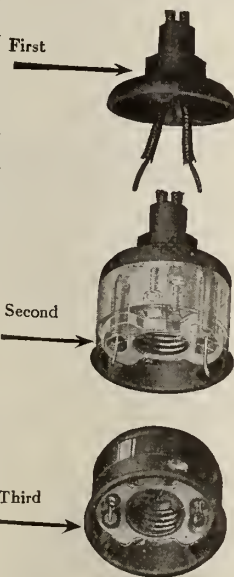
Cutter Holder-sockets.

Combination holders for standard heel reflectors and sockets for mazda lamps approved by National Board of Fire Underwriters. They permit of the greatest flexibility in light distribution.

Holder-sockets are made with cap for attachment to 1/2-in. and 3/4-in. conduit stems, with cover for attachment directly to outlet boxes and condulets, and with porcelain bushing for reinforced drop cord suspension. Holders are made for both 2 1/4-in. and 3 1/4-in. standard heel reflectors.



HOLDER-SOCKET WITH PORCELAIN BUSHING FOR REINFORCED DROP CORD SUSPENSION



METHOD OF WIRING HOLDER-SOCKET FOR ATTACHMENT TO CONDUIT

Standard Heel Reflectors.

Different types of reflectors with same size heel may be used with same holder, permitting change in light distribution without disturbing the wiring. Reflectors easily removed for cleaning. The 2 1/2-in. heel supplied on reflectors for 200-watt lamps and smaller, 3 1/4-in. heel on reflectors for 300-watt lamps and larger. Standard heel reflectors used with holder-sockets recommended for outlet box, conduit, and reinforced drop cord installations.



R L M Standard Dome Type



Standard Bowl Type

STANDARD HEEL REFLECTORS

Reflecto-Cap Diffuser.

This diffuser constitutes an important unit of the Cutter complete line of industrial lighting reflectors. Direct glare is eliminated by silverplated cap which covers lower part of bulb of the lamp. This cap conceals the filament and directs the rays to large reflector above, which distributes them uniformly over the working plane.

Where illumination of high intensity is required for detailed and accurate workmanship, or where materials with polished or oily surfaces offer special danger from reflected glare, the Reflecto-cap diffuser should be installed.

Sol-lux Vaporproof Fixtures.

"Safety first" units of highest class designed for plants where explosive gases and dust accumulating in the standard types of industrial lighting fixtures would cause explosions and fires, and where moisture and smoke fumes would hasten corrosion of exposed metal parts.

Each fixture uses a Cutter holder-socket. Special gaskets are used in all joints to make the fixtures tight. Fixtures may be used with or without lamp guards. Write for price list.



SOL-LUX VAPOR-PROOF FIXTURES WITH PEAR SHAPE GLOBE AND GUARD

Automatic Cut-out Hanger for Multiple Circuits.

Cutter automatic cut-out hangers facilitate cleaning reflectors without use of ladders, thus saving much time and expense with absolute protection against accidental short circuits or contact with live wires.

This hanger may be used with angle type reflectors and other fixtures requiring a fixed location. The position of the lower switch is always the same with respect to the upper part of the pulley.

Universal suspension clamp, furnished with this device, may be used for fastening the hanger to ceiling, or on cable, or on pipe bracket of 3/4-in. to 1 1/4-in. bore. With this hanger use Cutter Mid-get changeable pulley and 3/8-in. or 1/4-in. weatherproof cord or 1/4-in. galvanized ebony wire rope.



CUTTER AUTOMATIC CUT-OUT HANGER WITH HOLDER-SOCKET-REFLECTOR (R L M Standard Dome Type)

BENJAMIN ELECTRIC MFG. CO.

Lighting Devices and Fixtures

120-128 South Sangamon Street
CHICAGO, ILL.

BRANCH OFFICES

NEW YORK, N. Y., 243-47 West 17th Street
TORONTO, ONT., CANADA

SAN FRANCISCO, CAL., 590 Howard Street
LONDON, ENGLAND

DISTRICT OFFICES

BOSTON, MASS. PITTSBURGH, PA. CINCINNATI, OHIO DETROIT, MICH. ST. LOUIS, MO.

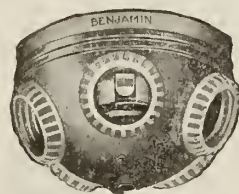
Products.

ELECTRIC LIGHTING SPECIALTIES, INDUSTRIAL LIGHTING EQUIPMENT, WIRING DEVICES AND ENAMELED STEEL REFLECTORS.

Punch Press Efficiency and Safety Devices, Stampings and Drawn Work.

**BENJAMIN
PRODUCTS**

TRADE-MARK



CAT. No. 15
Type 1—Diameter 4 in.



CAT. No. 19
Type 18—Diameter 3 in.

CLUSTER BODIES



CAT. No. 400.
BENCO KEYLESS
HEAVY DUTY
SOCKET

Made in aluminum, brass and copper case

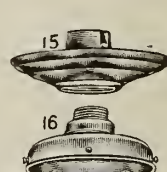
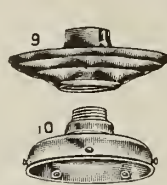


CAT. No. 4207.
BENCO PULL
CHAIN SOCKET



CAT. No. 4210.
BENCO MOGUL
BASE HEAVY DUTY
SOCKET

Made in aluminum, brass and copper case



TYPE "S" SCREW THREAD SOCKETS AND FIXTURES

All Benjamin Type "S" sockets, reflectors, holders and ceiling units are interchangeable.

The screw thread connects them all.

Any odd numbered piece will fit any even numbered piece



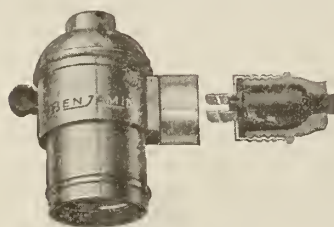
CAT. No. 11060N



CAT. No. 12060B

SHADE HOLDER REFLECTORS

Scientifically designed reflectors. Porcelain enameled steel for weatherproof work; aluminized and paint enameled steel for interior installations



CAT. No. 496.
CURRENT TAP SOCKET



CAT. No. 455.
TWIN SOCKET



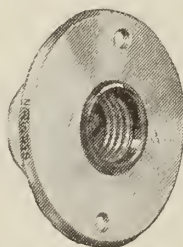
CAT. No. 5527.
ANGLE REFLECTOR



CAT. No. 5642
DOME CR-L-M REFLECTOR
Reflector sockets are fixtures which are used under heavy duty conditions everywhere.
Flat cone and shallow bowl reflectors are also furnished



CAT. No. 7662



CAT. No. 7660



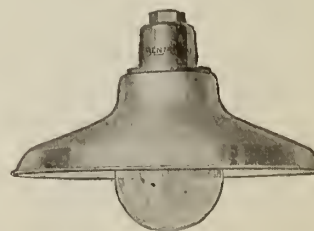
CAT. No. 7677

BENJAMIN SAFETY FLUSH SCREW BASE RECEPTACLES

Accommodate all makes of attachment plugs. The receptacle is normally dead, and contacts become alive only after plug is screwed home

Gasproof and Vaporproof Fixtures.

Benjamin gasproof and vaporproof fixtures have the lamp sealed in an outer screw globe. They are protected lights for use in industrial plants, mines, etc., where gases accumulate, or where there is excess vapor.



CAT. No. 1579
GASPROOF AND VAPORPROOF
FIXTURE

WESTERN ELECTRIC COMPANY

INCORPORATED

Flood Lamps

NEW YORK
NEWARK
SYRACUSE
BUFFALO
NEW HAVEN
BOSTON
PITTSBURGH
PHILADELPHIA
BALTIMORE

ATLANTA
SAVANNAH
BIRMINGHAM
JACKSONVILLE
NEW ORLEANS
RICHMOND
NORFOLK
CHARLOTTE

CHICAGO
INDIANAPOLIS
DETROIT
MILWAUKEE
GRAND RAPIDS
CLEVELAND
MINNEAPOLIS
ST. PAUL
DULUTH

KANSAS CITY
OKLAHOMA CITY
ST. LOUIS
MEMPHIS
OMAHA
CINCINNATI
DALLAS
HOUSTON
SALT LAKE CITY

SAN FRANCISCO
OAKLAND
LOS ANGELES
SEATTLE
PORTLAND
SPOKANE
TACOMA
DENVER

Products.

WESTERN ELECTRIC PORTABLE UTILITY LIGHTS.

Also, equipment for every electrical need, including all classes of Lighting, Power and Telephone Appliances and Wiring Materials; Motors; Generators; Switchboards; Fans; Sunbeam Mazda Lamps; Intercommunicating Telephones; Washing Machines; Vacuum Sweepers; Heat Regulators and other Electrical Household Appliances; Wire and Cable.

Portable Utility Lights.

The Western Electric portable utility light fully meets the demands for night illumination at close range within restricted area where the light is to be located at distances not greater than 100 to 125 ft. from the object to be illuminated.

It has a hammered-glass reflector which is spring-suspended in a one-piece cast iron housing. This housing is closed by a wire glass front fitted into a cast iron ring, forming a door hinged at the bottom. This door is operated by a hand latch.

Its rugged construction enables it to withstand rough usage and its wire glass front will not shatter.

Its light weight—30 lbs.—and a properly balanced handle make the light readily portable. It can be mounted on either vertical or flat surface.

SCOPE OF USE—This Western Electric portable utility light making use as it does, of a 200-watt Mazda C lamp is an exceptionally economical light for close range work.

Since most construction work requires close range lighting, this light is particularly suitable for contractors' needs. It is the light to use on loading platforms, excavation work, emergency repair work, illumination of monuments and for protection of supplies.

Flood Lamps.

The Western Electric-Davis larger flood lamps meet the requirements for lamps that will produce "electric daylight" at night, with a soft, enveloping and glareless, yet penetrating, light. An idea of their illuminating power may be gained from the fact that one lamp placed 60 ft. above ground will illuminate over 10,000 sq. ft.

The Western Electric-Davis flood lamp finds its application in all industrial plants where night work is necessary, indoors or outdoors; in protecting public works, central stations, bridges, etc.; in lighting railroad yards, terminals, transfer yards, etc.; facilitating exca-

Western Electric
TRADE-MARK

vating and building work; in lighting the above ground workings of mines; and in illuminating buildings, statues, beaches and playgrounds.

TYPES—There are two types, the portable and the bracket.

The portable lamps, complete with base and standard, weigh only 45 lbs. and are 3¼ ft. high. For outside work, they are usually mounted on tops of buildings for the best distribution of light over a maximum area. For interior use, they are mounted close to the ceiling. A set makes an ideal emergency lighting equipment.

The bracket type embodies the same lighting head as the portable. The difference is in the method of mounting, the bracket making it possible to affix the lamps to poles or trees.

No permanent wiring is needed.



PORTABLE UTILITY
LIGHT



INSTALLATION ON RAILWAY



INSTALLATION IN MANUFACTURING PLANT



INSTALLATION IN SHIPYARD

FURTHER DATA—Descriptive folders, prices and illumination data will be sent on request.

WESTINGHOUSE LAMP CO.

Manufacturers of Incandescent Lamps

GENERAL OFFICE

165 Broadway
NEW YORK, N. Y.

WORKS

BLOOMFIELD, N. J., MILWAUKEE, WIS., TRENTON, N. J., MIDDLETOWN, CONN.

SALES OFFICES

ATLANTA
BALTIMORE
BOSTON
BUFFALO

CHICAGO
CINCINNATI
CLEVELAND
COLUMBUS

DENVER
DETROIT
KANSAS CITY

LOS ANGELES
MILWAUKEE
MINNEAPOLIS

NEW ORLEANS
NEW YORK
PHILADELPHIA
PITTSBURGH

ST. LOUIS
SAN FRANCISCO
SEATTLE
SYRACUSE

DALLAS, TEXAS, WESTINGHOUSE LAMP CORPORATION

EXPORT SALES DEPARTMENT: NEW YORK, N. Y., 165 Broadway

CANADA: HAMILTON, ONT., CANADIAN WESTINGHOUSE CO., LIMITED

Product.

WESTINGHOUSE MAZDA LAMPS in every style and size, for all lighting requirements.

Quality.

For thirty-nine years, lamps labeled "Westinghouse" have stood for the highest attainment in the art of lamp manufacture, so that the name has come to be recognized as a guarantee of quality on incandescent lamps.

Made in four modern, completely equipped factories, *Westinghouse Mazda* lamps embody all the latest developments and improvements. Uniform quality and absolute dependability are the characteristics which have established for them an unusual record for satisfactory service.

Sizes, Voltages, etc.

Westinghouse Mazda lamps are made in every required size for every conceivable lighting service.

REGULAR MULTIPLE BURNING LAMPS—In sizes from 10 to 500 watts for standard voltage ranges. Straight side and round bulbs.

MAZDA C (GAS-FILLED) LAMPS—In sizes from 75 to 1000 watts for standard voltage ranges. Pear shape bulbs.

SERIES BURNING LAMPS—60 to 1000 c.p. in standard ampere ranges for street lighting. Straight side and pear shape bulbs.



SIGN LAMPS MULTIPLE BURNING—11 to 12½, 55 to 65, and 110 to 125 volts. Straight side bulbs.

SERIES BURNING ELECTRIC RAILWAY LAMPS—Five in series on voltage ranges 525 to 650. Straight side bulbs.

MULTIPLE BURNING TRAIN LIGHTING LAMPS—30 to 34 and 60 to 65 volts, round bulbs. Also locomotive headlight lamps, round bulbs.

STEREOPTICON LAMPS—Round bulbs.

SHOWCASE LAMPS—Tubular bulbs.

COMPENSATOR LAMPS—Straight side bulbs.

FLOOD LIGHTING LAMPS—Round bulbs.

Prices and Information.

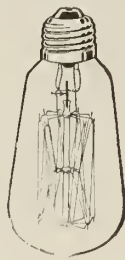
The Westinghouse Incandescent Lamp Data Book contains full information as to prices, discounts, sizes and dimensions of lamps, with drawings to scale, and will be sent free on request.

Engineering Service.

The services of the Commercial Engineering Department of the WESTINGHOUSE LAMP Co. are always available for assistance and advice on designing lighting installations.



25- AND
40-WATT
MAZDA



25- AND
50-WATT
MAZDA MILL TYPE



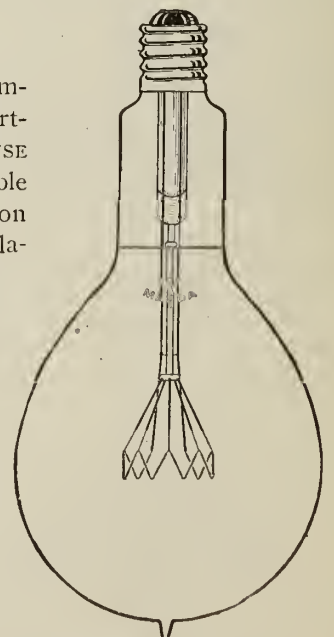
60-WATT
MAZDA



50-WATT
WHITE
MAZDA



100- AND
150-WATT
MAZDA



1000-WATT MAZDA

WHITELITE ELECTRIC COMPANY

Manufacturers of Incandescent Gas-filled Lamps

368-370 Broome Street
NEW YORK, N. Y.

Product.

WHITELITE INCANDESCENT GAS-FILLED LAMPS.

The WHITELITE ELECTRIC COMPANY makes nothing but lamps, and none but gas-filled lamps. The Whitelite plant has been the first in the United States to concentrate upon gas-filled lamps, from the day that form of illumination became a scientific actuality.



TRADE-MARK

Distinctive Features.

Untiring research, as specialists in gas-filled lamps, added to the numerous patents of the General Electric Company, under which Whitelite lamps are manufactured, have made it possible for the WHITELITE ELECTRIC COMPANY to produce a lamp of high efficiency and extreme durability. The Whitelite lamp is essentially a lamp of quality. Nothing goes into the make-up of the Whitelite lamp but what is highest in material and workmanship.

Facilities.

The Whitelite factories being situated in New York, with its great waterways and railroad lines, customers may count upon prompt shippings.

Sizes, Shapes and Voltage.

The Whitelite lamp, clear, frosted, or Daylite blue, is uniformly pear shaped, and comes in sizes from 40 to 1000 watts, in all voltages.

Prices.

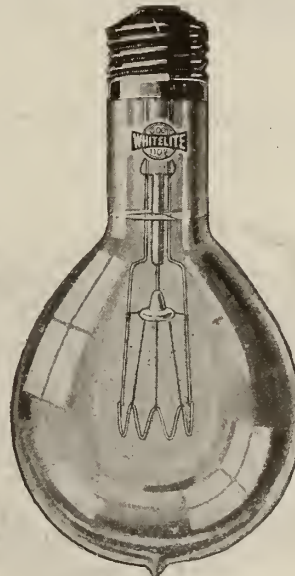
Price list and other detailed information will be sent on application. Discounts can be quoted only where indication is given as to extent of turn-over in gas-filled lamps.



40 to 200 Watts



300 Watts



400 to 1000 Watts

DATA, WHITELITE INCANDESCENT GAS-FILLED LAMPS

Volts	Size of lamp watts	Diam. bulb, in.	Max. over all length, in.	Screw base regularly supplied	Standard package quantity	Quantity in each carton
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MEDIUM VOLTAGE

100	40	2 1/4	5 1/8	Med.	50	5
	50	2 1/4	5 1/8	Med.	50	5
	60	2 3/4	6 1/8	Med.	50	5
	75	2 3/4	6 1/8	Med.	50	5
	100	3 1/8	7 1/8	Med.	24	1
	150	3 1/8	7 1/8	Med.	24	1
	200	3 3/8	8 3/8	†Med.	24	1
	250	3 3/8	8 3/8	†Med.	24	1
	300	4 3/8	9 3/4	*Mogul	24	1
	350	4 3/8	9 3/4	Mogul	24	1
130	400	5	10	Mogul	12	1
	500	5	10	Mogul	12	1
	750	6 1/2	13 3/8	Mogul	8	1
	1000	6 1/2	13 3/8	Mogul	8	1

HIGH VOLTAGE

200	80	3 1/8	7 1/8	Med.	24	1
	100	3 1/8	7 1/8	Med.	24	1
	150	3 1/8	7 1/8	Med.	24	1
	200	3 3/4	8 3/8	†Med.	24	1
	300	4 3/8	9 3/4	*Mogul	24	1
250	400	5	10	Mogul	12	1
	500	5	10	Mogul	12	1
	750	6 1/2	13 3/8	Mogul	8	1
	1000	6 1/2	13 3/8	Mogul	8	1

LOW VOLTAGE

28	25	2 1/4	4 3/8	Med.	50	5
	50	2 1/4	5 1/8	Med.	50	5
	75	2 3/4	6 1/8	Med.	50	5
32	100	3 1/4	7 1/8	Med.	24	1
	200	3 3/4	8 3/8	Med.	24	1

†If specified, will supply with Mogul Base.
*If specified, will supply with Medium Base.

WHITELITE INCANDESCENT GAS-FILLED LAMPS, LICENSED UNDER GENERAL ELECTRIC CO.'S PATENTS

WITHERBEE STORAGE BATTERY CO., INC.

ESTABLISHED 1903

FACTORY AND OFFICES
643-655 West 43rd Street
NEW YORK, N. Y.

Products.

STARTING, LIGHTING and IGNITION BATTERIES for Automobiles and Motor Trucks.



TRADE-MARK

Description.

"Witherbee" Batteries are of correct size, shape and capacity for every make and model of car, and for starting and lighting systems of any manufacture in general use.

Modern, carefully constructed batteries, they all possess high starting ability, and deliver the highest current required, without damage. The plates are specially processed and durably constructed to prevent buckling; only the finest rubber goes into the jars, and the cases are of acid-proofed hardwood.

Recognized standards since 1903.

Equipment and Types.

All "Witherbee" Batteries will be furnished with terminals suitable for the particular make and model of vehicle for which they are ordered, as specified and used by the manufacturer of that car. Special terminals and terminal leads of unusual length will be furnished at extra cost.

The tables shown herewith cover the principal replacement sizes in general use.

Literature.

Illustrated catalogue and replacement bulletin with prices sent on request.



"WITHERBEE" STORAGE BATTERY

DATA, 6- AND 8-VOLT "WITHERBEE" BATTERIES

Type	Assembly "S"		Assembly "E"		Height, in.	Weight, lbs.
	Length, in.	Width, in.	Length, in.	Width, in.		
WR 6-60	9 $\frac{3}{4}$	7 $\frac{1}{8}$	20 $\frac{3}{8}$	3 $\frac{1}{8}$	8 $\frac{7}{8}$	42
WH 6-60	9 $\frac{3}{4}$	5 $\frac{1}{8}$	15 $\frac{5}{8}$	3 $\frac{1}{8}$	10 $\frac{3}{8}$	
WL 6-60	9 $\frac{3}{4}$	7 $\frac{1}{8}$	20 $\frac{3}{8}$	3 $\frac{1}{8}$	9 $\frac{1}{2}$	46
WR 6-80	10 $\frac{1}{4}$	7 $\frac{1}{8}$	20 $\frac{3}{8}$	4 $\frac{1}{4}$	8 $\frac{7}{8}$	
WH 6-80	10 $\frac{1}{4}$	5 $\frac{1}{8}$	15 $\frac{5}{8}$	4 $\frac{1}{4}$	10 $\frac{3}{8}$	50
WL 6-80	10 $\frac{1}{4}$	7 $\frac{1}{8}$	20 $\frac{3}{8}$	4 $\frac{1}{4}$	9 $\frac{1}{2}$	
WR 6-100	12	7 $\frac{1}{8}$	20 $\frac{3}{8}$	4 $\frac{1}{4}$	8 $\frac{7}{8}$	59
WH 6-100	12	5 $\frac{1}{8}$	15 $\frac{5}{8}$	4 $\frac{1}{4}$	10 $\frac{3}{8}$	
WL 6-100	12	7 $\frac{1}{8}$	20 $\frac{3}{8}$	4 $\frac{1}{4}$	9 $\frac{1}{2}$	65
WR 6-120	14 $\frac{1}{2}$	7 $\frac{1}{8}$	20 $\frac{3}{8}$	5 $\frac{1}{8}$	8 $\frac{7}{8}$	
WH 6-120	14 $\frac{1}{2}$	5 $\frac{1}{8}$	15 $\frac{5}{8}$	5 $\frac{1}{8}$	10 $\frac{3}{8}$	69
PWRS 6-120	14 $\frac{1}{2}$	7 $\frac{3}{8}$			9 $\frac{1}{2}$	
WG 80	9 $\frac{1}{4}$	7 $\frac{1}{8}$	20 $\frac{3}{8}$	3 $\frac{1}{8}$	11 $\frac{1}{2}$	62
WG 120	11 $\frac{7}{8}$	7 $\frac{1}{8}$	20 $\frac{3}{8}$	4 $\frac{1}{8}$	11 $\frac{1}{2}$	80
Assembly "J"						
WGJ 6-120	12 $\frac{7}{8}$	8 $\frac{3}{8}$			12 $\frac{1}{4}$	85

DATA, 12-VOLT "WITHERBEE" BATTERIES

Type	Assembly "S"		Assembly "E"		Height, in.	Weight, lbs.
	Length, in.	Width, in.	Length, in.	Width, in.		
WR 12-35	12 $\frac{3}{4}$	7 $\frac{1}{8}$	20 $\frac{3}{8}$	4 $\frac{7}{8}$	8 $\frac{7}{8}$	58
WH 12-35	12 $\frac{3}{4}$	5 $\frac{1}{8}$	15 $\frac{5}{8}$	4 $\frac{7}{8}$	10 $\frac{3}{8}$	
WL 12-35	12 $\frac{3}{4}$	7 $\frac{1}{8}$	20 $\frac{3}{8}$	4 $\frac{7}{8}$	9 $\frac{1}{2}$	62
WR 12-50	15	7 $\frac{1}{8}$	20 $\frac{3}{8}$	5 $\frac{3}{4}$	8 $\frac{7}{8}$	
WH 12-50	15	5 $\frac{1}{8}$	15 $\frac{5}{8}$	5 $\frac{3}{4}$	10 $\frac{3}{8}$	70
WL 12-50	15	7 $\frac{1}{8}$	20 $\frac{3}{8}$	5 $\frac{3}{4}$	9 $\frac{1}{2}$	
WR 12-60	17 $\frac{1}{4}$	7 $\frac{1}{8}$	20 $\frac{3}{8}$	6 $\frac{1}{8}$	8 $\frac{7}{8}$	78
WH 12-60	17 $\frac{1}{4}$	5 $\frac{1}{8}$	15 $\frac{5}{8}$	6 $\frac{1}{8}$	10 $\frac{3}{8}$	
WL 12-60	17 $\frac{1}{4}$	7 $\frac{1}{8}$	20 $\frac{3}{8}$	6 $\frac{1}{8}$	9 $\frac{1}{2}$	90
WR 12-80	20 $\frac{1}{4}$	7 $\frac{1}{8}$	20 $\frac{3}{8}$	7 $\frac{1}{8}$	8 $\frac{7}{8}$	
WH 12-80	20 $\frac{1}{4}$	5 $\frac{1}{8}$	15 $\frac{5}{8}$	7 $\frac{1}{8}$	10 $\frac{3}{8}$	95
WL 12-80	20 $\frac{1}{4}$	5 $\frac{1}{8}$	15 $\frac{5}{8}$	8 $\frac{1}{8}$	9 $\frac{1}{2}$	
WR 12-100	23	7 $\frac{1}{8}$	20 $\frac{3}{8}$	8 $\frac{1}{8}$	8 $\frac{7}{8}$	102
WH 12-100	23	5 $\frac{1}{8}$	15 $\frac{5}{8}$	8 $\frac{1}{8}$	10 $\frac{3}{8}$	
WL 12-100	23	7 $\frac{1}{8}$	23 $\frac{1}{8}$	8 $\frac{1}{8}$	9 $\frac{1}{2}$	120

DATA, 16-VOLT "WITHERBEE" BATTERIES

Type	Assembly "S"		Assembly "E"		Height, in.	Weight, lbs.
	Length, in.	Width, in.	Length, in.	Width, in.		
WR 16-35	16 $\frac{1}{4}$	7 $\frac{1}{8}$	13 $\frac{1}{2}$	9	8 $\frac{7}{8}$	76
WH 16-35	16 $\frac{1}{4}$	5 $\frac{1}{8}$	10 $\frac{3}{4}$	9 $\frac{1}{8}$	10 $\frac{3}{8}$	
WL 16-50	19 $\frac{1}{2}$	7 $\frac{1}{8}$	13 $\frac{1}{2}$	10 $\frac{1}{2}$	8 $\frac{7}{8}$	90
WR 16-50	19 $\frac{1}{2}$	5 $\frac{1}{8}$	10 $\frac{3}{4}$	10 $\frac{1}{4}$	10 $\frac{3}{8}$	
WH 16-60	23 $\frac{1}{4}$	7 $\frac{1}{8}$	13 $\frac{1}{2}$	12 $\frac{1}{4}$	8 $\frac{7}{8}$	105
WL 16-60	23 $\frac{1}{4}$	5 $\frac{1}{8}$	10 $\frac{3}{4}$	12 $\frac{1}{4}$	10 $\frac{3}{8}$	

DATA, 18-VOLT "WITHERBEE" BATTERIES

Type	Assembly "S"		Assembly "E"		Height, in.	Weight, lbs.
	Length, in.	Width, in.	Length, in.	Width, in.		
WR 18-35	19	7 $\frac{1}{8}$	20 $\frac{1}{8}$	7	9	85
WH 18-35	19	6 $\frac{1}{8}$	15 $\frac{5}{8}$	6 $\frac{3}{4}$	10 $\frac{1}{2}$	
WR 18-50	22 $\frac{1}{4}$	7 $\frac{1}{8}$	20 $\frac{1}{8}$	8 $\frac{1}{4}$	9	102
WH 18-50	22 $\frac{1}{4}$	6 $\frac{1}{8}$	15 $\frac{5}{8}$	8 $\frac{1}{4}$	10 $\frac{1}{2}$	
WR 18-60	26 $\frac{1}{8}$	7 $\frac{1}{8}$	20 $\frac{1}{8}$	9 $\frac{1}{2}$	9	122
WH 18-60	26 $\frac{1}{8}$	6 $\frac{1}{8}$	15 $\frac{5}{8}$	9 $\frac{1}{2}$	10 $\frac{1}{2}$	

DATA, 24-VOLT "WITHERBEE" BATTERIES

Type	Assembly "S"		Assembly "E"		Height, in.	Weight, lbs.
	Length, in.	Width, in.	Length, in.	Width, in.		
WR 24-20	18 $\frac{3}{4}$	7 $\frac{1}{8}$	13 $\frac{1}{2}$	10 $\frac{3}{8}$	9	85
WH 24-20	18 $\frac{3}{4}$	6 $\frac{1}{8}$	10 $\frac{3}{4}$	9 $\frac{5}{8}$	10 $\frac{1}{2}$	
WR 24-35	23 $\frac{1}{4}$	7 $\frac{1}{8}$	13 $\frac{1}{2}$	12 $\frac{5}{8}$	9	120
WH 24-35	23 $\frac{1}{4}$	6 $\frac{1}{8}$	10 $\frac{3}{4}$	12 $\frac{5}{8}$	10 $\frac{1}{2}$	
WR 24-50	29 $\frac{5}{8}$	7 $\frac{1}{8}$	13 $\frac{1}{2}$	15 $\frac{3}{8}$	9	146
WH 24-50	29 $\frac{5}{8}$	6 $\frac{1}{8}$	10 $\frac{3}{4}$	15 $\frac{3}{8}$	10 $\frac{1}{2}$	

ECONOMY FUSE & MFG. CO.

Manufacturers of Approved Renewable Cartridge Fuses and Non-renewable Indicating Fuses

2707-2721 Greenview Avenue
CHICAGO, ILL.

BRANCH OFFICES IN PRINCIPAL CITIES

Complete Stock Carried by All Leading Jobbers and Dealers

Products.

ECONOMY APPROVED RENEWABLE CARTRIDGE FUSES.
"ARKLESS" NON-RENEWABLE INDICATING FUSES.

Economy "Approved in all Capacities" Renewable Fuses.

The first "approved in all capacities" renewable fuse using inexpensive bare renewal links for restoring a blown fuse to its original efficiency.

Economy fuses are made in two general types (ferrule and knife blade) with a full line of capacity ranges for all commercial voltages. This is the first line of fuses approved in all capacities by the Underwriters' Laboratories, established and maintained by the National Board of Fire Underwriters, employing an inexpensive bare link for restoring a blown fuse to its original efficiency.

The fusible elements are of the "drop out" renewal link type, accurately rated and of definite design. Every part of an Economy fuse is built on the "safety first" principle, which means that the design is right from an electrical standpoint, and that material entering into the construction of the completed fuse is the best that money can buy.

IMPROVED ECONOMY RENEWABLE FUSE—Study the renewable link feature. See the two narrow bridges of metal holding the "drop out" features in place. In operations on short circuits, these two bridges fuse. The entire fuse metal does not volatilize, only the two narrow bridges. This very greatly decreases the danger factor due to the tremendous pressure generated when an entire strip of fusible metal is instantly converted into gases. No powdered filler to deteriorate or solidify. Only the fuse metal is destroyed; the fuse itself is ready for years of service. See the new winged washer which makes it simple and easy for any one to replace the "drop out" renewal link in a few minutes.

ECONOMY FUSE SAVINGS—There is 80% of fuse maintenance cost saved yearly, as compared to the cost of securing adequate protection by the use of non-renewable "one-time" fuses.

ECONOMY FUSE USERS—Users include industrial plants, large corpora-

tions, light and power companies, arms and munition plants, powder mills, mining and smelting companies, department and large stores, publishing companies, flour mills, food product plants, hotels, theaters, public buildings, steamships, wireless stations ashore and afloat, and various departments of the United States Government.

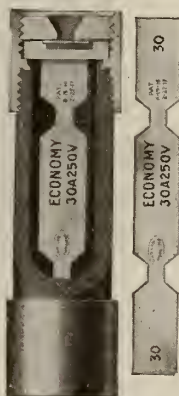
WHY ECONOMY APPROVED RENEWABLE FUSES ARE USED—Because Economy fuses cut yearly fuse costs 80% and furnish proper protection under all conditions of service. Unlike "one-time" fuses, which are discarded after operation, Economy fuses are used over and over again to obtain complete protection against the fire and accident hazards of overloads, short circuits, and the effects of lightning discharges on electrical circuits.

"DROP-OUT" RENEWAL LINK—It is the heart of an Economy fuse. It instantly restores a blown Economy fuse to its original efficiency at the absolute minimum of cost.

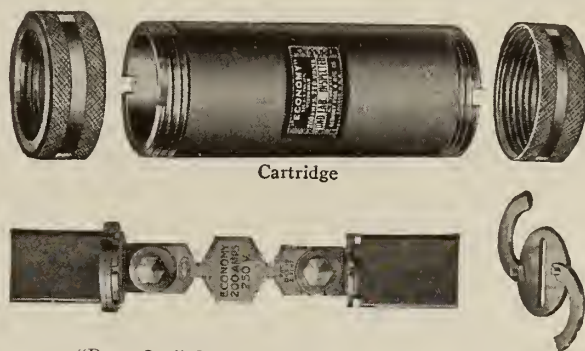
A stock of "drop-out" links, always on hand, represents only a small investment.



SECTIONAL VIEW, KNIFE BLADE TYPE FUSE AND LINK



SECTIONAL VIEW, FERRULE TYPE FUSE AND LINK



"Drop Out" Renewal Link and Winged Washer
ECONOMY KNIFE BLADE TYPE FUSE DISSEMBLED

SAFETY—The use of economy fuses in establishments where the fire hazard is great (powder factories, arms and munition plants, chemical works, flour mills, submarines, battleships, etc.), and where "safety first" is the highest consideration (department stores, hospitals, schools, hotels, theaters, institutions, ships, railway cars, etc.), is the proof of their safety in use.

"Arkless" Non-renewable Indicating Fuses.

We are also sole manufacturers of "Arkless," the non-renewable fuse with the "100% guaranteed indicator." For use on circuits not subject to frequent overloads.

Samples.

Any capacities sent on request, provided they are to be used for comparison and tests. Ask for Catalogue 51 when ordering samples.

FEDERAL ELECTRIC COMPANY

Manufacturers of Electrical Specialties

Lake and Desplaines Streets

CHICAGO, ILL.

SAN FRANCISCO, CAL., 91 New Montgomery Street

NEW YORK, N. Y., 627-649 West 43d Street

BRANCHES IN ALL LARGE CITIES

Stocks Carried by Leading Jobbers and Dealers

Product.

NATIONAL RENEWABLE FUSES for the protection of electrical circuits.

Approval.

National renewable fuses are approved by the Underwriters' Laboratories, Inc., their report E-4199, December 1, 1919.

The National renewable fuse is the only renewable fuse that is approved by the Associated Factory Mutual Fire Insurance Companies.

The National renewable fuse is also approved by the Mutual Fire Prevention Bureau of the Millers' Mutual Fire Insurance Companies.

The National renewable fuse is the only renewable fuse having all the three above approvals. Neither of the above mentioned mutuals have approved the naked element type of renewable fuse; they specify a powder packed element.

Description of National Renewable Fuses.

The fuse consists of an inner cartridge containing the fuse element and smothering powder, and an outer fiber cartridge of suitable contacts and a permanent metallic indicator which is part of the element, for identifying the capacity of the renewable element used, without opening the outer cartridge.

The knife blade fuses and elements are both provided with gas vents in the ends to allow the gases to escape on short circuits.

The ferrule on the ferrule type is staked, and on the knife blade type is riveted to the fiber casing, and not screwed on the threaded fiber.

Distinctive Features.

(1) Only one element of the proper size and rating can be used at a time.

(2) Powder packed element confines and smothers the fierce heat of the arc when the fuse blows, and also protects and increases the life of the outer casing or holder.

(3) The indestructible metallic tell-tale indicator tells the amperage rating at a glance.

(4) Simplicity—easy to reload.

Economy.

Wherever the National renewable fuse is used, a big saving is effected. First, because the renewable cartridge costs but a small part of the cost of the old style one-time fuse; and second, because its initial cost and maintenance expense are less than most renewable fuses.

Indorsement.

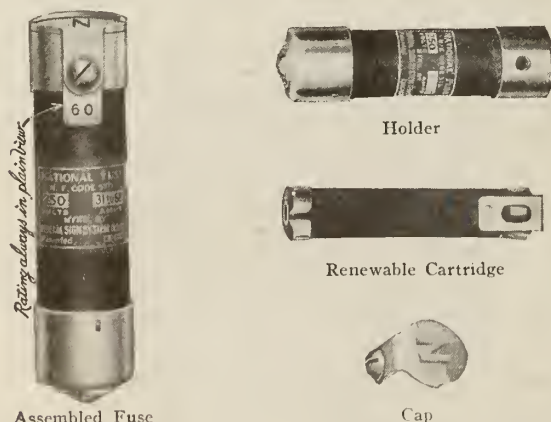
The National renewable fuse is indorsed and used extensively by prominent industrial plants throughout the country.

Sizes.

Manufactured in 250 and 600 volts, up to and including 600 amperes.

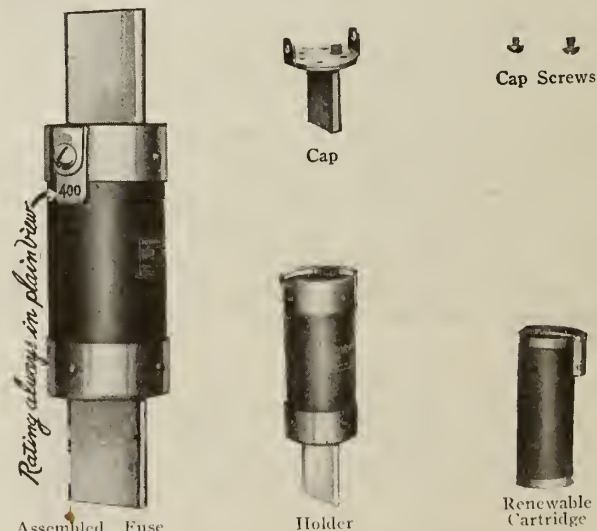
Bulletin.

A copy of "Correct Fuse Ratings for Motor Circuits" will be sent on request.



FERRULE TYPE NATIONAL RENEWABLE FUSE

Only 3 parts; other ferrule type renewable fuses have 6 or more parts



KNIFE BLADE TYPE NATIONAL RENEWABLE FUSE

Only 5 parts; other knife blade type renewable fuses have 9 or more parts

THE MONSON MAINE SLATE CO.

112 Water Street
BOSTON, MASS.

QUARRIES AND MILL
MONSON, MAINE

Products.

MONSON MAINE UNFADING BLACK SLATE.

Facilities.

THE MONSON MAINE SLATE CO. owns and operates the largest slate mills in the United States, which are equipped with the most modern machinery, are complete in every detail, and are operated by a corps of skilled workmen who have been trained by many years' experience in this line.

These facilities, together with its exceptionally fine railroad connections, enable this company to make prompt shipments to any point in the United States.

Adaptability of Monson Maine Unfading Black Slate.

The physical and chemical properties of this slate especially adapt it for electrical work of all kinds. It is furnished cut to the purchaser's specifications.

It is also adapted for roofing, sinks, urinals, tiles, chimney tops, slabs, counter tops, garden borders and walks, headstones, grave linings and covers, grave vaults, vestibule floors, greenhouse shelves, baseboards, wainscoting, refrigerator shelves, register frames, billiard table tops, blackboards, etc.

Electrical Qualifications of Monson Maine Slate.

The following distinctive features are embodied in Monson Maine unfading black slate:

It is the best non-conductor of any slate quarried and, because of its insulating qualities, is especially adapted for electrical work of all kinds. It is jet black, uniform in color and absolutely non-fading, therefore it requires no preparation to make various units match.

Its natural finish permits scratches to be eradicated. It is uniform in substance and can be easily planed, drilled and turned like wood or metal. It has greater tensile strength than any other slate and far greater than marble. It meets the most exacting tests, and in appearance and durability, it has no superior.

It is absolutely acidproof, weatherproof, non-porous and is not subject to discoloration.

Monson Maine Roofing Slate.

Slate roofs which are known to have been in continuous service for more than 150 years, are still in good condition, a proof of their marked superiority over other types of roofing.

Due to its great durability and its non-fading and weatherproof qualities, Monson Maine slate is ideal for roofing.

Slate tiles and roof slates in any size with edges sawn and holes drilled and countersunk, will be furnished in accordance with purchaser's specifications.

GRADES—Selected No. 1—No slate to be less than full $\frac{3}{16}$ in. thick. All corners cut square and full and both surfaces smooth and level.

Extra No. 2—One surface smooth, all corners cut square and full, but thickness varies.



Chemical Properties.

The following is an extract from a report of test made on Monson Maine black slate by the Massachusetts Institute of Technology, Boston, Mass., on Jan. 1, 1891.

Loss of ignition and organic matter...	3.88%
Silica	56.42%
Alumina	24.14%
Protoxide of iron.....	4.46%
Lime .....	.52%
Magnesia	2.28%
Potash	5.53%
Soda	3.15%

Physical Properties.

The figures given below show the comparative crushing strength of Monson Maine black slate and other slates, stones, etc., obtained through tests made by eminent authorities. These tests were made on 1-in. cubes.

NAME OF STONE	CRUSHING STRENGTH	AUTHORITY
Monson Maine black slate	34,680 lbs.	Jerome Sondericks
Vermont slate	29,270 lbs.	Prof. W. O. Crosby
Fairhaven slate	12,870 lbs.	F. R. Hutton
Sandstone	8,633 lbs.	Franklin
Blue stone	13,096 lbs.	Hutton
Granite	17,342 lbs.	Gilmore
Vermont marble	8,375 lbs.	U. S. Navy
Italian marble	10,173 lbs.	Gilmore
Limestone	9,996 lbs.	Gilmore

Specifications.

To insure installation of the best slate that can be procured and to prevent substitution of other slate, specifications should call for Monson Maine Unfading Black Slate as quarried and manufactured by THE MONSON MAINE SLATE CO., Boston, Mass.

Samples.

Samples of Monson Maine unfading black slate will be sent to prospective users on request.

Service.

This company maintains a service department which is at the disposal of prospective purchasers, without obligation, for the submission of estimates and general information concerning the company's products.

References.

The superiority of Monson slate is recognized by all the leading electrical concerns in the United States. A few of the users of this slate are listed below:

General Electric Co., Western Electric Co., Westinghouse Electric & Mfg. Co., Pennsylvania Railroad, Philadelphia Rapid Transit Co., Interborough Rapid Transit Co., Boston Elevated Railway Co., Edison Co., Ford Motor Co., Willys-Overland Co., Buick Motor Co., International Harvester Co., U. S. Steel Corp., Illinois Steel Co., American Sheet & Tin Plate Co., American Steel & Wire Co., United Shoe Machinery Co., Western Union Telegraph Co., Postal Telegraph Co., Bethlehem Shipbuilding Corp., Crouse-Hinds Co., Cutler-Hammer Mfg. Co., Bryant Electric Co., D. & W. Fuse Co., Trumbull-Vanderpool Electric Mfg. Co., Holtzer-Cabot Electric Co., Geo. Cutter Co., Condit Electrical Co., Hatfield Electric Co., Leonard Bundy Electrical Co., Pittsburgh Electrical & Machine Co., New York Telephone Co., Cleveland Electric Illuminating Co., Public Service Corporation, United States Government.

STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY

GENERAL OFFICES AND FACTORIES

1050 University Avenue
ROCHESTER, N. Y.

BRANCH SALES OFFICES

CHICAGO, ILL., 710 West Jackson Boulevard
KANSAS CITY, MO., Coca-Cola Building

TORONTO, CAN., 10 Front Street, East

Products.

Manufacturers of INTER-COMMUNICATING TELEPHONE SYSTEMS, TELEPHONE APPARATUS, TELEPHONE CABLES and SUPPLIES.

Inter-communicating Telephone System No. 1.

Selective ringing, selective talking, *with 6-, 12-, 22- and 32-station capacity*; cost of a switchboard system and an operator's salary are saved; each telephone station may select, ring and talk with any of the other stations *without interference with remaining stations which may be using system simultaneously*.

ADAPTABILITY—For offices, factories, public buildings, large residences, etc., where simultaneous conversations are necessary.

SERVICE—Three kinds: (1) For communication between a certain group of local stations. (2 and 3) This local service with additional service to and from city or town telephone system of either the "central energy" or local battery type, by means of one or more exchange trunk lines. One station on local system designated as the answering station.

Telephone exchange may be of two styles: (a) "central energy" type, with which answering station handles and transfers *incoming calls only*—outgoing calls being controlled from each local station; (b) "generator call" type, where both incoming and outgoing calls are conducted through the answering station.

STANDARD EQUIPMENT—All telephone apparatus and accessories, including desk, wall and combination telephones, long distance transmitters and receivers, 3-position type switching key mechanism, key boxes, extension bells and other trunk line equipments, cables, terminal boxes, mounting standards, bell ringing transformers, batteries, etc. Each part is of the same high quality as used in regular city exchange systems.

OPERATION—*To Establish Connection*—Press 1 button once only; same button is used for selecting and ringing desired telephone. Push button switching keys have 3 operating positions—normal, talking and ringing; pushing button all the way down closes a circuit which *causes bell of distant telephone to ring*; button being released, it snaps back half way to *talking position*, completing talking circuit with the telephone called; receiver is then removed and conversation may begin.

Switching keys interlock by means of a tumbler plate so that, when any call is made, any key button *still remaining in talking position* is restored to normal position when any other key button is pressed.

To Answer a Call—Connection is made with party calling by pressing the white "home" button and by taking receiver from hook; "home" button is restored automatically when next call is made on system.

Telephones for System No. 1.

No. 905, for use at regular stations, consists of two pieces—a No. 989 desk stand and either a No. 8R, 9R, 10R or 11R key box. For answering stations, see table.

Key boxes contain switching key, vibrating ringer, impedance coil and line and battery terminals; directory spaces opposite each key button for inserting names of stations; removable covers for testing and inspection.



NO. 905-A DESK TELEPHONE
DESK TELEPHONES FOR SYSTEM NO. 1

Code number	Capacity	Desk stand number	Key box number	Key box mounting space	List price
FOR REGULAR STATIONS					
905-A	6 stations	No. 989	8R	4 $\frac{3}{4}$ " x 6 $\frac{3}{8}$ "	\$59.50
905-B	12 stations	" 989	9R	5 $\frac{3}{4}$ " x 6 $\frac{1}{8}$ "	69.00
905-C	22 stations	" 989	10R	5 $\frac{3}{4}$ " x 9 $\frac{3}{8}$ "	94.00
905-D	32 stations	" 989	11R	5 $\frac{3}{4}$ " x 12 $\frac{1}{8}$ "	117.00
FOR ANSWERING STATIONS					
906-A	6 stations	No. 990	8A	4 $\frac{3}{4}$ " x 6 $\frac{3}{8}$ "	\$59.50
906-B	12 stations	" 990	9A	5 $\frac{3}{4}$ " x 6 $\frac{1}{8}$ "	69.00
906-C	22 stations	" 990	10A	5 $\frac{3}{4}$ " x 9 $\frac{3}{8}$ "	94.00
906-D	32 stations	" 990	11A	5 $\frac{3}{4}$ " x 12 $\frac{1}{8}$ "	117.00
DESK TELEPHONE PARTS					
No. 989	Desk telephone		(Regular)		\$28.00
No. 990	Desk telephone		(Answering)		28.00
8R	Key box 6 stations		(Regular)	4 $\frac{3}{4}$ " x 6 $\frac{3}{8}$ "	31.50
8A	Key box 6 stations		(Answering)	4 $\frac{3}{4}$ " x 6 $\frac{3}{8}$ "	31.50
9R	Key box 12 stations		(Regular)	5 $\frac{3}{4}$ " x 6 $\frac{1}{8}$ "	41.00
9A	Key box 12 stations		(Answering)	5 $\frac{3}{4}$ " x 6 $\frac{1}{8}$ "	41.00
10R	Key box 22 stations		(Regular)	5 $\frac{3}{4}$ " x 9 $\frac{3}{8}$ "	66.00
10A	Key box 22 stations		(Answering)	5 $\frac{3}{4}$ " x 9 $\frac{3}{8}$ "	66.00
11R	Key box 32 stations		(Regular)	5 $\frac{3}{4}$ " x 12 $\frac{1}{8}$ "	89.00
11A	Key box 32 stations		(Answering)	5 $\frac{3}{4}$ " x 12 $\frac{1}{8}$ "	89.00

WALL TELEPHONES—

No. 903 is regularly manufactured and carried in stock with a quarter sawed oak cabinet having a dull golden oak finish and nickelplated trimmings. Built in 4 sizes—see table on succeeding page. All apparatus (except switching key) mounted within hinged front section of cabinet, affording convenient access.



NO. 903-B TELEPHONE
Wall type

WALL TELEPHONES FOR SYSTEM NO. 1

Code number	Capacity	Key box mounting space	List price
FOR REGULAR STATIONS			
903-A	6 stations	6 3/4" x 11 5/8"	\$49.50
903-B	12 stations	6 3/4" x 11 5/8"	57.80
903-C	22 stations	6 3/4" x 14 1/2"	85.50
903-D	32 stations	6 3/4" x 17 1/4"	112.00
FOR ANSWERING STATIONS			
904-A	6 stations	6 3/4" x 11 5/8"	\$49.50
904-B	12 stations	6 3/4" x 11 5/8"	57.80
904-C	22 stations	6 3/4" x 14 1/2"	85.50
904-D	32 stations	6 3/4" x 17 1/4"	112.00

COMBINATION TYPE No. 1128—Convenient for either office or residence use.

Installed as either a wall or desk telephone outfit.

The Battery—Two separate sets of dry cells required to operate system—one set of about 7 cells to supply for talking purposes, and other set of 7 to 10 cells for ringing the telephone bells.

Number of cells in ringing battery depends on length of lines.



No. 1128-A TELEPHONE

COMBINATION TELEPHONES FOR SYSTEM NO. 1

Code number	Capacity	Combination telephone	Key box number	List price
FOR REGULAR STATIONS				
1128-A	6 stations	10-I	8R	\$63.00
1128-B	12 stations	10-I	9R	72.50
1128-C	22 stations	10-I	10R	97.50
1128-D	32 stations	10-I	11R	120.50
FOR ANSWERING STATIONS				
1129-A	6 stations	10-IC	8A	\$63.00
1129-B	12 stations	10-IC	9A	72.50
1129-C	22 stations	10-IC	10A	97.50
1129-D	32 stations	10-IC	11A	120.50

CABLING OF SYSTEM—Cables contain all wires (Nos. 18 and 22 B & S gauge copper) necessary for operation of system; full metallic circuit wiring between all stations; and any pair of wires are identified by their coloring, making installation work easy. Each wire is tinned and insulated with servings of silk and cotton in opposite directions. Splices or junctions in cable should be made with the terminal boxes (for all sizes of cable).

Types of Cables—(1) Braided sheath type, recommended for interior use. (2) Leaded type, for all outdoor use or places subject to excessive moisture or corrosive fumes, dampness, etc.



CABLE

Inter-communicating Telephone System No. 2.

Service is equivalent to No. 1 System with these exceptions:

- (1) It transmits one conversation only at a time; and
- (2) it is not arranged for connections with a public service telephone exchange.

Any or all stations may be called in rapid succession. Wiring arranged for local service between all stations.

ADAPTABILITY—Used for small size local service systems such as small commercial establishments, factories, clubs and residences. The circuits are simple and do not require the 3-position switching key.

SIZES—Instruments and accessories furnished in 2 standard sizes: for 6 and 11 stations.

INSTALLATION AND OPERATION—Further details will be mailed on application.



No. 1122-B WALL TELEPHONE FOR SYSTEM NO. 2
Mounting space, 5 3/4" by 9 in.

Inter-communicating Telephone System No. 3.

A central station system for communication between one master station and a number of outlying stations as in schools, small hotels and public institutions. Arrangement provides for talking and ringing between master station and all outlying stations over a 3-wire circuit—2 common talking circuit wires and an individual signalling wire to each station. Outlying stations can not call each other direct, but must first call the master station, which in turn calls desired station. All calls, therefore, are checked. One conversation only can be maintained at a time.

EQUIPMENT—Master station is equipped with both wall and desk telephones similar to those illustrated on preceding page; outlying stations are fitted with desk, wall and combination telephones, impedance coil (for regulating supply of current to transmitters of the various telephones) and all accessories.

SIZES—Instruments and accessories are furnished in 4 sizes: for 5, 10, 20 and 30 stations. A complete system need not be installed at the beginning—additional stations can be provided at any time, if master station capacity is of sufficient size.



No. 965 WALL TELEPHONE FOR SYSTEMS NO. 3 AND NO. 4
Mounting space, 5 3/4" by 7 3/4" in.

Inter-communicating Telephone System No. 4.

For communication between any 2 points not farther than 1,500 ft. apart. An ideal equipment for a private line between 2 offices, 2 departments in a factory, and for house to garage lines, etc.

EQUIPMENT—System No. 4 is equipped with wall, desk and combination telephones and other necessary accessories.

Prices and Further Information.

On receipt of full particulars, estimates and detailed information, with catalogues, bulletins, etc., will be mailed without delay.

References.

Extensive lists of satisfied users of this company's inter-communicating telephone systems will be forwarded to interested inquirers on application.

THE SCREW MACHINE PRODUCTS CORPORATION

Manufacturers of Select-O-Phone, Automatic Interior Telephone
and Calling System

PROVIDENCE, R. I.

Products.

The SELECT-O-PHONE SYSTEM, a combined Automatic Interior Telephone and a General, or Factory, Calling Service.



Standard Desk Type Select-O-Phone.

The standard desk instrument is finished in dull black, with heavily nickered fittings, and is practically identical in size and appearance with the usual desk telephone for exchange service, but contains the numbered dial with which connections are obtained without a switchboard operator.



STANDARD
DESK TYPE
SELECT-O-PHONE

Description.

The Select-O-Phone automatic telephone service consists of an automatic switchboard and telephone instruments. It has an ultimate capacity of 33 direct lines and 2 extensions for each line. All of these are intercommunicating with each other.

Advantages.

SIMPLICITY—The Select-O-Phone requires no expensive and complicated cable arrangements or terminal boxes. Wiring for its operation is very simple and inexpensive, and stations already installed may be moved easily. This simplicity also facilitates the addition of new instruments to the system.

FLEXIBILITY—The Select-O-Phone is built throughout on the unit plan. One of the chief objects kept continually in mind during its development was to design a system that would be flexible; one, the first cost of which would not be prohibitive to the user who required a small number of stations, but at the same time a system that could be added to as requirements demand.

Special Features.

- Requires no operator.
- Gives a service of 24 hours.
- Gives connection in 4 seconds.
- Secret conversation.
- Speeds up city telephone service by relieving overburdened switchboard.
- No cut-offs during conversations.
- Conference of 3 or more on the same wire—all remaining at their post of duty.
- Executive control for special messages of the chief.

General Calling Service.

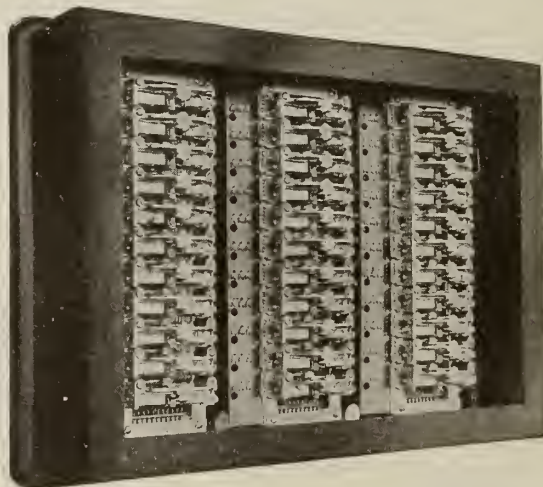
The general calling service, when combined with the Select-O-Phone automatic telephone service, provides a means of instantly locating and verbally connecting with a desired person anywhere in the plant. They step to the nearest Select-O-Phone station, answer the call and proceed on their way without loss of time.

It is not necessarily a part of the Select-O-Phone system, but the many advantages it offers makes it a valuable adjunct, especially for factories and large institutions. Its omission in no way interferes with the telephone service, as rendered by the Select-O-Phone, and it need not be installed unless desired. Provision is made in every system for its addition at any time.

Automatic Switchboard.

TYPE M-33—The cabinets are made of selected, well-seasoned hardwood, finished in dull black, size 28½ by 20½ by 8 in.

They are designed to mount on wall and the glass front cover is removable. They are handsome pieces of furniture, harmonizing with any office and occupying a very small space.



TYPE M-33 AUTOMATIC SWITCHBOARD

Type M-33 switchboards are always furnished with the "busy" unit and fully wired for mounting the general call relay and additional racks as needed.

TYPE M-11—A smaller switchboard of a similar design is made to meet the demands of those requiring an ultimate capacity of only 11 lines.

Catalogue.

Illustrated catalogue containing schematic wiring plan, power plants, etc., sent on request.

METALWOOD MANUFACTURING CO.

Hydraulic Machinery and Equipment

Leib and Wight Streets
DETROIT, MICH.

SALES REPRESENTATIVES

NEW YORK, N. Y.

MONTREAL, CANADA

PHILADELPHIA, PA.

TORONTO, CANADA

CHICAGO, ILL.

Products.

HYDRAULIC STRAIGHTENING PRESSES.
HYDRO-PNEUMATIC QUICK OPERATING PRESSES.
HYDRAULIC PRESSES.
HYDRAULIC ARBOR PRESSES.
HYDRAULIC BROACHING PRESSES.
HYDRAULIC FORCING AND ASSEMBLY PRESSES.
HYDRAULIC ACCUMULATORS.
HYDRAULIC HIGH DUTY PUMPS.
PIPE AND FITTINGS FOR HYDRAULIC LINES.
DROP FORGED STEEL HYDRAULIC FITTINGS.

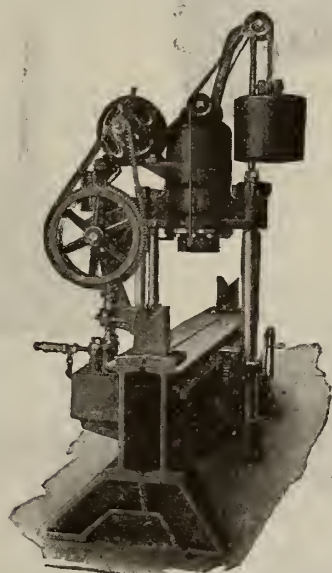
Service.

This company maintains an engineering department which is always at the service of its customers, and will gladly furnish any information desired.

Hydraulic Straightening Presses.

These machines are carefully designed along the lines of advanced engineering practice and are constructed of high grade material throughout.

The bed is made of two extra heavy steel I-beams supported by two heavily flanged cast legs. Adjustable V-block centers are provided for the support of shaft.



HYDRAULIC STRAIGHTENING PRESS

Made in capacities of 35, 50, 65 and 125 tons for straightening 3-in. to 6-in. bars and shafts, including No. 191 crank shaft press designed especially for crank shaft straightening.

Press is built for accumulator drive; belt drive from



line shaft; and direct motor drive as a self-contained removable unit.

Hydro-pneumatic Quick Operating Presses.

Manufactured in capacities of 10, 15, 20, 30 and 40 tons for light straightening, broaching, forcing and assembly operations.

Hydraulic Presses.

Designed for vulcanizing and forming in rubber manufacture; leather and coin embossing; metal and plastic material forming presses.

Hydraulic Arbor Presses.

For industrial and railroad shop work, made in capacities of 35, 60 and 100 tons.

Hydraulic Broaching Presses.

For use in accumulator or belt driven types.

Hydraulic Forcing and Assembly Presses.

Horizontal style, quick operating types, for rear axle housing and brake drum work.



FORCING AND ASSEMBLY PRESS

Hydraulic Accumulators.

Made in four types and a wide range of capacities for various requirements.

Hydraulic High Duty Pumps.

These pumps are manufactured in horizontal and vertical types and in capacities of 2½ to 20 gals.

Pipe and Fittings for Hydraulic Lines.

Consist of flanges, pipe and pipe bends, valves, etc., including "Metalwood" quick operating type valve; alleviators and intensifiers.



HYDRAULIC VALVE

Drop Forged Steel Hydraulic Fittings.

Ells, tees, stop and check valves, flange unions, couplings, bushings, etc.

Bulletins.

Furnished on application.

SOUTHWARK FOUNDRY AND MACHINE CO.

Manufacturers of Hydraulic Machinery and Power Tools

PHILADELPHIA, PA.

NEW YORK, N. Y.

BRANCH OFFICES

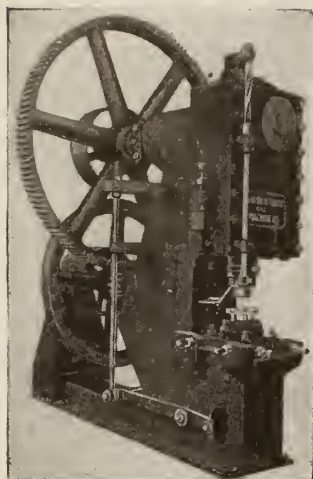
BIRMINGHAM, ALA.

Products.

HYDRAULIC MACHINERY and POWER TOOLS:

Gate Shears; Angle Shears; Multiple Punches; Forcing Presses; Drawing Presses; Flanging Presses; Plate Planers; Tile and Die Presses; Bending Rolls; Push Benches; Pull Benches; Riveters; Plate Bending Presses; Wheel Presses; Jogging Presses; Stamping

and Drawing Presses; Heater Presses; Forging Presses; Intensifiers; Dishing Presses; Washer Presses; Accumulators; Bending and Straightening Machines; Punching and Shearing Presses; Powder Presses; Flue Welders; Locomotive Repair Machinery; Scrap Reclaiming Equipment; Shipyard Machinery.



WASHER PRESS

May be equipped to feed washer stock in band or bars.
May also be arranged for belt or motor drive



BENDING ROLLS

Made in many sizes, varying in capacity from rolling of small sheets up to large ship plates, which are at times as long as 34 ft.

General construction consists of 3 rolls, arranged in a pyramidal setting. Two bottom rolls driven by suitable gear trains and electric motor, while top roll is an idler arranged for vertical adjustment through suitable screw down mechanism, which is generally driven by independent electric motor.

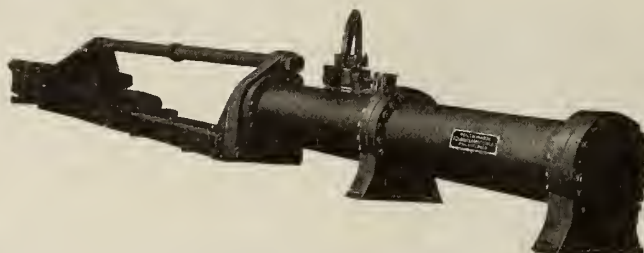
On all but large ship rolls, top roll is provided with an extension for balancing weight of roll; while outer bearing, which is removable, can be dropped for the purpose of taking out completed shells. This roll can also be thrown out of parallel in a vertical plane with 2 lower rolls for handling conical sections.

Housings and gear bearings mounted on continuous cast iron bed plate, which in turn is set on suitable concrete foundation



ACCUMULATOR

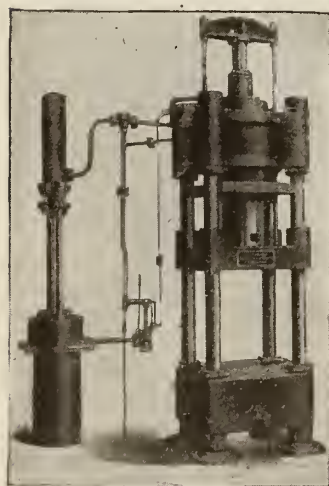
60-in. ram, 20-ft. stroke, 2940 gals., 600 lbs. per sq. in.
Furnished either moving cylinder or moving ram type of any capacity or pressure



HORIZONTAL DRAWING PRESS

300-ton press having a stroke of 14 ft.

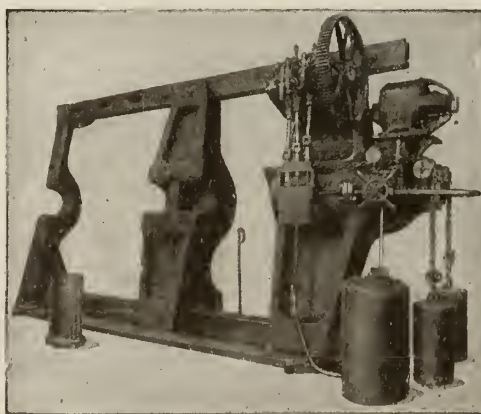
Arranged with double die-bed; 1 die-bed arranged in front of resistance platen and another arranged back of resistance platen, so that for short draws, only sufficient stroke is utilized to finish the material, thus economizing on pressure water



VERTICAL PRESS AND INTENSIFIER

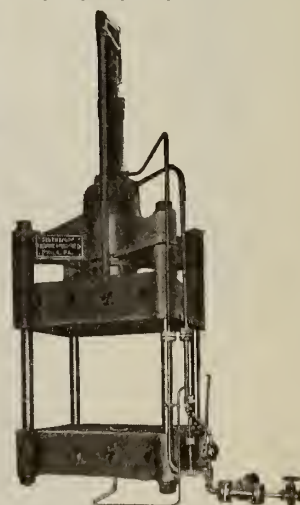
1500-ton hydraulic forging press complete with intensifier.

Low pressure admitted to main cylinder through check valve and tee by operating main valve. This brings moving platen down to ram and fills high pressure intensifier cylinder. Maximum capacity obtained by operating 3-way valve on low pressure intensifier cylinder. Raising intensifier ram admits intensified pressure water through check valve into main cylinder of press



600-TON MOTOR DRIVEN WHEEL PRESS

Motor driven inclined type. Pump body of forged steel. Mounted on heavy cast iron base plate. Equipped with axle bushing and stop plate. Capacities from 100 to 600 tons



FLANGING PRESS

4-column 350-ton press adapted for general use in car and boiler shops for flanging steel shapes.

Platens made of open hearth steel casting with tee slots planed from solid, or of special close grained cast iron.

This company has built presses of this design with clearances from 4 by 6 ft. to 12 by 14 ft. between columns, and up to 2500 tons capacity. All presses equipped with operating valves and piping between valve and press

Plate Planers.

For edge planing, plates are clamped down to bed of machine either by hand, hydraulic or pneumatic jacks. Jacks are mounted on a structural steel girder, which is connected to bed plate through housings at each end of machine. Carriage is equipped with 2 tools, 1 for planing in each direction. Travel of carriage is obtained through means of a long bronze nut fastened to underside of it, and a screw which is supported in a half-round groove running the full length of the bed.

At the end of the machine are tight and loose driving pulleys which operate the screw through a single reduction of cut gears. Driving belts are shifted by hand or automatically from the carriage which operates adjustable dogs on belt shifter shaft.

For ordinary belt drive, pulleys are belted to an overhead countershaft. The most common type of drive is the belted motor type, in which motor is mounted directly above reversing pulleys on a structural stand. Direct connected reversing type motor can also be used, and in this case is usually under manual control of operator who travels with the carriage.

Made to take plates in lengths from 16 to 40 ft.

All planers are made with overhung housing, so that plates longer than the travel of the carriage can be handled by re-setting.

Gate Shears.

Made in various sizes, from those having blades 2 ft. in length up to 16 ft., with different depths of throats in housings from 12 to 60 ins.

Usually built of 2 main housings; lower beam for supporting shear blocks and plunger which carries upper shear knives and suitable distance braces between the 2 housings.

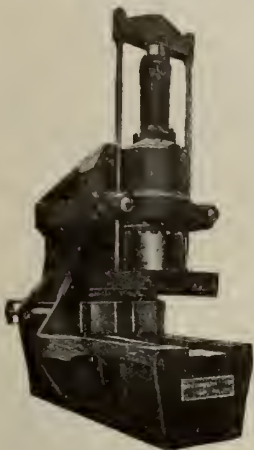
Operation of the ram is controlled by the jaw clutch and foot treadle.

The machine is usually triple geared to direct connected motor.

Automatic clamping beams in front of the shear knives hold plate in position while the cut is made.

Solenoid or magnetic clamp can also be furnished in the table which holds the work.

Plunger guides are lined with bronze taper gibs, which are used to take up the wear.

**JOGGING PRESS**

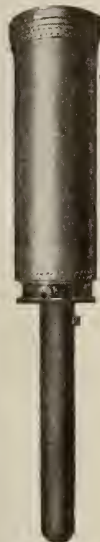
Capacities, 350 and 500 tons. For use in offsetting plates, beams and bulb angles.

Equipped with 1 vertical and 1 horizontal ram.

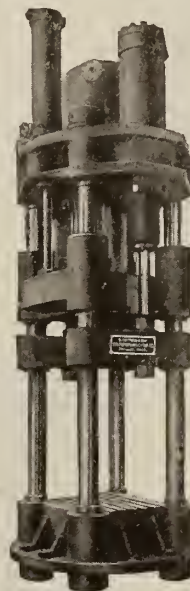
Gap to center of vertical ram 33 ins. Table 5 ft. 3 ins. by 4 ft. 8 ins. Vertical clearance between highest position of moving platen and table 3 ft. 9 ins.

**PORTABLE RIVETER**

100-ton special riveter with 15-in. gap and 7-in. stroke. Distance from center of removable forged steel riveter horn to face of top die, 3 ft. Stroke of ram, 7 ins. Designed of all cast steel and provided with adjustable hanger

**HEATER PRESS**

Capacity, 1000 tons. Ram, 30 ins. diameter; 3000 lbs. pressure. Full stroke of ram, 14 ft. Inside diameter of shell, 4 ft. 8 ins.

**STAMPING AND DRAWING PRESS**

4-column type having 2 moving platens. Designed with capacities from 100 to 1000 tons. Working pressure, 1500 lbs.

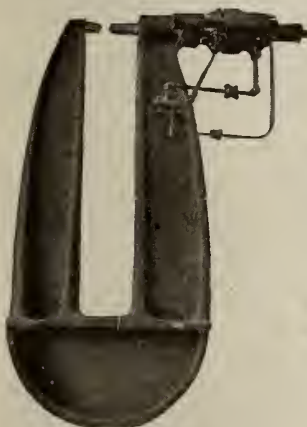
Two standard bronze body 3-way valves furnished with this press.

Small stripper cylinder, single or double-acting type, can be arranged in center of bottom of platen if desired

**200-TON SECTIONAL FLANGING PRESS**

Furnished complete with operating valves. Designed for 1500 lbs. pressure. Equipped with 2 vertical rams, 1 horizontal ram and 1 supplementary ram.

Housing of semi-steel. Cylinders of steel castings cast separately. Rams of special close grained cast iron mixture

**STATIONARY RIVETER**

Single power. All rams outside packed, stuffing boxes easily accessible. Pull-back operated by constant pressure, while main ram is controlled by standard piston type 3-way operating valve.

Built in capacities from 15 to 60 tons with gaps from 6 ins. to 12 ft. 6 ins.

Standard opening between stakes 24 ins.

Triple and six power. Solid, split stake type. Capacities up to 200 tons with gaps to 25 ft.

**PUSH BENCH WITH EXTENSION DIE BED**

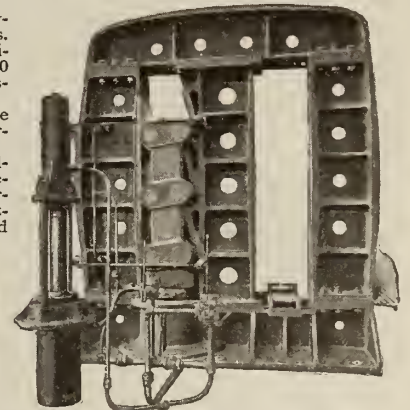
Used for reducing pipes by pushing over a mandrel. Also used for drawing cups and cartridge cases.

Special device for stripping tubes from mandrel is arranged at end of front head.

Operated by standard 4-way operating valve.

Presses built with cylinders ranging from 5 ins. in diameter up to 26 ins. for 1500 lbs. working pressure, with strokes of from 18 ins. to 26 ft.

Hydraulic draw benches for tube mills also built

**VERTICAL PLATE BENDING PRESS**

Vertical opening, 12 ft. 4 ins. Stroke of bending beam, 6 ins. Operates with 1000 lbs. line pressure.

To get maximum capacity of 1000 tons in horizontal direction, a hydraulic intensifier is provided, which will intensify pressure water in press cylinder and give a stroke of approximately 1 in.

Can also be arranged with flexible top member so as to facilitate bending of shells to complete circle

THE WATSON-STILLMAN CO.

Engineers and Builders of Hydraulic Machinery

MAIN SALES OFFICE

50 Church Street

NEW YORK, N. Y. -

CHICAGO OFFICE, McCormick Building

WORKS: ALDENE, UNION CO., N. J.

Products.

HYDRAULIC JACKS; HYDRAULIC SHEARS; IRON and WIRE ROPE SHEARS; CONCRETE TESTING PRESSES; PAXTITE LEATHER PACKINGS.

Benders, Tunneling Shields and Equipment, Heating and Chilling Presses, Forcing Presses and Special Machinery.

Universal Hydraulic Jack.

This jack is designed to fill the requirements of a universal purpose jack for work where the old style jacks have not filled the requirements. In its construction, no detail has been omitted which is necessary to render it capable of handling the work for which it is designed.

On account of the form of this jack it is easy to handle; and being made entirely of steel renders it light in weight.

It has a horizontal head which enables the jack to work at any angle from vertical to horizontal, and when laid flat upon the side the ram will push out its entire lifting length. To the bottom of the head is attached a cylinder, which passes over the outside for the purpose of excluding sand and dirt, from between the ram and cylinder, which would cut them and disable the tool as in case of some other styles of jacks.

It is provided with a large round steel bottom which gives it a firm foundation.

An independent claw can be used when a low lift is required, and removed when the jack is used for other purposes, thus relieving the tool of the additional weight.

This jack will be found durable, plain in construction, and reliable in service; and on account of its special design, will facilitate the handling of heavy equipment, bridges, etc.

These jacks are built in capacities to 60 tons.

Independent Pump Hydraulic Jack.

This jack will work where any other can be used, and it will work where conditions make the use of other jacks impossible. Being connected to its pump by a flexible copper pipe 8 or 12 ft. long, the jack can be placed in recesses out of reach of the operator or in

locations where another jack would be dangerous. The pump can be set at a distance determined by the length of the pipe, with a safe and firm footing for the operator.

Since the jack is merely a plain cylinder and ram, it has a maximum raise with a minimum over all height; and the pump being a separate unit, the weight is distributed, making the outfit more portable.

The pump shown coupled to the jack is our standard single plunger type. It is simple and serviceable and all parts are accessible for repair and lubrication.

The reservoir is cast iron, the pump body of bronze and the plunger of hardened tool steel. The reservoir capacity is ample for the total displacement of the jack with which it is furnished.

A double plunger pump, which provides two pressures and two speeds, will be furnished if desired.

This pump is particularly valuable when rapidity of operation is important.

Any type of hand or power driven pump can be used in connection with these jacks.

The flexible connection between the pump and the jack is a $\frac{1}{4}$ -in. annealed copper pipe, 8 ft. long, tested to 10,000 lbs. per sq. in.

Outside Pump Hydraulic Jack.

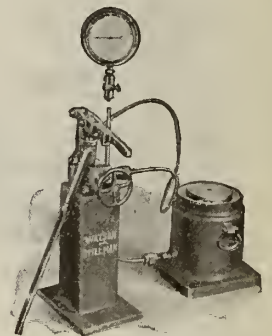
The outside pump hydraulic jack, vertical type, is built with double plunger pump. The features of these jacks are the simplicity of design, accessibility of working parts, and large bases.

Compactness is not attained at the expense of simplicity, or lightness at the expense of strength; they are made to work.

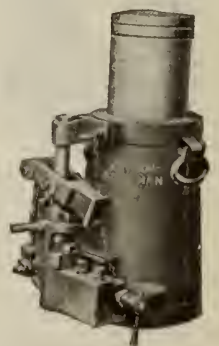
They are used extensively by contractors, builders, dry dock and wrecking companies for underpinning and foundation work, in machineries, and for hauling out oil well pipes. These are built in capacities from 60 to 200 tons and lifts of 9, 12 and 18 in.



UNIVERSAL HYDRAULIC JACK



INDEPENDENT PUMP HYDRAULIC JACK



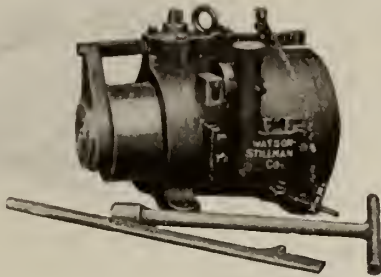
HYDRAULIC JACK WITH DOUBLE PLUNGER PUMP

Outside Pump Hydraulic Jack, Horizontal Type.

This is another type of the outside pump jack. It is used in horizontal pressing; for pushing crank pins; for moving bridges, boilers, machinery, etc. The ram is pulled back by a rack and pinion device.

Single or double plunger pumps can be supplied with this jack at no additional cost.

The capacities of standard sizes are 60 to 200 tons, with 12-in. movement.



OUTSIDE PUMP HYDRAULIC JACK, HORIZONTAL TYPE

Horizontal Claw Hydraulic Jack.

The horizontal claw hydraulic jack is a very handy tool.

It will push horizontally its entire lifting stroke, and is so constructed that grit or dirt can not get between cylinder and ram.

It is built in capacities from 4 to 40 tons and 12-in. to 18-in. movements.



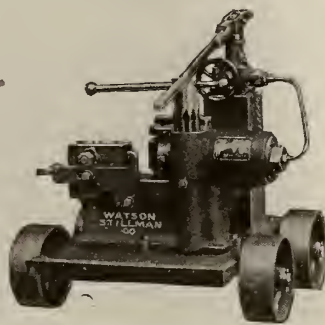
HORIZONTAL CLAW HYDRAULIC JACK

Hydraulic Shear for Cutting Reinforcing Bars, etc.

This shear is especially adapted for cutting reinforcing bars, flats, rounds, ovals or very high carbon or tough material. The cutting blades are square and so designed as to give 8 available cutting edges before resharpening. It is portable and can be operated by one man. Tool shown is No. 3 size with a 4½-in. ram, exerting a pressure of 75 tons, and will cut material up to 1¼-in. square.



IRON AND WIRE ROPE SHEAR

HYDRAULIC SHEAR
For cutting steel reinforcing bars**Flat and Round Bar Iron and Wire Rope Shear.**

This lever shear is adaptable for cutting flat iron, round iron or wire rope, by merely changing the shear blades. Its construction is powerful throughout; and considering its weight and size, its capacity is high. They are made in a number of sizes and capacities.

Hydraulic Testing Press.

This press was designed originally for making compression tests on specimen blocks of concrete, etc. Its handy size makes it adaptable to many uses in laboratory or machinshop, such as press fitting small parts, and for an unlimited number of uses in bending, straightening, etc. It is only 27 in. high, but is capable of a maximum pressure of 30 tons. Other sizes on demand.



TESTING PRESS

Pax-tite Packings.

Pax-tite packings are guaranteed to outlast under similar conditions of service any competitive packings on the market. As large users of packings in our own line of hydraulic machinery, we have been able to prove this claim.

Pax-tite packings are made from the best leather obtainable, prepared by a special process which gives them every quality necessary to the successful operation of hydraulic machinery.

They are made in all standard sizes. Special designs and sizes can be built to specifications.



PAX-TITE LEATHER PACKINGS

ALBERENE STONE COMPANY

Manufacturers of Laboratory Equipment

223 East 23rd Street
NEW YORK, N. Y.

BOSTON, MASS., 51 Bristol St.
NEWARK, N. J., Prudential Building

PITTSBURGH, PA.

CHICAGO, ILL., 214-222 N. Clinton St.
PHILADELPHIA, PA., Pennsylvania Building

Products.

LABORATORY FIXTURES: Table Tops, Backs, Shelves, Supports, Sinks, Hood Bases, Superstructure for Hoods, Tanks and Gutters.

Flooring, Window Sills, Steam Baths, Sand Baths, Flues, Strainers and Linings for Smelting Furnaces.



TRADE-MARK

Sinks, gutters and tanks are made up with a tongued and grooved joint, similar to that shown in illustration, which renders these fixtures perfectly watertight. By the use of proper cement, long service can be secured.



SLIP TONGUE JOINT

Fume Hoods.

The non-absorbent quality of ALBERENE STONE together with its density renders it a splendid resistant to the action of fumes and makes possible a permanent superstructure with practically no maintenance charge.

Installation.

The ALBERENE STONE COMPANY assumes responsibility for the delivery of the material to the building and its erection in position on foundations to be provided by this company, or by the owners or other contractors. The company is, therefore, in a position to complete the interior equipment of a laboratory consisting of table tops, shelving, sinks, gutters and hoods, excluding plumbing connections and fittings, but including pipe frame supports or cabinet work where required.



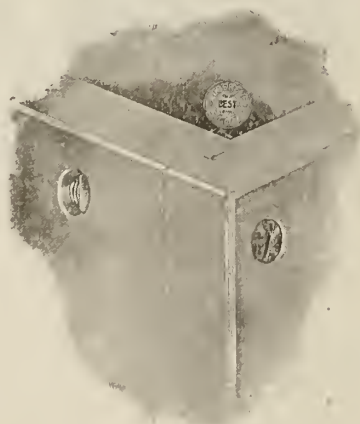
FUME HOOD, TABLE TOP, BACK, REAGENT SHELF, AND SINK OF ALBERENE STONE

General.

ALBERENE STONE is the trade-name applied exclusively to the output of the quarries of the ALBERENE STONE COMPANY and serves both as an identification and a guarantee of quality and service. ALBERENE STONE is a natural quarried stone, gray in color, close grained, non-porous and of uniform density and hardness. The non-absorbent quality of ALBERENE STONE renders it acid and alkali resistant for table tops, sinks, gutters, and shelving for laboratory use. Acids and alkali have very slight action upon the stone. Samples furnished for test prior to installation.

Fixtures.

Table tops for industrial and research laboratories of ALBERENE STONE are proving most satisfactory. The construction is similar to that shown in the accompanying illustrations. The slip tongue joint makes possible the erection of table tops of any length required, with joints that are almost imperceptible.



TONGUED, GROOVED AND BOLTED JOINT



ALBERENE TABLE TOP, SHELF, SUPPORTS, FLOORING AND BASE

Co-operation and Responsibility.

Based on over 30 years' experience the ALBERENE STONE COMPANY will gladly furnish information concerning equipment and prepare details.

The ALBERENE STONE COMPANY guarantees its products against defective material and workmanship.

AMERICAN PROCESS COMPANY

Manufacturers of Drying, Pressing and Cooking Machinery

68 William Street
NEW YORK, N. Y.

Products.

DRYERS; PRESSES; DIGESTERS and COOKERS.

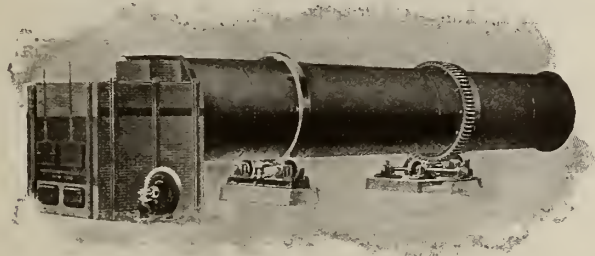
Scope of Use.

The dryers manufactured by AMERICAN PROCESS COMPANY will handle any kind of animal, vegetable and mineral materials, organic or inorganic matter, solid or liquid. They are operated either by direct heat or steam heated air. Continuous screw presses of different construction, used for separating any solid matter from its liquid, can be adapted for slaughter house tankage (residuum of fats) as well as for pressing fish and reclaimed rubber. Digesters and cookers to meet any and all conditions.

American Process Machinery.

Distinguishing features of AMERICAN PROCESS COMPANY's machinery are its automatic, continuous and uniform action.

ADVANTAGES—(1) Product is uniform; (2) labor is reduced to a minimum; (3) wear and tear of starting, stopping and reversing or otherwise changing the load are eliminated, thus prolonging life of machine far beyond that of similar types; (4) economy in fuel consumption, heat being applied direct; (5) saving in power and increase in capacity by continuous action.



SAND, ORE AND FERTILIZER DRYER

Direct heat rotary dryer, with gear ring. Materials and gases travel in same direction. Wet material and furnace gases enter shell together at higher end. Wet material falls to bottom of shell, is caught by an interior shelf, elevated to almost highest point of rotation, and then falls again through furnace gases. This operation, with highest temperature in contact with wettest material, continues until dried material is discharged through lower end of dryer. Erection of dryer with furnace can be performed by any competent mechanic.

DRYER CAPACITIES AND DIMENSIONS

No.	Capacity (lbs.) sand, ore, etc., per hour, when 5% moisture	Capacity (lbs.) of fertilizer, etc., when 50% moisture	Horse-power	Shipping weight, lbs.	Floor space
C II	10,000	1,000	5-8	10,000	27' 6"x6'x6' 6"
C III	20,000	2,000	8-12	12,000	32' 6"x6'x6' 7"
C IV	30,000	3,000	10-15	15,000	37' 6"x6'x6' 7"
C V	40,000	5,000	15-20	28,000	42' 6"x9'x8' 9"
C VI	50,000	8,000	20-25	30,000	50' 6"x9'x9'

Counter current dryers and brick lined roasters are also manufactured.

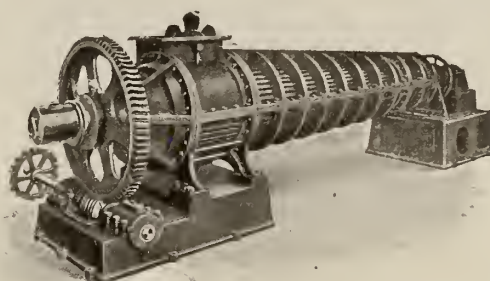


STEAM HEATED AIR DRYER

For drying borax, baking powder, nitrate of ammonia, etc.

Automatic Continuous Screw Press.

This press is self-contained and of continuous screw type, consisting of a horizontal tapered screw, built up on a hollow perforated shaft and arranged to allow admission of steam, if desired. Screw fits closely inside of a similarly tapered slatted curb, and rotates. Material, forced into conveyor portion of screw, then into curb, must move towards small end of press as screw turns. Size of discharge opening is regulated. Drainage is both internal and external. To regulate supply of material, a patent feeder is furnished.



CONTINUOUS SCREW PRESS

For pressing fish, slaughter house tankage (residuum of fats, etc.), reclaimed rubber, etc. Material fed in at one end and discharged at the other; liquids forced out between slats, into drainage holes of shaft, thence to a tank. Built in all sizes

Automatic Continuous Digester and Cooker.

Direct steam, self-contained type and operated continuously. A screw conveyor (inside a cylindrical shell) rotates, cuts up, digests and thoroughly agitates material and carries it forward. Steam admitted through perforations in hollow shaft of conveyor. Note forced rotary feed at admission end. Liquid and solid matter are discharged together, thence to a tank. Drainage tank can be built at small expense.



AUTOMATIC CONTINUOUS DIGESTER AND COOKER

Feed, digester proper and discharge all driven by sprockets and chain belting. Very little vibration, and digester can be erected in upper stories of building. Built in all sizes

Co-operative Services.

Complete drawings and directions are always furnished for the erection and operation of dryers and, generally, no outside assistance is required. Recommendations made and, if desired, an engineer will be placed in charge of the installation.

References.

List of satisfied users sent on application.

THE BIGGS BOILER WORKS COMPANY

Vulcanizers and Devulcanizers

East Market Street and Case Avenue
AKRON, OHIO

Products.

VULCANIZERS and DEVULCANIZERS having the "SIMPLEX" BOLTLESS QUICK CLOSING DOOR.

For Tanks, see page 617.

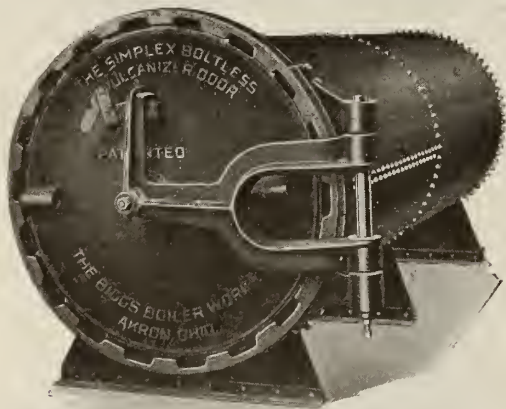
"Simplex" Boltless Quick Closing Vulcanizer Door.

Made throughout of high grade cast steel, accurately machined and is entirely self-contained. Overhead chain blocks, counterweights or trolleys are eliminated, and parts subject to wear are extremely heavy. It will operate satisfactorily when attached to vertical or horizontal vulcanizers, or similar equipment. Door is tight when used at specified operating pressure *without using fastening bolts* of any description.

Even the larger sizes can be opened or closed in 30 seconds without using any mechanical leverage other than short bar inserted in lugs provided. Practically no upkeep.

The design and construction of the "Simplex" has been accepted by the insurance companies, and will be accepted by them for insurance. Certificate of inspection furnished, if desired.

THE BIGGS BOILER WORKS COMPANY guarantees the "Simplex" to do all that is claimed for it. Workmanship and material guaranteed for one year.



"SIMPLEX" BOLTLESS HEAD ON A STANDARD HORIZONTAL VULCANIZER

Jacketed Vulcanizers.

Used very largely for special work where a dry heat is desired, and steam is not permitted to come in contact with material to be treated. These vulcanizers are rigidly constructed. On sizes larger than 42 in. in diameter, the entire collapsing strain of inner shell is thrown on to the staybolts. Steam jacket extends around entire shell and rear head, and in standard practice the front head is not jacketed. If necessary, this can be done.

If it is desired to carry a steam pressure on inner chamber as well as jacket, this can be accomplished. Working pressure, however, to which each chamber will be subjected, or number of inches of vacuum to be pulled, should be given.

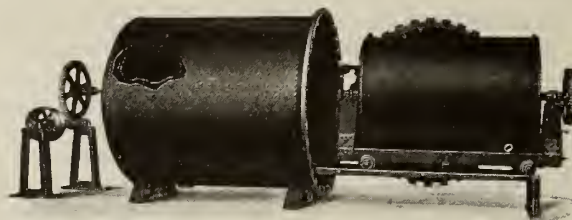
Furnished in all sizes and for all pressures.

Vulcanizers for Insulated Wire.

This company furnishes single shell and jacketed vulcanizers for vulcanizing insulated wire.

Equipment illustrated is so arranged that reel revolves continually during vulcanization. Provided with shaft and gear to facilitate unwinding wire. Made in all diameters and for any working pressure.

Reels, car and gearing are usually special. Vulcanizers may be furnished with inside track only, customer furnishing reels and cars. Also furnished with any special type of inside car or similar device for special work.



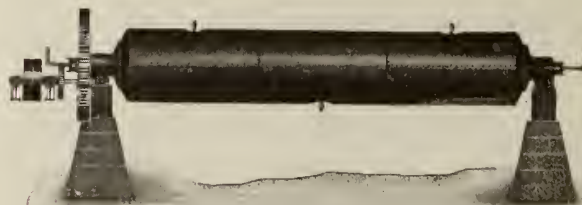
VULCANIZER FOR INSULATED WIRE

Jacketed Rotary Devulcanizers.

With the jacketed rotary devulcanizer, material to be devulcanized is placed in inner chamber containing the liquid, steam is admitted to jacket, and the entire devulcanizer is revolved continuously, and agitation assisted by stationary angles.

Machines are ordinarily constructed for 125 to 150 lbs. steam working pressure on the jacket, which should produce a temperature of approximately 350° to 365° Fahr. Made in all sizes and for any pressure. Furnished with inspection certificate issued by the insurance companies, which will be accepted by them for insurance.

This company also furnishes stationary horizontal or vertical devulcanizers, having a central shaft containing paddles, which do the agitating.



ROTARY DEVULCANIZER

Experience.

The experience of this company, together with special equipment and facilities, places them in position to furnish specially designed vulcanizers and devulcanizers at attractive prices.

W. E. PRINDLE, PRESIDENT R. W. BOYD, VICE-PRESIDENT P. R. PERKINS, SECRETARY GEO. H. JONES, TREASURER

THE BUCKEYE DRYER CO., INC.

Manufacturers of Dryers for Industrial Use

243 North High Street
COLUMBUS, OHIO

REPRESENTATIVES

NEW YORK, N. Y., B. P. GOLDMAN, M. E., 220 West
42d Street

DENVER, COLO., THE DRY MILLING ENGINEERING
Co., Boston Building

Products.

DRYERS.

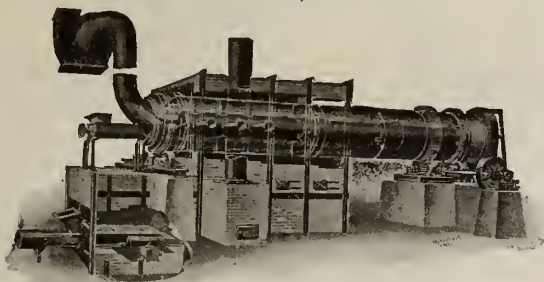
Advantages of Buckeye Dryers.

Seven types—a dryer for every purpose.
Capacity, fuel economy, thoroughness in construction, economy in operation and maintenance.

Tires, rollers, gears and all wearing parts made of steel.

Types.

Type "A" is best adapted to drying materials which carry a very high percentage of moisture, such as sewage sludge, liquid manure, garbage, packing house tankage above 40% moisture, etc.



TYPE "A" DRYER

Type "B" machine is best adapted to drying materials carrying from 10% to 40% moisture, such as pressed tankage, pressed blood stock feeds, coal, waste from canning factories, gypsum, etc.



TYPE "B" DRYER

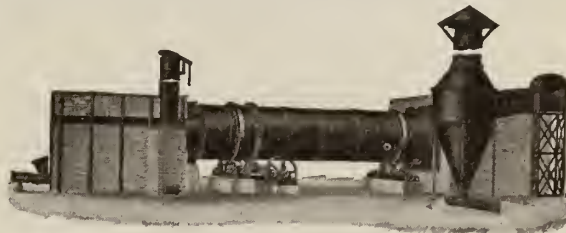
Type "C" is of the indirect heat type in which the products of combustion do not come into contact with the materials being dried. This machine is suitable for drying materials containing from 10% to 40% of moisture, where for any reason it is desired to prevent the products of combustion from coming into contact with the materials being dried, such as sensitive chemicals, high grade salt, etc.



TYPE "C" DRYER

Type "D" is a direct heat dryer, the interior of which is divided into various compartments, through

which the material is distributed while being dried. It is best adapted to drying pulp from beet sugar factories, potatoes for making potato flour, etc.



TYPE "D" DRYER

Type "E" is a plain shell dryer with a set of steam coils incased in a metal housing for heating the air before it enters the dryer, and is suitable for drying sensitive chemicals, sugar, etc., which can not be subjected to high temperature.



TYPE "E" DRYER

Type "F" is a dryer carrying the steam coils in the shell or drum of the dryer, and is suitable for drying certain materials which can not be subjected to high temperatures.



TYPE "F" DRYER

Type "G" is a plain shell dryer suitable for use in drying rough, coarse materials, such as rock ores, sand, gravel, etc., which can not be injured by overheating.



TYPE "G" DRYER

Some Users of Buckeye Dryers.

Morris & Co.; Wilson & Co.; Morton Salt Co.; Carey Salt Co.; Colonial Salt Co.; Pennsylvania Salt Mfg. Co.; Goodyear Tire & Rubber Co.; Milwaukee, Wis. and Houston, Tex. Sewage Plants.

During the year 1919, 51% of the business consisted of repeat orders from large concerns, who, after trying out many machines, adopted Buckeye dryers.

BUFFALO FOUNDRY & MACHINE CO.

Chemical Apparatus, Vacuum Dryers

NEW YORK OFFICE:
17 Battery Place

28 Winchester Avenue
BUFFALO, N. Y.

CABLE ADDRESS:
"BUFOUNDRY"

Products.

VACUUM DRYING APPARATUS:

Vacuum Drum Dryers
Vacuum Shelf Dryers
Vacuum Rotary Dryers
Vacuum Drying and Impregnating Apparatus
Dry Vacuum Pumps and Condensers
Expansion Tanks
Solvent Reclaiming Apparatus
Special Vacuum Apparatus

EVAPORATORS:

Horizontal Tube Evaporators
Vertical Tube Evaporators
Crystallizing Evaporators
High Concentrators
Rapid Circulating Evaporators
All Cast Iron Evaporators
Caustic Soda Plants and Recovery Apparatus
Salt Filters
Preheaters
Receivers

CHEMICAL APPARATUS for producing Heavy Chemicals, Acids and Alkalis, High Explosives and Organic Chemicals, Intermediate Products for coal tar colors and kindred materials:

Nitrators
Reducers
Sulphonators
Aniline, Beta-naphthol and Phenol Stills
Autoclaves for high and low pressures
Fusion Kettles
Caustic Pots
Caustic Flakers
Nitric Acid Retorts
Denitrators
Sulphuric Acid Concentrating Pans
Hydrochloric Acid Concentrating Pans
Crystallizers for Ammonium Nitrate and TNT
Vacuum Crystallizers
Acid Eggs
Acid Resistant and other Special Castings for dilute and concentrated acids
Waste Product Recovery Apparatus

STEAM HAMMERS:

Standard Guide Single Frame
Steel Frame Combined Type
Open Frame Hammers
Double Frame Hammers
Steam Drop Hammers

"BUFLOVAK" SUGAR APPARATUS, INCLUDING COMPLETE SUGAR PLANTS AND REFINERIES:

Hydraulic Sugar Cane Mills	Pulp Catchers
Hydraulic Crushers and Pre-crushers	Vacuum Pans
Sulphurous Acid Generators	Vacuum Dryers
Sulphurous Acid Coolers	Vacuum Pumps
Heaters	Steam Separators
Tanks	Bag Filters
Evaporators	Filter Presses
Catchalls	Granulators
Condensers	Crystallizers
Coolers	Sand Filters
Mixers	Bone Black Filters
Diffusion Batteries	Bone Black Dryers
	Kilns
	Retorts

Sugar Machinery Department.

This department is under the supervision of a specialist who has had many years of experience in designing, constructing and operating sugar machinery and entire sugar manufacturing plants for producing brown, white and refined sugars in the cane and beet sugar fields. Facilities enable us to manufacture, assemble and test machinery of any weight and size capable of rail or water transportation.

Research Laboratories.

Complete working units of various chemical apparatus and each type of evaporator and vacuum dryer are contained in this company's research laboratories. An opportunity is afforded to make practical working tests without charge or obligation, provided materials are furnished and transportation paid. The various laboratories are as follows:

Organic and Inorganic Chemical Laboratories.

Demonstrating and Testing Laboratory for vacuum drying, evaporating and various chemical operations.

Metallurgical Laboratory.

Physical Testing Laboratory.

Qualified experts are in charge of these laboratories, and customers are invited to make liberal use of them.

Engineering and Consultation.

Supplementing the services of our regular engineering staff, the benefit of consultation with specialists occupying the foremost position in their respective fields is offered. Among the fields thus covered are the following:

Organic chemicals. Heavy chemicals, acids, and high explosives.

Caustic soda, potash, and other alkalis.

Vacuum drying. Evaporating.

Sugar plants and complete sugar refineries.

"Buflovak" Vacuum Drying Apparatus.

"Buflovak" vacuum dryers are especially noted for efficiency and economy in drying a wide range of materials, including liquids, semiliquids and solids. The production of a uniform quality of dry material at low cost is always assured when using "Buflovak" dryers, because of the quick drying time, low operating cost, and the absolute control of the temperature at which the drying is done. The low temperatures at which materials can be handled in these dryers permit with absolute safety the drying of many materials that would otherwise be injured, or dried only at prohibitive cost. The drying is done very rapidly, and materials can be dried in a few hours that would otherwise require days and weeks.

"Buflovak" dryers are built for all materials and to suit any capacity desired.

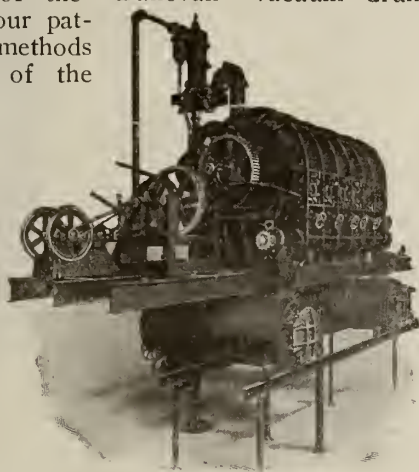
Vacuum Drum Dryer.

The ideal apparatus for drying liquids containing solids, such as tanning, dyewood, and other extracts, pharmaceuticals, milk, glue, acids, chemicals, colors, liquid food products, etc.

While the vacuum drum dryer has in theory been considered the ideal apparatus for drying liquids, satisfactory commercial results were not attained until the development of the "Buflovak" vacuum drum dryer, containing our patented devices and methods for the applying of the liquid to the drum.

The economical and satisfactory performance of these dryers in a wide range of industries is an assurance of their successful operation in any plant.

Built in sizes to meet any capacity.



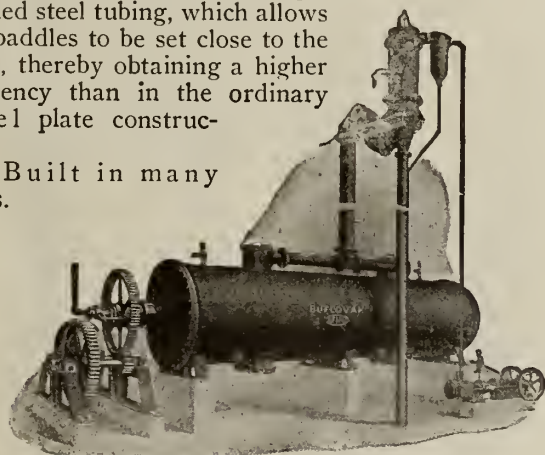
"BUFLOVAK" VACUUM DRUM DRYER

Vacuum Rotary Dryers.

Used for drying materials that permit agitation or mixing while being dried.

The interior contains a revolving heating tube, with mixing arms and paddles attached. The outer jacketed shell and the inner revolving tube are made of lap-welded steel tubing, which allows the paddles to be set close to the shell, thereby obtaining a higher efficiency than in the ordinary steel plate construction.

Built in many sizes.

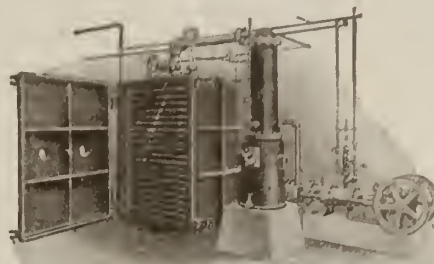


"BUFLOVAK" VACUUM ROTARY DRYER

Vacuum Shelf Dryers.

For drying materials that can be handled in pans or trays. In this, as in all "Buflovak" dryers, the most expensive and sensitive materials may be dried without injury or danger of overheating, because the temperature is always under absolute control.

Built in sizes to meet any capacity.



"BUFLOVAK" VACUUM SHELF DRYER

Impregnating Apparatus.

For drying various materials and impregnating them with insulating, waterproofing, fireproofing, coloring and other compounds. Used for insulating electric coils, cables, transformers, etc.; impregnating wood with stain or color for producing imitations of other woods; impregnating any material with paraffin, creosote, oils, colors, waterproofing compounds and other liquids.

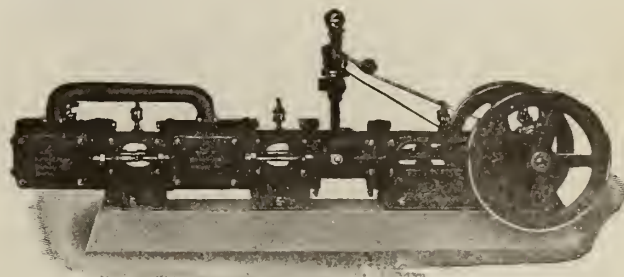


"BUFLOVAK" VACUUM DRYING AND IMPREGNATING APPARATUS

"Buflovak" Dry Vacuum Pumps.

The success achieved in "Buflovak" vacuum apparatus is partly due to the efficiency of "Buflovak" dry vacuum pumps, which are noted for their high vacuum, durability and low power consumption.

Built in various sizes—single-stage or two-stage, steam, belt or motor driven.



"BUFLOVAK" DRY VACUUM PUMP

Horizontal Tube Evaporators.

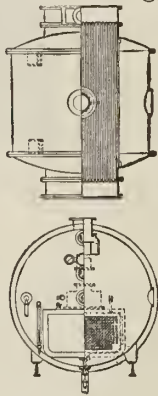
Used for common solutions which are to be distilled or concentrated to a higher density without the separation of salts, and which have no tendency to foam or produce scale.

An important feature of the horizontal type is the possibility of increasing the capacity by simply adding another cylindrical shell and providing longer tubes. This avoids the necessity of installing entirely new equipment.

The shells are made in one piece up to 12 ft. long, thereby reducing to a minimum the number of joints and the chances of leakage.



Front View

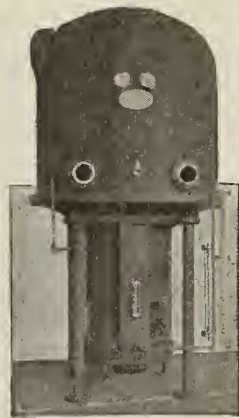


Plan and Elevation

"BUFLOVAK" HORIZONTAL TUBE EVAPORATOR

Rapid Circulation Evaporator, Vertical Type.

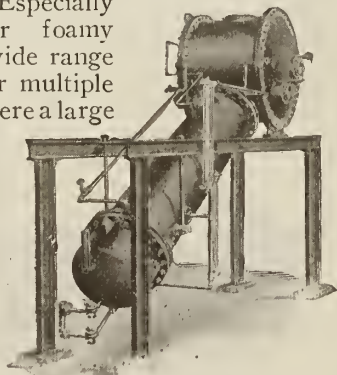
This type is especially suitable for the concentration of thin liquids of foamy nature, and organic solutions which should not be exposed to the heat for any length of time. This type is especially noted for its high capacity, which is accounted for by the climbing film of liquor that covers the upper part of the tubes. The density of the liquor is under perfect control, which is not the case with other evaporators of the climbing film type. The evaporator occupies very little floor space, and the erection and operation are extremely simple.



"BUFLOVAK" VERTICAL TYPE RAPID CIRCULATION EVAPORATOR

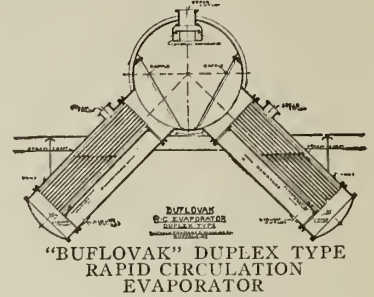
Rapid Circulation Evaporator, Inclined Type.

For concentrating and distilling (without salt separation) common solutions which have a tendency to foam or produce scale. Especially adapted for delicate or foamy liquors. Furnished in a wide range of sizes in single effect, or multiple effects, of many units. Where a large heating surface is required, each unit can be constructed with two steam chests bolted to a single vapor body, as shown in the drawing of the duplex type, which also shows the general arrangement of the vapor body, steam chest and tubes.



"BUFLOVAK" INCLINED TYPE RAPID CIRCULATION EVAPORATOR

In the rapid circulating evaporator the amount of liquor in circulation is very small and the possibility of foaming is reduced to a minimum, as the liquor level is always kept rather low and the foam is broken up in the upper part of the tube where film evaporation takes place.

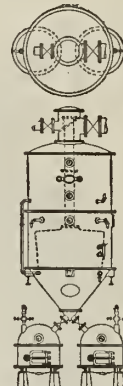


"BUFLOVAK" DUPLEX TYPE RAPID CIRCULATION EVAPORATOR

Vertical Tube Evaporator.

This type is used mainly for liquors with soluble salts which precipitate during concentration. The construction is very simple, making the apparatus easy to operate and maintain. The steam chest is of the floating type and forms a separate unit, which allows a better circulation of the steam and liquor than is possible with the old style of evaporator where the steam chest was an integral part of the body.

Built in 12 standard sizes, with heating surface running from 300 to 2440 sq. ft. The salt filters are furnished in 5 standard sizes, having a net capacity of from 300 to 5000 lbs. per charge.



Plan and Elevation



Exterior View

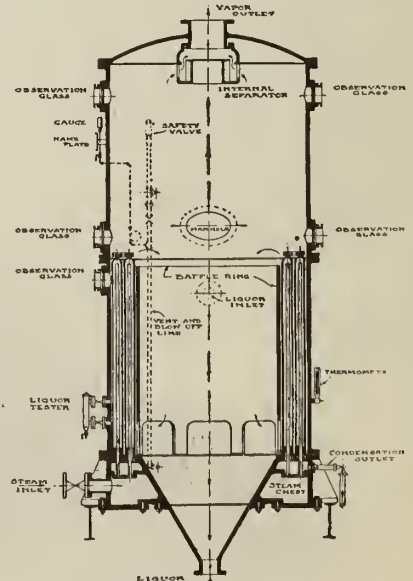
"BUFLOVAK" VERTICAL TUBE EVAPORATOR

High Concentrators.

Especially adapted to the high concentration of caustic soda, potash, ammonium nitrate and electrolytic caustic solutions above 36 Be. This evaporator produces a very rapid circulation of the liquor, and is designed for concentrating liquors to higher densities than are practicable in evaporators of standard construction.

The tubes are made of alkali resisting or acid resisting iron, copper or special bronze, depending on the nature of the liquor to be concentrated.

Furnished in single or multiple effects, with or without salt separation.



ELEVATION OF "BUFLOVAK" HIGH CONCENTRATOR

"Buflokast" Chemical Apparatus.

Only a few of the many types of "Buflokast" chemical apparatus are shown here. A partial list is given on the third page preceding. This line includes apparatus for producing heavy chemicals, acids, caustic soda and other alkalis, organic chemicals, high explosives, coal tar intermediates, etc. Apparatus furnished for all standard chemical operations, such as nitration, denitration, reduction, sulphonation, chlorination, distillation, crystallization, caustic fusion, etc.

Complete Chemical Plants.

Besides the individual pieces of chemical apparatus listed and illustrated, complete plants for the manufacture of many chemical products are also furnished. This service includes the designing, construction and initial operation (under guarantee where desired).

"Buflokast" Autoclaves.

These should not be confused with ordinary cheap autoclaves. They are designed with a view to providing a rigid construction with a large factor of safety, so as to insure a high degree of safety in operation.



"BUFLOKAST" AUTOCLAVE
With jacket and stirring device

"Buflokast" Nitrator, Standard Type.

Constructed with cooling jacket, and larger sizes provided with special closed-end cooling tubes. Jacket furnished tight or loose, as required in each case. Single or double agitating shafts.

Temperature of each cooling tube individually controlled, thereby regulating the temperature in all parts of the nitrator. Substantially constructed throughout.



"BUFLOKAST" NITRATOR, STANDARD TYPE

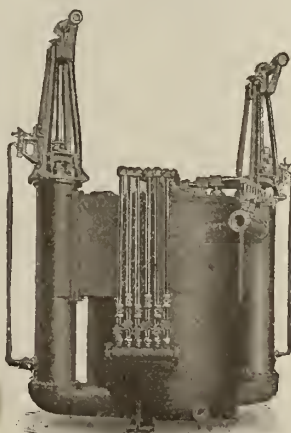
"Buflokast" Nitrator, Hough Type.

Designed in response to the demand for a nitrator combining in a self-contained, compact unit all the elements required to insure high efficiency, safe operation and large output, in manufacturing such products as trinitrotoluol (TNT), dinitrobenzol, mononitrobenzol, etc. It can be used with equal efficiency for nitrating, reducing, sulphonating, chlorinating, and other purposes in the chemical industry.

This apparatus has a capacity for output far in excess of any other type ever placed on the market, and reduces to a minimum the amount of operating labor required.

With modifications to suit the special requirements of each case, it can also be used to advantage for other purposes, especially for mixing, blending, and washing oils.

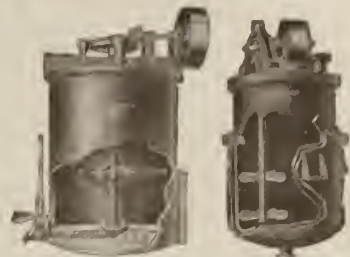
Built in small and large sizes.



"BUFLOKAST" NITRATOR, HOUGH TYPE

"Buflokast" Reducers and Sulphonators.

Furnished in a wide range of sizes, and constructed to meet the requirements of each case. Noted for their efficiency and durability. Reducers are furnished with or without jackets.



"BUFLOKAST" REDUCER

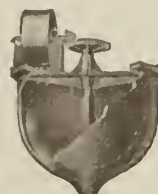
"BUFLOKAST" SULPHONATOR

"Buflokast" Caustic Pots and Fusion Kettles.

Constructed of a special composition of iron that is noted for its success in withstanding the combined action of the caustic and high temperature to which these pots are usually subjected.



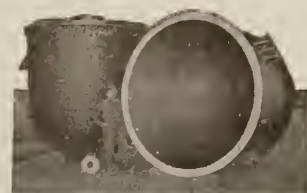
"BUFLOKAST" CAUSTIC POT



"BUFLOKAST" FUSION KETTLE

"Buflokast" Nitric Retorts.

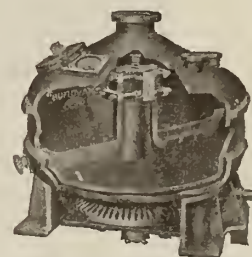
Furnished independently or in conjunction with our complete nitric plants; being used by most of the high explosive companies and other manufacturers of nitric acid. Furnished in vertical or horizontal types.



"BUFLOKAST" NITRIC ACID RETORTS

"Buflokast" Crystallizers.

Furnished in the atmospheric and vacuum types. Used for concentrating and crystallizing many products, including ammonium nitrate, TNT, and other chemicals. The atmospheric type is designed for materials that permit the use of high temperatures, and the vacuum type for more delicate materials where low temperatures are necessary.



VACUUM CRYSTALLIZER
When furnished in the atmospheric type, the dome is omitted

Special Chemical Castings.

"Buflokast" service also includes the manufacture of special castings for chemical, heat resisting and other requirements. The materials for these castings are carefully analyzed and metal compositions produced with laboratory exactness. The result is a finished casting of known quality, with physical and chemical properties suited to the conditions it is to meet.



SPECIAL JACKETED KETTLE

L. R. CHRISTIE COMPANY

Dryers, Calciners, Coolers

501 Peoples Bank Building
PITTSBURGH, PA.

NEW YORK OFFICE, 339 Hudson Terminal Building

Products.

ROTARY DRYERS, CALCINERS, ROASTERS, COOLERS.
Continuous Retorts.

Services.

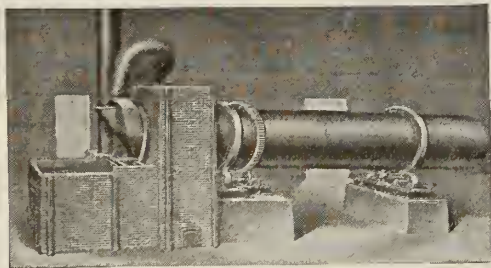
The engineers of the L. R. CHRISTIE COMPANY have, through their extensive experience in designing and operating drying and similar machinery, developed several improved types based on established principles and data and are qualified to furnish apparatus best suited to any particular requirements.

Types of Dryers.

Practically every standard type of rotary dryer is manufactured by the L. R. CHRISTIE COMPANY.

Some of the distinctive types may be briefly described as follows:

SEMIDIRECT HEAT—A flue conveying hot gases surrounded by material to be dried, all enclosed by a steel cylinder and rotating as a unit. Gases after passing



SEMIDIRECT HEAT DRYER

through flue, where most of their heat is given up, mix with material in space between flue and cylinder. A novel method of introducing gases to inner flue and applying same externally and internally at the wet end makes this machine exceptionally reliable and efficient. Unobstructed inlet for material and outlet for waste gases; small amount of brickwork. Economical and continuous in operation.

INDIRECT HEAT—An annular drying compartment made up of two cylinders rotating as a unit. The inner cylinder acts as a heat flue for the waste gases, permitting further extraction of heat. Hot gases applied externally and internally, but do not have contact with the material being dried. Supply of air to drying compart-



INDIRECT OR WASTE HEAT DRYER

ment under control and amount reduced to a minimum where necessary. Heat is applied to best advantage, permitting low exhaust temperatures and resultant economies.

DIRECT HEAT—A rotating cylinder with furnace at feed or discharge end, depending on character of material being dried. Hot gases applied directly to material. High temperature of material may be obtained in this type. Simple in construction, but not as economical of fuel as the semidirect type.

STEAM HEATED—Internal coil, jacketed or independent air heater as best suited to requirements. Used where low temperatures are necessary to prevent injury to material. Sometimes combined with cooler to great advantage.



DRYER USING INDIRECT STEAM HEAT

Calciners and Roasters.

A rotary cylinder lined with refractory brick, capable of heating materials to high temperatures, so as to drive off combined moisture, burn out foreign matter, or cause chemical reactions.

Coolers.

Rotary cylinders for cascading material to be cooled through a current of air. Used for cooling materials after being dried, calcined or otherwise heat treated.

Frequently the heat given off is used to supplement the heat used in primary apparatus.

Further Information.

More complete description of the type best suited to any requirement will be furnished upon receipt of full information as to:—

Character of material to be dried.

Capacity in dry tons of 2000 lbs. per hour.

Initial percentage of moisture.

Final percentage of moisture.

Is moisture free or combined?

If combined, at what temperature is it driven off.

Temperature which material will stand without injury.

Fineness (mesh) of materials.
Are materials injured by direct contact with furnace gases?

Is waste heat available?

Temperature. Quantity.

Fuel to be used: coal, oil, gas or waste heat.

Any additional information.

DAHLSTROM METALLIC DOOR COMPANY

CABLE ADDRESS:
"DAHLSTROM JAMEST"

71 Blackstone Avenue
JAMESTOWN, N. Y.

NEW YORK OFFICE, 130 East 15th Street

CHICAGO OFFICE, 19 South La Salle Street

BRANCH OFFICES IN ALL PRINCIPAL CITIES

Products.

FUME HOODS, RADIATOR COVERS, CEILING LIGHTS, INTERIOR FINISH for Railway Coaches and kindred products.

Fume Hoods.

A very necessary and particular part of hospitals and laboratories. Installed in such institutions as the State Laboratory, Albany, N. Y. and the Rockefeller Institute, New York City.

Railway Coaches.

The interiors of the first steel sleepers, diners, private cars and day-coaches were developed and built at the Dahlstrom plant. Our equipment for doing this class of work is unsurpassed.



TRADE MARK.

Radiator Covers.

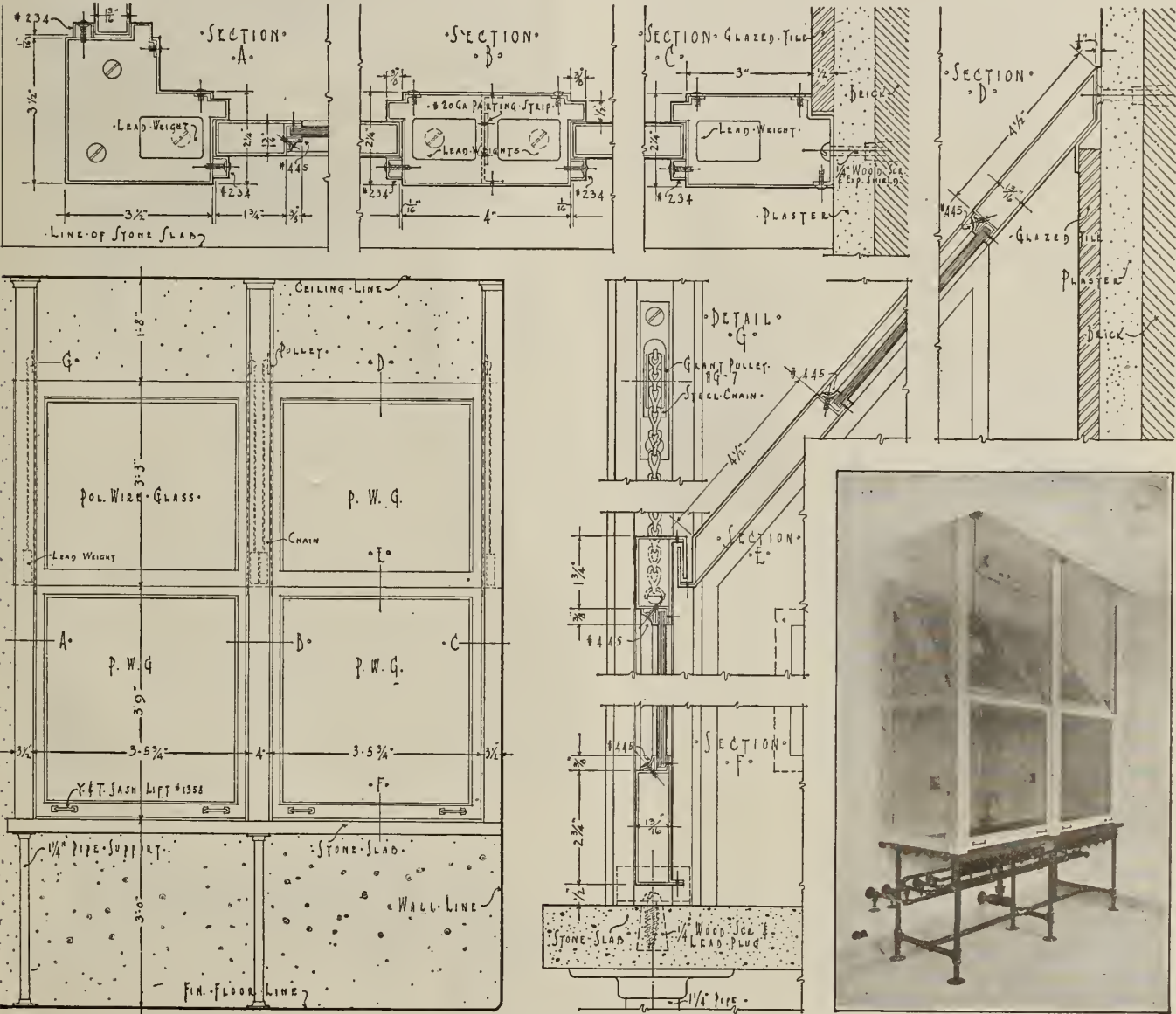
A simple but greatly desired feature of buildings, adding much to the sanitation and beauty of an office, apartment or hotel room.

Special Ornate Ceiling Lights.

The most striking of such installations is the Chester Water Side Station, Chester, Pa. These lights span practically the entire roof over 80 ft. above the floor.

Services.

The illustration below touches merely upon one article, but it may perhaps serve to illustrate the trend of the services that this Company can render the engineer.



SECTION DRAWINGS OF FUME HOOD

J. P. DEVINE CO.

Manufacturers of Apparatus for the Chemical and Allied Industries

1375 Clinton Street
BUFFALO, N. Y.

BRANCH OFFICES

NEW YORK, N. Y., 42nd Street Building

CHICAGO, ILL., C. B. ACHESON, People's Gas Building
LONDON, ENG., JAS. LIVINGSTON, LTD.

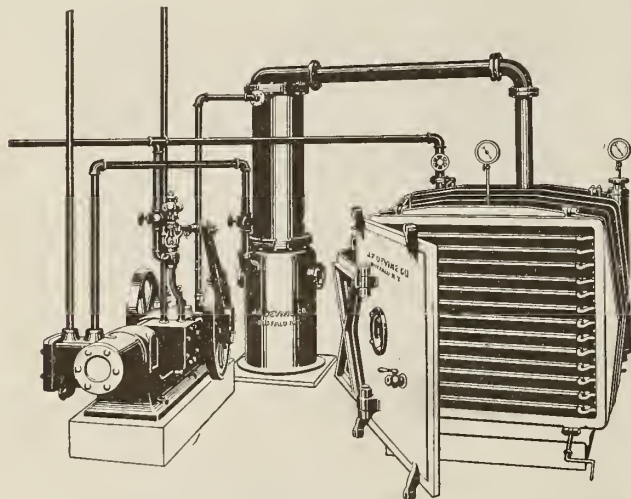
Products.

VACUUM CHAMBER DRYERS; VACUUM DRUM DRYERS; VACUUM ROTARY DRYERS; IMPREGNATING APPARATUS; NITRATING, REDUCTION, SULPHONATING and FUSION KETTLES; AUTOCLAVES; EVAPORATORS; VACUUM PUMPS; ROTARY VACUUM PUMPS.

Also, Solvent Recovery Apparatus, Acid Eggs, Acid Retorts, Beta Naphthol Stills, Caustic Pots, Columns, Crystallizing Pans, Digestors, Distilling Apparatus, Extractors, Logwood Extract Plants, Wood Distillating Plants, Sand Dryers, Fertilizer Apparatus, Steam Jacketed Pipes and Valves, Percolators, Vulcanizers, Washers, Defecators, Crystallizers, Filter Presses and other Apparatus for the Sugar Industry, Special Apparatus.

Vacuum Chamber Dryers.

This chamber dryer is designed for handling all materials that can be handled on trays or pans.



DEVINE VACUUM CHAMBER DRYER WITH SURFACE CONDENSER AND VACUUM PUMP

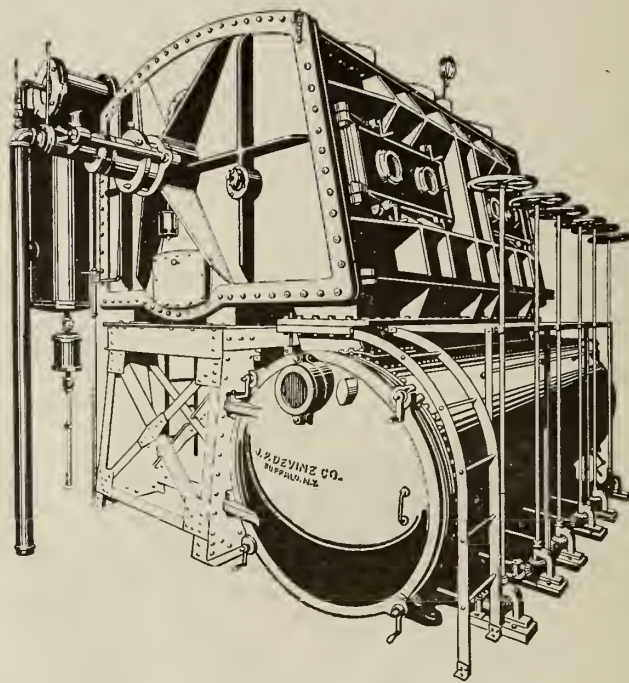
For colors, dyes, extracts, salts, rubber, smokeless powder and high explosives and other chemicals and food products. Materials which are difficult to dry in the atmosphere without decomposition can be handled rapidly and efficiently in this type of dryer without any danger of impairing their qualities. Vacuum drying chamber is designed to remove water rapidly and at a low temperature, assuring uniform drying and low operating cost.

Ask for Bulletin 101 on this subject.

Vacuum Drum Dryers.

This drum dryer is designed for handling all solutions containing solids, drying same to a powder.

For dyewood and tanning extracts, milk and food products, pastes, etc. This type of machine affords a rapid and uniform drying, because the drum takes up but a very thin film of wet material. Water is then evaporated from material, leaving dried substance on



DEVINE VACUUM DRUM DRYER

drum to be taken off by our improved method. Drying process is continuous and independent of climatic conditions, free from dust, and is uniform.

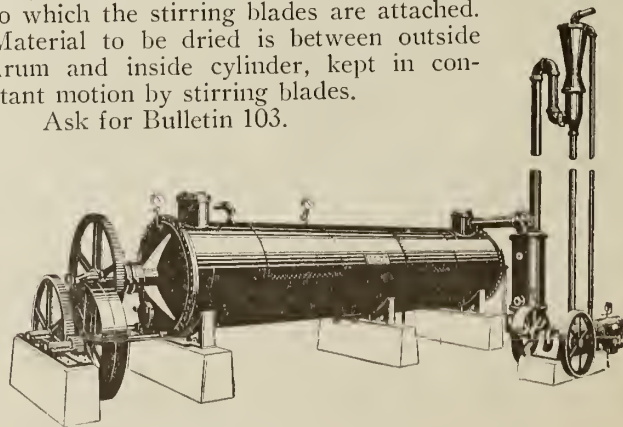
Fully described in Bulletin 102.

Vacuum Rotary Dryers.

For materials that can be mixed or tumbled in the drying.

For starch, granular substances and chemical products. Moist material is charged into dryer and by means of a high efficiency dry vacuum pump and condenser, furnished as part of the unit, a high vacuum is produced, the vapor being pulled over into the producer and condensed. Concentric with steam jacketed outside cylinder, is a revolving drum, heated by live exhaust steam, to which the stirring blades are attached. Material to be dried is between outside drum and inside cylinder, kept in constant motion by stirring blades.

Ask for Bulletin 103.



DEVINE ROTARY VACUUM DRYING APPARATUS

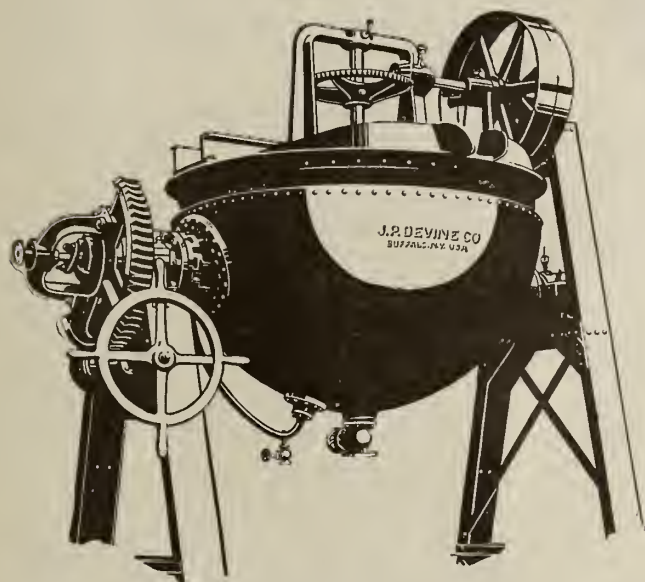
Impregnating Apparatus.

For armature, field, magnet and transformer coils, power and telephone cables, piano sharps, pencil slats and other wood products, leather fabrics, cotton or cord tire fabrics with rubber compound, etc. This is a combination vacuum drying and impregnating apparatus, the coils or material to be handled first being dried under vacuum, thereby removing both air and moisture from interior as rapidly as from surface. Compound is then drawn into impregnating tank and penetrates to innermost recesses of material; and to render this penetration more thorough, air at artificial pressure is admitted into impregnation tank above surface of compound.

Ask for Bulletin 104.

Nitrating, Reduction, Sulphonating and Fusion Kettles.

All sizes and capacities for every requirement. Built with or without stirring device, and supplied with or without reflux condensers. Also arranged for heating with fuel oil, gas, steam or water jacketed.



DEVINE CHEMICAL KETTLE

Nitrating kettles built with large cooling surface, powerful stirring device. Reduction kettles, combination rake stirring device, internal renewable cast iron slabs.

Ask for Bulletin 105A.

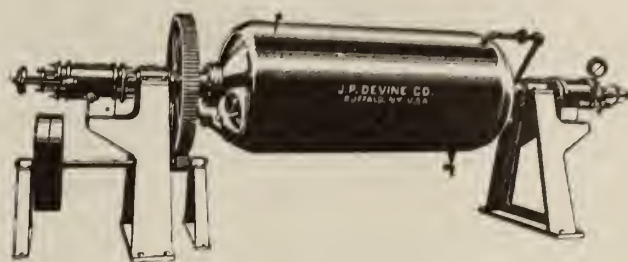
Autoclaves.

Sizes range from 1/4-gal. to 300-gal. capacities; for working pressures up to 1000 lbs. per sq. in., with or without stirring device. High pressure autoclaves are made of cast steel, and low pressure autoclaves of cast iron, copper or bronze. Provision made for heating. Every autoclave is fitted with cover with all necessary openings, pressure gage, safety valve, thermometer tube, etc.

Carbonators.

The rotary carbonator is constructed of sheet steel with all joints welded, and it is designed to work satisfactorily both under high pressure and high vacuum. Hollow trunnions permit steam, air, or gas being introduced or removed from the interior.

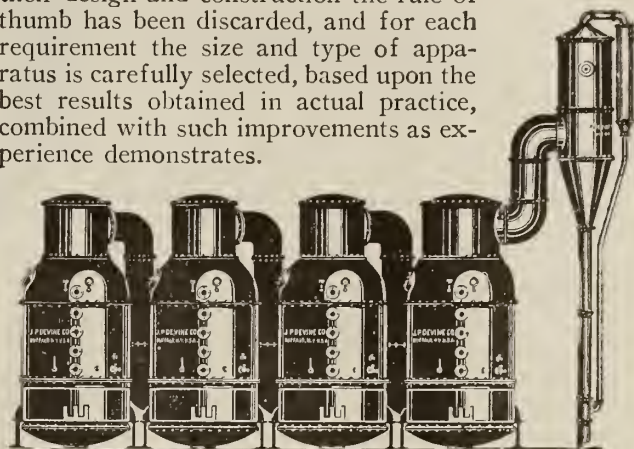
This apparatus is very versatile and can be adapted to five distinct operations: mixing, concentrating, drying, grinding and carbonating.



DEVINE ROTARY CARBONATORS

Evaporators.

Single and multiple effect units of all sizes and capacities of cast iron, sheet steel, copper, etc. These vacuum evaporators and pans are designed to insure maximum efficiency at a minimum cost of operation. In their design and construction the rule of thumb has been discarded, and for each requirement the size and type of apparatus is carefully selected, based upon the best results obtained in actual practice, combined with such improvements as experience demonstrates.



DEVINE QUADRUPLE EFFECT VACUUM EVAPORATOR

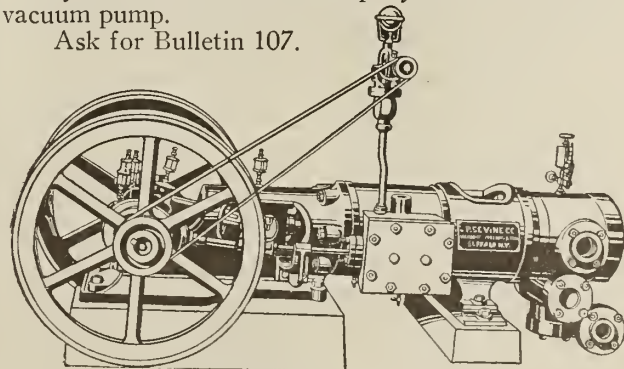
In the construction of Devine evaporators great stress is laid on securing the most rapid and intense circulation of the liquors, as only by such a circulation can all particles of the liquid come in contact with the heating surface, thus securing the quickest concentration without overheating the material. Special care is likewise given to metal of which the heating tubes are to be constructed, as well as to the lining, to resist acids and to prevent incrustation.

Ask for Bulletin 106.

Vacuum Pumps.

The vacuum pumps which are furnished with the vacuum apparatus, are constructed in two principal types, the dry vacuum type and the wet vacuum type. The dry vacuum type is built with either rotary valve or slide valve, and also in single- or two-phase. The rotary valve type is recommended where large capacity of air is required. The wet vacuum pump is furnished with jet condenser. This company also builds a rotary vacuum pump.

Ask for Bulletin 107.



DEVINE VACUUM PUMP

DURIRON CASTINGS COMPANY

Manufacturers of Acid Resistant Apparatus

DAYTON, OHIO

BRANCH OFFICES

NEW YORK, N. Y., 90 West Street

CHICAGO, ILL., 110 South Dearborn Street

SAN FRANCISCO, CAL., Monadnock Building

Products.

ACID RESISTANT COCKS and VALVES, PIPE and FITTINGS, RECIPROCATING and CENTRIFUGAL PUMPS, EXHAUST FANS, STEAM SIPHONS, LABORATORY UTENSILS, etc.

Apparatus for corrosive processes, including complete Nitric Acid Units, Jacketed Kettles, Pots, Stills, Condensers, Towers, Concentrators, Tanks, Jets, Manifolds, Stirrers, Acid Lifts, and special castings as ordered.

Field of Service.

Duriron withstands the action of nearly all corrosive liquors and gases. Since corrosion is met with in every industry, Duriron apparatus is not restricted to the chemical industries, but is universal in service. A consideration of its physical as well as its chemical properties will show its advantages—and new uses are being developed constantly.

Properties.

Duriron is a hard cast metal—an alloy with practically all the acid and alkali resisting properties of glass. It is strong and is highly resistant to erosion as well as corrosion.

Duriron is extremely hard and close grained, and shows a white fracture. At temperatures slightly below melting point (about 2300° Fahr.) it will not soften, lose shape or oxidize.

The physical properties of Duriron are:

Specific gravity.....	7.00
Weight per cu. in.....	0.253 lbs.
Melting point.....	2300° Fahr.
Coefficient of expansion...	.00001565 per degree Fahr.
Electrical conductivity, 1/40 that of standard annealed copper	
Thermal conductivity, 10 times stoneware or quartz	
Contraction allowance in casting, $\frac{1}{16}$ in. per ft.	

Except in a few instances Duriron successfully resists all acid and alkaline solutions.

DURIRON'S RESISTIVITY TO CORROSION

1 year in 25% sulphuric acid.....	.179 of 1% loss
1 year in 25% nitric acid.....	.155 of 1% loss
1 year in 25% acetic acid.....	.015 of 1% loss
1 year in copper sulphate.....	.010 of 1% loss

Exposures of various duration of Duriron to the following solutions showed *no loss*:

Ammonia	Boric acid
Ammonium hydroxide	Picric acid
Arsenate of lead	Calcium chloride
Arsenious acid	Sodium chloride
Sulphate of alumina	Calcium carbide



Apparatus.

Owing to the difficulties both in casting technique and in finishing, Duriron is ordinarily sold as completed units of either standard or special design.

COCKS AND VALVES—Straight-way plug cocks are made in 8 sizes ranging from $\frac{3}{8}$ to 4 in.; three-way plug cocks, in 5 sizes, ranging from 1 to 4 in.

GLOBE VALVES—In 1-, 2- and 3-in. sizes; also check valves and safety valves of the same sizes.

DURIRON PIPE AND FITTINGS—Standard pipe is made in 1- to 12-in. inside diameters, joints of which are flanged, bell and spigot or compression coupling types.

A comprehensive line of standard fittings are made to provide for all usages.

PUMPS—Both centrifugal and reciprocating, in various sizes and capacities.

EXHAUST FANS—In 4-, 8- and 12-in. suction and discharge.

STEAM SIPHONS—In 4 sizes, ranging from 1- to 2½-in. suction and delivery.

LABORATORY UTENSILS—Jacketed experimental kettle of 1-gal. capacity with agitator; crucibles, cascade basins, casseroles and evaporating dishes of various sizes; sinks, traps and drains—all designed with due regard for practical convenience and enduring service.

Acid lifts to take liquids from carboys, desirable for either laboratory or general use.

SPECIAL APPARATUS—From Duriron a large variety of apparatus, used in the chemical and general industrial fields is made, including complete units for nitric acid manufacture, Hough condensers, and a general class of apparatus listed in the second paragraph under products.

Co-operative Services.

Duriron Chemical and Mechanical Engineers will assist or take complete charge of the designing of apparatus for any specific purpose, and will without obligation make recommendations relative to any problems of corrosion or erosion.

Send for Duriron sample. Give it the "acid test" in *your* acid.



MARKING STAMPED ON DURIRON SAMPLES

GRAND RAPIDS VENEER WORKS

Grand Rapids Vapor Kilns

800-1000 Front Avenue, N. W.
GRAND RAPIDS, MICH.

WESTERN BUILDERS OF GRAND RAPIDS VAPOR KILNS
SEATTLE, WASH., WESTERN VAPOR KILN CO.

BRANCH OFFICES

SEATTLE, WASH., WESTERN VAPOR KILN Co., 580 First Avenue, So.

MANCHESTER, ENGLAND, OLIVER MACHINERY Co.
ST. JOHNS, N. B., A. R. WILLIAMS MACHINERY Co.
SYDNEY, AUSTRALIA, BOORMAN & BOORMAN

Products.

Designers and manufacturers of GRAND RAPIDS VAPOR KILNS, KILN TESTING INSTRUMENTS, GRAND RAPIDS LUMBER TESTERS, LINNODEIKS (wet and dry bulb thermometers), RECORDING THERMOMETERS, PANELS and VENEERS.

Also, "Tiemann" Humidity Regulated Kilns, Forest Products Laboratory Kilns, Ebonoid Waterproofing Paint, "Kilntite" Kiln Lining, "Plastico" (plastic cement), and "Hussey" Door Carrier.

Services.

Complete engineering and contract service, consultation, designing, installation, equipment, operation and remodeling.

In Pacific coast territory, the affiliated company, the Western Vapor Kiln Co., takes complete contracts for kiln buildings, equipment, yards, etc. In other territory co-operation with local contractors is given.

Grand Rapids Vapor Process.

A cooking process which dissolves and evaporates sap coagulations (which are not elements of strength but of decay), leaving intact the fibrous structure of the wood with its essential oils and gums, thus maintaining its strength, expanding instead of contracting the lumber and making it practically independent of changes of temperature or climate.

Lumber Dry Kilns.

Made in box, single charge and progressive types. Preliminary conference on kiln layouts solicited. Partial service through architects and engineers will be rendered, or complete service, making all building plans and specifications, supplying and installing all equipment, demonstrating and training operator, all under definite guarantee as to cost and output.

Kilns designed, remodeled and equipped to meet the exacting government requirements of *airplanes, gunstocks, shipbuilding, vehicles*, etc.

Testing Instruments, Kiln Records.

Grand Rapids lumber tester for determining moisture content of lumber. Linnodeiks for determining relative humidity in kiln atmosphere by means of maximum reading wet and dry bulb thermometers. Recording thermometers, decimal rules, metric scales, etc.

Consultation solicited on kiln operations by means of submitting the operation records. A full line of kiln record blanks, recording thermometer dials and graphic charts constantly in stock. Samples on request.

Veneers and Panels.

Manufacturers (on approved list of United States Government) of waterproof plywood for army and navy airplane construction; also of a full line of foreign and domestic veneers, together with a complete line of

thin lumber, panels and heavy built up stock for furniture, desk, phonograph and piano manufacturers.

Leaflets.

Uniform loose leaf style, 4 by 10 ins. with cover, cheerfully sent on request without charge.

- | | |
|---|---|
| 13. "Why" (drying questions answered) | 63. †Efficient Kiln Methods and Locations |
| 29. Scientific Lumber Drying | 70. Kiln Drying Pine (Western) |
| 30. Cooking Lumber Dry | 71. Kiln Drying Fir, Spruce, Hemlock, Cedar |
| 31. Correct Methods of Drying | 72. †How to Prevent Lumber Drying Degradation |
| 32. Economical Arrangement of Kilns | 73. †Efficient Kiln Building Service |
| 33. Modern Lumber Drying Plant | 80A. Kiln Instruments |
| 34. Dry Kilns, Government Service | 83. Maps, Showing Vapor Kilns |
| 35. *Gov't. Spec. Drying Airplane Woods | 84. Trucks, Transfers, Lifts, etc. |
| 36. Efficient Dry Kiln Layouts | 85. †Vapor Kilns in Transportation Trades |
| 37. Costs of Kiln Drying Lumber | 86. Natco Hollow Tile for Kilns |
| 38. Lumber Drying Tests | 88. Record Booklets and Blanks |
| 60. Kiln Drying - Common Dimension | 89. Export Kilns |
| 61. Airplane Demand and Kiln Drying | *Edition exhausted |
| | †In course of preparation |

References.

- | | |
|---|---|
| FURNITURE | RAILROAD CARS |
| Berkey & Gay Furniture Co., Grand Rapids, Mich. | American Car & Fdry Co., St. Louis, Mo. |
| Imperial Furniture Co., Kroehler Mfg. Co., 5 plants | Haskell & Barker Car Co., Michigan City, Ind. |
| Crocker Chair Co., Sheboygan, Wis. | Pressed Steel Car Co., 2 plants |
| Breece Manufacturing Co., Portsmouth, Ohio | Canadian Car & Fdry Co., 2 plants |
| AIRPLANES | Eastern Car & Fdry Co., New Glasgow, N. S. |
| Standard Aero Corp., Plainfield, N. J. | MUSICAL INSTRUMENTS |
| Thomas-Morse Corp., Ithaca, N. Y. | Sohmer & Co., Astoria, N. Y. |
| U. S. A., McCooks Field, Dayton, Ohio | Baldwin & Co., 2 plants |
| SAWMILLS | Lyon & Healy, Chicago, Ill. |
| Shevlin-Hixon Lumber Co., Bend, Ore. | Heintzman & Co., Toronto |
| Booth-Kelly Lumber Co., 3 plants | Simplex Player Action Co., Worcester, Mass. |
| Bloedell-Donovan Mills, Bellingham, Wash. | Adler Manufacturing Co., Louisville, Ky. |
| Miller-Link Lumber Co., Orange, Tex. | AUTOMOBILE BODIES |
| Meadow River Lumber Co., Rainelle, W. Va. | Packard Fisher Nash |
| MARINE | Franklin Cadillac Reo |
| Cramp Ship & Eng. Bldg. Co., Philadelphia, Pa. | Pierce - Peerless Dodge |
| Detroit Shipbuilding Co., Detroit, Mich. | Arrow |
| Toledo Shipbuilding Co., Toledo, Ohio | INTERIOR TRIM |
| American Balsa Corp., New York, N. Y. | Morgan Co., Oshkosh, Wis. |
| VEHICLES | Farley & Loetscher Mfg. Co., 2 plants |
| Republic Truck Co., Alma, Mich. | Curtis & Bros., 3 plants |
| Thornhill Wagon Co., Lynchburg, Va. | J. B. Smith & Sons, Ltd., Toronto, Can. |
| Massey-Harris Co., Toronto | GENERAL |
| Sayers & Scovill, Cincinnati, Ohio | Eastman Kodak Co., Rochester, N. Y. |
| | Remington Arms & Ammunition Co., Ilion, N. Y. |
| | Seth Thomas Clock Co., Thomaston, Conn. |
| | Michigan Maple Block Co., Petoskey, Mich. |
| | Kellogg Switchboard & Supply Co., Cassopolis, Mich. |
| | Conlon Electric Washer Co., Chicago, Ill. |

2200 installations in service

ESTABLISHED 1893

RUGGLES-COLES ENGINEERING COMPANY

Designers and Builders of Dryers for all Materials

50 Church Street
NEW YORK, N. Y.

BRANCH OFFICE, CHICAGO, ILL., 332 South Michigan Avenue
WORKS: YORK, PA.

Products and Services.

RUGGLES-COLES DRYERS—Apparatus for driving off moisture from materials by the application of heat or by absorption of the moisture by heated air.

The Engineering Department of this company will gladly consult with any person in regard to any drying problem.

Scope of Use.

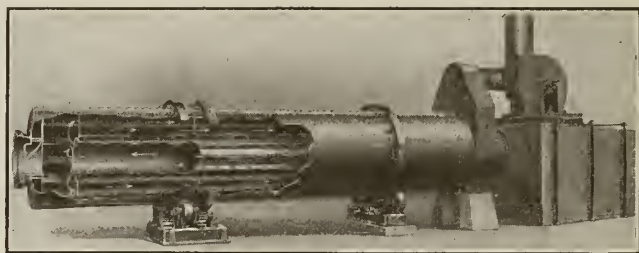
In Ruggles-Coles dryers the following materials have been successfully and economically dried:

Asbestos rock	Limestone
Bagasse	Litharge
Barium sulphate	Manganese ore
Bauxite	Marl
Bichromate of potash	Metal chips
Binder rock	Nitrate of ammonia
Carbonate of lime	Nitrate of potash
Carbonate of potash	Nitrate of soda
Carbonate of soda	Peanut hulls
Carborundum	Peat
Chalk	Phosphate, pebble
Charcoal	Phosphate rock
Chrome ore	Pineapple waste
Clays	Pitch
Clinker	Potash salts
Coal	Pumicestone
Coke	Pyrites
Concentrates	Quartz
Copper ore	Radium ore
Copra	Rock
Cork chips	Salt
Corn germs	Sand
Cotton seed	Sewage sludge
Feldspar	Shale
Fish scrap	Silica
Flue dust	Slurry
Fuller's earth	Soapstone
Glass sand	Sugar refuse
Grains	Talc rock
Graphite	Tankage
Gravel	Tobacco stems
Gypsum	Vanadium ore
Iron ore	Whiting
Kaolin	Wood chips
Leather scraps	Wood pulp
Lignite	Zinc ore

Class "A" Dryer.

This is a patented double shell, direct heat type of dryer, the gases of combustion passing directly from the furnace through the inner shell and back between the two shells in intimate contact with the material being dried.

This type of dryer is exceptionally economical in fuel consumption, using 30% to 40% less fuel for the



SECTIONAL VIEW OF RUGGLES-COLES CLASS "A" DRYER
Showing principle of operation

same capacity than any other type of dryer. It is made in 8 standard sizes.

Class "B" Dryer.

This is an indirect heat type of dryer, similar to the Class "A" machine, except that the gases, after leaving inner flue, pass through ducts attached to the inside of the outer shell, the gases not coming in contact with the material being dried. This type of machine is used for those materials which can not come in contact with furnace gases.



SECTIONAL VIEW
CLASS "B"
DRYER

Other Types of Dryers.

This company also build Class "C" type and Class "W" type, being steam dryers; and Classes "D," "E" and "EC" types, being paddle dryers. They also build roasters and coolers.

Particulars of these other different types will be sent on application.



SECTIONAL VIEW
CLASS "F"
DRYER

When Writing About Drying Problems.

To aid in the selection of proper type and size of machine, prospective purchasers are requested to send the following facts:

(1) Initial amount of moisture in material; (2) amount of moisture to remain in dried material; (3) capacity of dried material required per hour; (4) whether free or combined moisture is to be driven off; (5) to what temperature material can be heated without injuring same; (6) if furnace gases would be injurious to the material; and (7) size of material, and any other special physical or chemical characteristics.

Also, if possible, send (in a sealed container) sample of material to be dried, and it will be analyzed for moisture without charge.

STEACY-SCHMIDT MFG. CO.

Designers and Manufacturers of Sugar Machinery

Queen Street, Hay Street, Arch Street, Mill Road and Pennsylvania Railroad
YORK, PA.

CABLE ADDRESS: "BROOMELL"—Codes used: A. B. C. 5th Edition and Western Union

Products.

MACHINERY for CANE and BEET SUGAR PLANTS
and REFINERIES.
For Lime Kilns and Hydrating Plants, see page 612.

Experience.

The STEACY-SCHMIDT MFG. CO. has been building sugar machinery for over 25 years. Engineers who are specialists in this line have perfected the designs. The experience thus gained enables this company to furnish any machinery for sugar plants, beet sugar plants or sugar refineries.

Steacy-Schmidt products can be found in any of the up-to-date refineries in the United States and Cuba, or in the cane plants of the latter country and the beet plants of the former.

Service.

Co-operation with the engineer is the desire and aim of the STEACY-SCHMIDT MFG. CO. whose extended experience and technical knowledge are at all times available for consultation.

Much of the machinery has been sold in accordance with the requirements, specifications and blue prints of engineers, as well as direct to the owner.

Sugar Machinery.

Mechanical equipment to fulfil the many and varied wants of the sugar machinery trade is built at the Steacy-Schmidt shops: char dryers, char coolers, char

kilns, blow-ups, defecators, juice heaters, double, triple and quadruple effect evaporators, vacuum pans, lime tanks, retorts, coolers, jacketed, open and closed type crystallizers, etc.

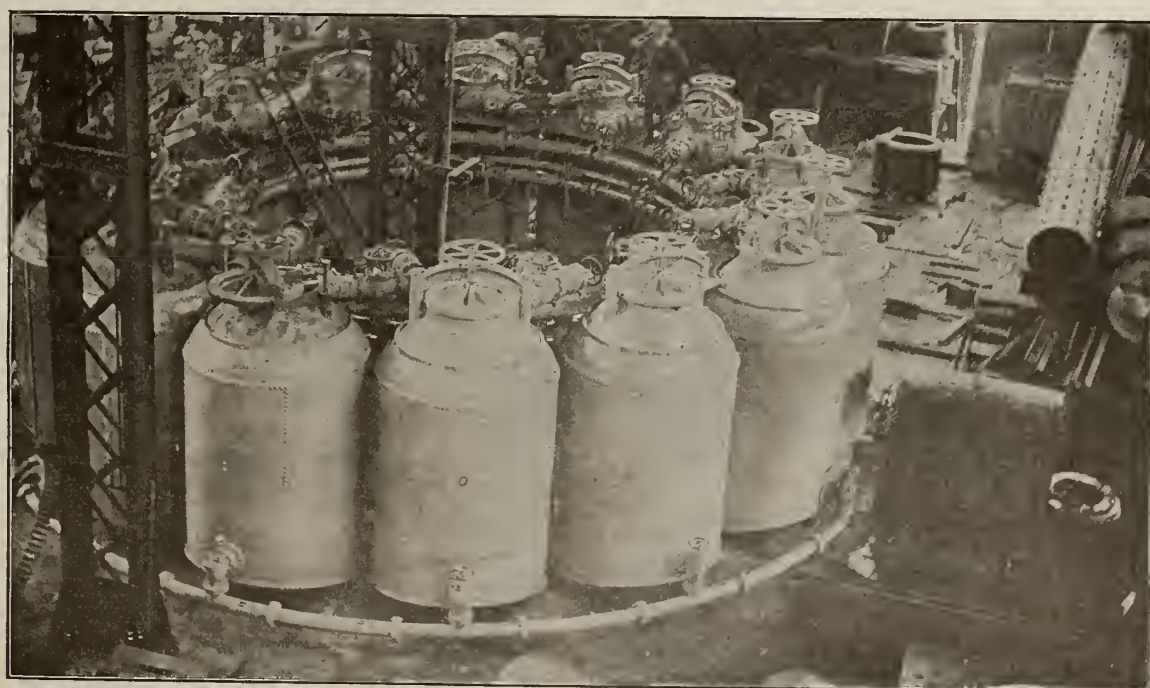
Quotations.

This company solicits the opportunity to quote on the requirements of either engineer or owner for any or all of the special machinery needed in the manufacture and refining of sugar.

References.

Following are a few of the installations of sugar machinery made by the STEACY-SCHMIDT MFG. CO.:

American Sugar Refining Co., Brooklyn, N. Y.
Arbuckle Brothers, Brooklyn, N. Y.
Atlantic Sugar Refineries, St. John, N. B.
Federal Sugar Refining Co., Yonkers, N. Y.
National Sugar Refining Co., Yonkers, N. Y.
Warner Sugar Refining Co., Edgewater, N. J.
Pennsylvania Sugar Refinery, Philadelphia, Pa.
Revere Sugar Refinery, Boston, Mass.
Cuban-American Sugar Co., Cuba
E. Antonio Vazquez, Havana, Cuba
American Beet Sugar Co., Grand Island, Nebr.
Utah-Idaho Sugar Co., Shelly, Idaho
The Dyer Co., Cleveland, Ohio
Honolulu Sugar Co., Honolulu
Honolulu Iron Works, New York, N. Y.
Joubert & Goslin Foundry & Machine Works, Birmingham, Ala.
Reserve Plantation, Louisiana
Robert Sayre Kent, Inc., Brooklyn, N. Y.
S. S. Hepworth Co., New York, N. Y.
United Filters, Brooklyn, N. Y.



STEACY-SCHMIDT 14-CELL DIFFUSION BATTERY

WHITING FOUNDRY EQUIPMENT CO.

Manufacturing Engineers and Designers

HARVEY, ILL.

BRANCH OFFICES AND SALES AGENTS

ATLANTA, GA., SEEGER MACHINE TOOL Co., 34 South Forsythe Street
BIRMINGHAM, ALA., MANUFACTURER'S SELLING AGENCY, Brown-Marx Building
BOSTON, MASS., WONHAM, BATES & GOODE, INC., 141 Milk Street
BUFFALO, N. Y., GEO. F. CRIVEL & Co., 430 Ellicott Square
CHICAGO, ILL., WHITING FOUNDRY EQUIPMENT Co., (Branch Office) 1245 Marquette Building
CLEVELAND, OHIO, WHITING FOUNDRY EQUIPMENT Co., (Branch Office) Leader-News Building
DENVER, COLO., S. G. ELBE, 211 Tramway Building
DETROIT, MICH., WHITING FOUNDRY EQUIPMENT Co., (Branch Office) 570 Penobscot Building
LOS ANGELES, CAL., ECCLES & SMITH Co., 241 South Los Angeles Street
MONTREAL, QUE., DOMINION FOUNDRY SUPPLY Co., 183 Wellington Street
NEW ORLEANS, LA., J. S. BARELLI, 612 Godchaux Building

NEW YORK, N. Y., WONHAM, BATES & GOODE, INC., 17 Battery Place
PHILADELPHIA, PA., S. R. VANDERBECK, 20 South 15th Street
PITTSBURGH, PA., WHITING FOUNDRY EQUIPMENT Co., (Branch Office) Fulton Building
PORTLAND, ORE., ECCLES & SMITH Co., 46 Front Street
ST. PAUL, MINN., ROBINSON CARY & SANDS Co., Fourth and Wacouta Streets
SAN FRANCISCO, CAL., ECCLES & SMITH Co., 71 First Street
SALT LAKE CITY, UTAH, F. E. ARNOLD, 706 Kearns Building
SEATTLE, WASH., W. R. HENDREY & Co., Hoge Building
SPOKANE, WASH., UNITED SUPPLY Co., Box 2173
TORONTO, ONT., DOMINION FOUNDRY SUPPLY Co., Spadina and Richmond Streets
VANCOUVER, B. C., B. C. EQUIPMENT Co., 602 Hastings Street, West
WASHINGTON, D. C., H. A. GILLIS, 210 Riggs Building
WINNIPEG, MAN., CANADIAN RAILWAY EQUIPMENT Co., McIntyre Block

Products and Services.

We design, equip and start into operation complete FOUNDRY PLANTS for manufacturing any class of castings: Grey Iron, Brass, Car Wheel, Pipe, Steel (Converter) and Malleable Iron.

FOUNDRY EQUIPMENT: Cupolas; Cupola Charging Machines; Tumbling Barrels; Dust Arresters; Water Cinder Mills; all types Ladles; Core Ovens; Core Oven Cars; Core Oven Car Pullers; Converters; Brass and Malleable Iron Furnaces; Annealing Ovens; Cars and Trucks; Charging Cars; Turntables; Trolleys; Overhead Tramrail Systems; Air Hoists; Air and Hydraulic Elevators; Gate Hoists; Casting Breakers; Drop Test Machines; Cupola, Brass Furnace and Converter Linings.

RAILWAY EQUIPMENT—Screw Jack Locomotive Hoists; Screw Jack Coach Hoists; Transfer Tables; Turntable Tractors; Car Wheel Foundry Equipment.

Special Machinery: Gate Hoists, Spout Hoists for Ore Docks, Phosphate Dryers, etc.

For Cranes of various types, see page 882.

Whiting Cupola.

Strong and durable. Patented tuyere system gives most efficient distribution of blast. Produces hot, fluid iron. Over 3500 sold. Special design for continuous melting.

DATA, CUPOLAS

No.	Capacity per hour, tons	Diam. of shell, in.	Diam. inside lining, in.
0	1/4 to 1/2	27	18
1	1/2 to 1	32	23
2	1 to 2	36	27
2 1/2 A	1 to 2	41	27
2 1/2 B	3 to 5	41	32
3	3 to 5	46	32
3 1/2	5 to 6	51	37
4	6 to 7	56	42
5	7 to 9	63	45
6	9 to 10	66	48
7	10 to 12	72	54
8	12 to 14	78	60
9	14 to 18	84	66
9 1/2	18 to 21	90	72
10	21 to 24	96	78
11	24 to 27	102	84
12	27 to 30	108	87



STANDARD CUPOLA

Tumblers.

CLASS A—Round, steel plate barrel arranged for exhaust. Low standards permit loading from either side. All parts extra heavy and durable; removable trunnions. Designed for heavy duty.



CLASS "A" TUMBLER

Belt or direct motor drive.

CLASS B—Square barrel, extra heavy steel plate reinforced by angles. For stove plate and frail work. Arranged for exhaust.

CLASS C—Round barrel with removable cast iron staves. Not suitable for exhaust.

SPECIAL—Wet or dry, for brass and light work.

DATA, TUMBLERS—CLASSES A, B AND C

Diam., in., classes A, and C; square for B	L'gth, in.	Approximate floor space including pulley			Size of pulley, in.		Belt	Speed of pulley, r. p. m.
		A	B	C	A and C	B		
24	36	3' 6" x 7' 0"	4' 5" x 7' 6"	3' 6" x 6' 9"	18x3 1/2	20x4 1/2	Single	150
24	48	3' 6" x 8' 0"	4' 5" x 8' 6"	3' 6" x 7' 9"	18x3 1/2	20x4 1/2	Single	150
30	36	4' 5" x 7' 6"	5' 1" x 9' 0"	4' 5" x 8' 0"	20x4 1/2	20x5 1/2	Single	150
30	48	4' 5" x 8' 6"	5' 1" x 9' 0"	4' 5" x 8' 0"	20x4 1/2	20x5 1/2	Single	150
30	60	5' 1" x 10' 0"	5' 1" x 10' 0"	5' 1" x 9' 0"	20x5 1/2	24x5 1/2	Single	150
36	48	5' 1" x 9' 0"	6' 3" x 9' 7"	5' 1" x 8' 3"	20x5 1/2	24x5 1/2	Single	150
36	60	5' 1" x 10' 0"	6' 3" x 10' 7"	5' 1" x 9' 3"	20x5 1/2	24x5 1/2	Single	150
36	72	5' 1" x 11' 0"	6' 3" x 11' 0"	5' 1" x 10' 3"	20x5 1/2	24x5 1/2	Single	150
42	48	6' 3" x 9' 7"	6' 3" x 9' 7"	6' 3" x 8' 9"	24x5 1/2	30x6 1/2	Double	150
42	60	6' 3" x 10' 7"	7' 3" x 10' 3"	6' 3" x 9' 9"	24x5 1/2	30x6 1/2	Double	150
42	72	6' 3" x 11' 7"	7' 3" x 11' 3"	6' 3" x 10' 9"	24x5 1/2	30x6 1/2	Double	150
48	60	6' 6" x 10' 7"	6' 6" x 10' 7"	6' 6" x 9' 9"	30x6 1/2	30x6 1/2	Double	150
48	72	6' 6" x 11' 7"	6' 6" x 11' 7"	6' 6" x 10' 9"	30x6 1/2	30x6 1/2	Double	150
60	60	7' 3" x 10' 3"	7' 3" x 10' 3"	7' 3" x 9' 9"	32x6 1/2	32x6 1/2	Double	120
60	72	7' 3" x 11' 3"	7' 3" x 11' 3"	7' 3" x 10' 9"	32x6 1/2	32x6 1/2	Double	120

*On class B tumblers double belt is used on all sizes 36 in. square or larger

Dust Arrester.

A necessity for use with tumblers, sand blast equipment and grinders. Made in various sizes.

Core Ovens.

DRAWER TYPE—Drawers have rigid, braced frame, supported on three flanged wheels with roller bearings. Drawers may be pulled separately or together as desired.

CAR TYPE—Arrangement of flues, dampers, etc., insures uniform heating and highest fuel efficiency. Give size required (width, length and height), number of shelves and location.

STANDARD ARRANGEMENT OF DRAWER OVEN FRONTS OR SECTIONS

Number of drawer		5	5	5	5	5	5	5	5	5	5	4	4	4	3	3	3
Height of drawer in clear, in.	5th.....	4	4	5	6	7	7	8	6	14	5	11		9			
	4th.....	4	5	5	6	7	7	8	8	8	5	6	8	11			
	3rd.....	4	5	5	8	7	7	8	12	8	5	8	10	11	7	12	11
	2nd.....	5	5	8	12	9	10	8	5	8	5	12	10	15	14	12	11
	1st or bottom.....	15	13	10	16	9	10	9	5	10	11	5	16	18	20	12	11
Approximate total height from floor to bottom of top drawer, in.		71	71	71	85	75	77	76	73	77	69	63	72	74	73	63	51

Special arrangement of drawers at additional price.

Ladles.

CRANE LADLES — Shell plates, tank steel; bottom, best flange steel. Unless specified, open gearing supplied. Capacities up to 30 tons. Cast steel trunnions.

CRANE TRUCK LADLES—Geared, in capacities from 1 to 6 tons; plain, from 1000 to 3000 lbs.

STANDARD TRUCK LADLES —Plain and geared in capacities 1000 to 3000 lbs.; heavy type, geared, from 4000 to 8000 lbs. capacity.

SHANK LADLES—Capacities 100 to 3000 lbs.
HAND LADLES—Capacities 30 to 60 lbs.
Also bottom tap, teapot spout, car wheel and reservoir ladles.

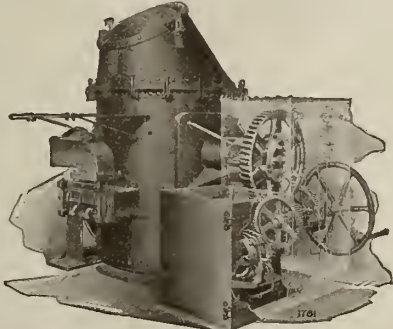


CRANE LADLE

Whiting Converter.

Recommended for light castings from intricate patterns, requiring hot fluid metal, also for ordinary grades of steel castings of medium weight. Castings of 2 tons or more can be poured by accumulating several heats. Adapted for special mixtures. Heats may be taken daily or intermittently as desired.

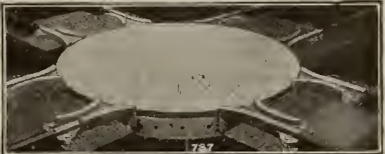
Two sizes: 1 and 2 tons capacity.



CONVERTER 1

Turntables.

Rigid, self-contained construction. No tipping, no getting out of line, no journal friction. Entire load carried on chilled rollers, held rigidly apart by spacing frame. Flat top standard. Furnished also with track rail cast on top or with grooves for wheel flanges, to suit any gauge.



STANDARD TURNTABLE

Air Hoists.

For hoists 3 1/4 to 6 in. diameter, cylinders are seamless, drawn brass tubing, polished inside. Standard parts carried in stock. Hoists 7 to 24 in. are cast iron, carefully moulded and accurately bored and reamed. Heads in 2 pieces. Valve is disk type of improved design. Stem does not pass through air chamber, eliminating leakage. Automatic cut-off.

HORIZONTAL HOISTS—For locations where headroom is insufficient for vertical hoists or where more easily supported.



AIR HOIST

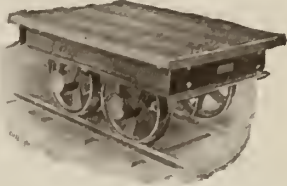
Cars and Trucks.

For severe service in foundry, shop or yard. Heavy steel frames; full line of core oven cars and trucks, with and without shelves; chilled wheels, roller bearings.

DATA. STANDARD TRUCKS

No.	Capacity, tons	Gauge, in.	Platform		Diam. of wheels, in.
			Wide	Long	
2	2	18 to 24	3'-0"	4'-0"	16
3	3	18 to 24	3'-0"	4'-0"	16
5	5	18 to 24	3'-0"	4'-0"	18
12	2	24 to 30	3'-6"	5'-0"	16
13	3	24 to 30	3'-6"	5'-0"	16
15	5	24 to 30	3'-6"	5'-0"	18
140	10	30 to 36	4'-6"	6'-0"	20
141	10	56 1/2	6'-0"	8'-0"	20

Special sizes made to order.



STANDARD SHOP TRUCK 1

Elevators.

For 1-story lifts only. Designed specially for foundry service in lifting charges to charging floor. Compressed air and hydro-pneumatic.

Overhead Tramrail Systems.

Consist of standard I-beams suspended from roof beams or trusses by hangers. Curves, switches or turntables introduced as required. Extensions readily made. Save time, floor space and labor in handling light loads.

Furnaces.

BRASS—For use with natural or forced draft. Base fitted with removable ash pit door, which is closed tight for forced draft. Light steel plate cover supplied if desired. Standard furnaces designed for 3-in. lining.

Complete outfits for brass foundries a specialty.
MALLEABLE FURNACES; ANNEALING OVENS—Complete outfits for making malleable castings. Practical outfits.

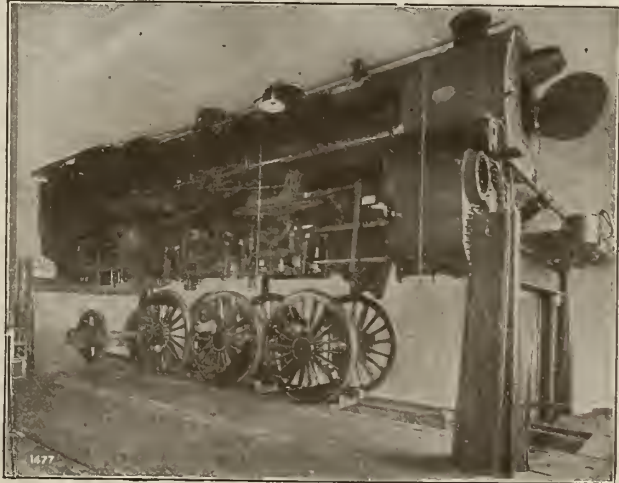
Railway Equipment.

LOCOMOTIVE HOIST—For unwheeling and wheeling any size locomotive. Special six-jack design for handling mallet compounds. Can be installed in any shop or yard at fraction of cost of high capacity traveling crane. Absolutely safe; wheels remain at floor level in all operations. Big time and labor saver.

COACH HOIST—For removing trucks from passenger coaches and interurban street cars with speed and safety. Car or coach kept level while raising or lowering.

TRANSFER TABLES—For locomotives or coaches. Designed for shallow pit. Practically any capacity, length or speed.

TURNTABLE TRACTOR—New design of simple, rugged construction for turntables of any capacity and pit rail radius.



FOUR-JACK LOCOMOTIVE HOIST

THE INTERNATIONAL TIME RECORDING COMPANY OF NEW YORK

GENERAL OFFICES

50 Broad Street

NEW YORK, N. Y.

WORKS: ENDICOTT, N. Y.

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Products.

SYNCHRONIZED TIME SYSTEMS.
IMPULSE TIME SYSTEMS.
MASTER CLOCKS.
SECONDARY CLOCKS.
PROGRAM DEVICES.
TIME RECORDERS: Card, Dial and Autograph.
COST RECORDERS.
TIME STAMPS.
RECORDING DOOR LOCKS.

International Service.

This company will furnish, without cost, specifications, layouts of conduit, wiring diagrams and estimates covering installations of electric clock systems, upon receipt of necessary information, plans, etc.

Special designs or styles to suit architects' specifications can be secured in any model of International time systems and time recording devices.

The company will contract for installing its products where necessary; but the apparatus is so simple and substantial, that the average electrical contractor can install to the company's specifications and render perfect satisfaction.

Experience, Reputation and Quality of Products.

THE INTERNATIONAL TIME RECORDING COMPANY OF NEW YORK is the largest manufacturer in the world of time systems, time and cost recording equipment and allied products.

Its thoroughly equipped plant is the largest devoted to the manufacture of the above products and is the impressive result of 32 years' consistent advancement, reflecting in every department the efficient operating policies represented by International products.

The large force of skilled and experienced engineers and mechanics build into International products a degree of mechanical reliability and an appreciation of high manufacturing ideals, which is the finest and surest guarantee of satisfaction to the user.

International products are designed with utmost care by specialists; they embody the best materials and are scrupulously and repeatedly inspected and tested. They measure up in the minutest detail to the standards of accuracy, simplicity and durability upon which the dominance of International products has been built.

They are backed up by a field service of competent men to look after them.

Synchronized Time Systems.

For 25 years there has been nothing basically new in electric time system construction, nor have any great improvements been made in connection therewith.

In the past, minute impulse systems were erroneously termed "synchronized time systems."

A distinctive disadvantage of the impulse system was that, if the electric current was shut off, all secondary units in the system stopped (as they were not complete units in themselves, depending upon electrical impulses from the master clock), and when the current was again applied, secondary clocks and other devices were not in synchronism.

Synchronism was thus not fully maintained in the past by impulse systems, and THE INTERNATIONAL TIME RECORDING COMPANY OF NEW YORK, recognizing the disadvantages of such systems, developed and placed upon the market a new method which gives synchronism its full meaning and value for the first time.

The elements that have proved troublesome in impulse electric time systems have thus been eliminated.

DISTINCTIVE FEATURES OF THE NEW INTERNATIONAL SYNCHRONIZED TIME SYSTEM—In the new International system, should the electric current be cut off for any reason, especially over week-ends and holidays, all units in the system (being independent and self-winding) will continue operation. When the current is again applied, the secondary clocks and all other devices become synchronous with the master clock, thus accurate time is assured throughout the entire system and all battery troubles are eliminated.

This system will operate with equal accuracy and satisfaction on 110 and 220 volts A.C., 25 to 60 cycles or 110 to 220 volts D.C. The electric current consumed is so remarkably small that the expense is negligible.

The new International time equipment is operated by a 2-wire system from master clock to all units, and all units are electrically wound each day by the current wires from the nearest electric incandescent light or wall plug. Each separate unit is wound daily by its own electric motor, thus all key or manual winding is eliminated.

All units in the system will run 7 days without electric current.

Interruption of current can not harm or upset accurate operation of the system.

Any unit may be removed from the system and run independently with satisfactory results, as each unit is equipped with a reliable *marine clock movement* which will run in any position. There are no pendulums except in the master clock.

Each unit is self-corrective when added to the system and becomes synchronous with the master clock at the next synchronizing period, which is every hour.

No auxiliary apparatus, such as batteries, rectifier, pilot clocks, stepping keys, etc., is required.

The International system is a decided improvement over the impulse system employing minute jumpers as secondaries. International secondaries are complete clocks, not dependent upon a master clock for operation; but each secondary is synchronized every hour with the master clock, so that there is absolute unison with the International system. The lasting qualities of all contacts is thus 60 times greater than on the impulse system, because in the International synchronized system there is one contact an hour instead of one each minute, or 24 a day instead of 1440.

International synchronized time systems provide efficient time service at the lowest possible cost of upkeep and they do not require periodical inspection and attention as is essential in a battery system.

COMPONENT PARTS OF THE SYSTEM—The units comprising a typical International synchronized time system are a master clock, secondary clocks, program devices, time recorders, cost recorders, time stamps, relays, bells, gongs and whistles.

Master Clock—International master clocks are self-winding and control any number

of secondary clocks, program devices, time recorders, cost recorders and time stamps, bringing the entire system into synchronism.

Escapement is Graham dead beat, all parts are highly polished, pinions are of cut steel carefully hardened and burnished, pendulums have wooden rods with metal bob or mercurial compensation as desired, and circuit closers are platinum tipped.

Dials, hands and cases are standard in numerous styles, but can be varied to suit special requirements.

Secondary Clocks—These clocks are controlled by means of the master clock every hour and all clocks throughout the building are in exact synchronism with the master clock.

These units are complete clocks within themselves and will continue to keep time should the master clock be stopped for cleaning or any other purpose. They do not require regulation, winding, setting, etc.; are not affected by temperature changes or vibrations; are dust-proof, and their construction eliminates expensive cost of upkeep.

Secondary movement is of the highest refined special marine type.

These clocks can be located in places best suited for observation with reference to accessibility.

Any number of secondary clocks can be operated



Octagonal Case

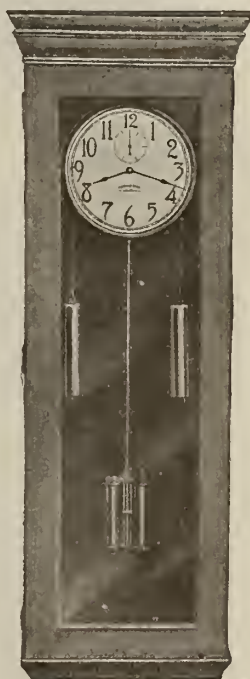


Round Case



Square Case

INTERNATIONAL SECONDARY CLOCKS



INTERNATIONAL MASTER CLOCK

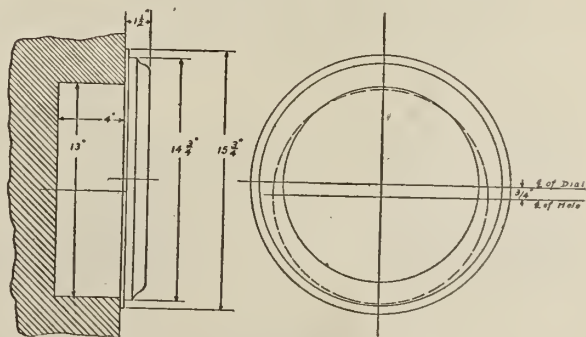


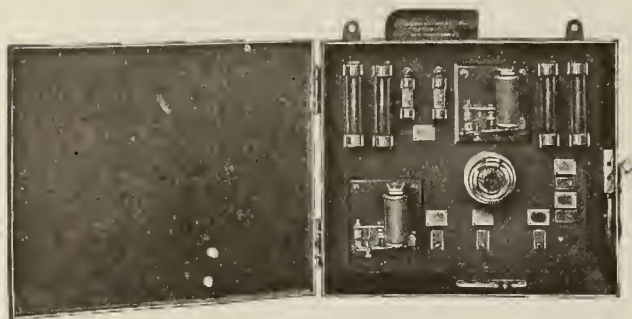
DIAGRAM SHOWING HOW SECONDARY CLOCKS ARE MOUNTED IN WALL

from one master clock regardless of the distance between master clock and outlying stations.

Dials, hands and cases are standard in a number of styles, but can be varied to suit requirements.

Relays—International relays are used to open and close local circuits and insure uniform current throughout the system.

Relay cabinets are furnished as illustrated.



INTERNATIONAL RELAY CABINET

METHOD OF WIRING—Method of wiring is in accordance with Class C, National Code, which is generally known and understood by the average electrical contractor.

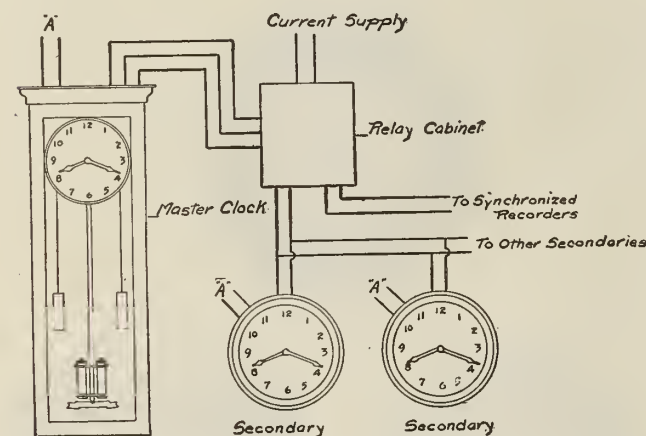


DIAGRAM SHOWING VARIOUS DEVICES OF THE NEW INTERNATIONAL SYNCHRONIZED TIME SYSTEM

Taps "A" connect to nearest electric light wires (for winding motor)

objection, thus silent and efficient time service is assured.

POWER REQUIRED—The International impulse system is provided with a storage battery of the proper size for the successful operation of the system. The International impulse system can be equipped with an automatic charging device, which minimizes the misuse of the battery system by inexperienced or careless operators.

Program Devices.

International program devices are used to automatically control a series of signals such as bells, gongs or whistles, or the operation of other devices according to a predetermined schedule.

They are actuated by the master clock and will ring a regular program in any 12-hour period at minute or longer intervals, and will automatically change to another program during a selected 12-hour period. They will also eliminate the programs for any given hour or day of the week.

Changes in programs or schedules can be quickly and easily effected without interfering with the mechanism of the program devices and without the use of special tools.

Duration of signals can be changed over a very wide range to meet all requirements.

Made in 2-, 4-, 6- and 8-circuit sizes, each circuit controlling a group of bells, gongs or whistles that are operated or sounded in unison.



INTERNATIONAL PROGRAM DEVICE

Impulse Time Systems.

In these systems, the controlling and operating energy is drawn from storage batteries or from commercial current.

The system is operated by a master clock, which is self-winding and controls any number of secondary clocks, program devices, time recorders, cost recorders, time stamps, bells, gongs and whistles.

The master clock actuates the secondary clocks and other devices by minute and half-minute electrical impulses.

POLARIZED SECONDARY CLOCKS—These clocks are not complete clocks within themselves, but their operation depends on minute or half-minute electrical impulses transmitted by the master clock.

They have a decided advantage over ordinary secondary clocks in that their peculiar construction renders their operation noiseless. In ordinary secondary clocks, the minute hand, upon receiving an impulse from the master clocks, gives a decided "click." The polarized secondary clock is so designed that it overcomes this

Time Recorders.

International time recorders give elastic systems of time recording and are popular because of their flexibility and accuracy.

They are manufactured in many different styles and sizes, in either spring driven or electric models.

All have the same basic mechanism, but additional features make them applicable to any possible requirement.

Such features as automatic in-and-out, automatic day-to-day and automatic 2-color ribbon shift are embodied in International time recorders.

Standard cases or cabinets are made from first quality kiln dried quartered oak. Special woods and finishes furnished when specified.

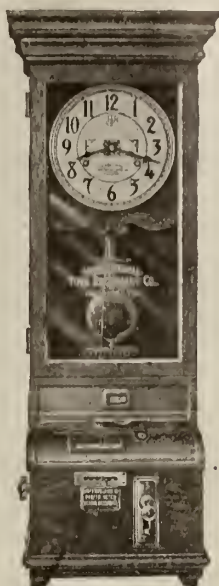
These recorders may be provided for use with the International synchronized time system or with the impulse system.

CARD TIME RECORDERS—These recorders are made in many styles, and are adaptable to any business and will meet all requirements.

They provide individual time card records for daily, weekly, bi-weekly or semi-monthly, and monthly pay periods.



Electric Drive



Spring Drive

INTERNATIONAL CARD TIME RECORDERS

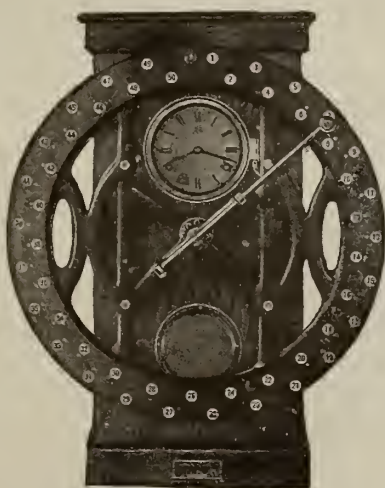
AUTOGRAPH TIME RECORDERS—These recorders are specially adapted for places where arrival and departure of employees are irregular.

When registering time of arrival or departure, each employee is required to affix his signature in the place provided; thus it positively identifies the person who makes the record.

DIAL TIME RECORDERS—Registers time on daily or weekly sheet form and renders a printed pay roll complete. Made in electric or spring driven models, in 50-, 100- and 150-capacity sizes, and in automatic and non-automatic types.



INTERNATIONAL AUTO-GRAPH TIME RECORDER WITH CASE OPEN



INTERNATIONAL DIAL TIME RECORDER

Cost Recorders.

Specially adapted for recording the time spent on jobs; the time machines are in operation; the time spent on assembly, and numerous factors of a similar nature essential to reliable cost accounting.

The International cost recorder is the highest type of cost recording device made and is equipped with an automatic feature which eliminates from cost records all non-working hours, thus they reduce to the minimum the labor necessary in computing time records into a dollar-and-cents record of the job.

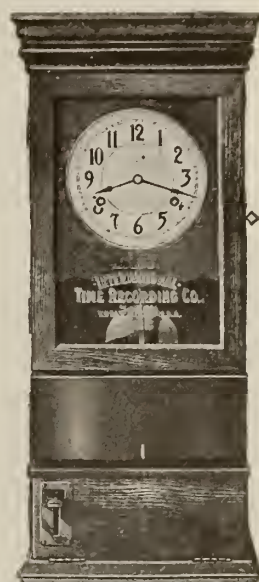
They furnish a printed record in one or two colors of time on a card of any size, form, width or thickness. They are equipped to print records in periods, hours and minutes, or in tenths and hundredths of hours, recording the stopping time above the starting time; thus a simple method of subtraction is provided.

These recorders are so flexible that they are adapted to any cost accounting system.

Made in electric and spring driven models.



Electric Drive with Spacing Device



Spring Drive

INTERNATIONAL COST RECORDERS

Time Stamps.

International time stamps are in extensive use for registering time and date of receipt of letters, telegrams, cards, correspondence, messages, and all other papers passing through offices, hotels, garages, shops, freight offices and many other places where they have been found indispensable for this purpose.

The printed impression of the International time stamp shows the hour, fractions of the hour, also the month, the day and the year. Time may be shown in hours, minutes, and tenths or hundredths of the hour.



Electric Drive



Model A Spring Drive

INTERNATIONAL TIME STAMPS

International electrically operated time stamps eliminate the objections of derangement of mechanism and incorrect time, as they have no delicate parts to be injured by severe service.

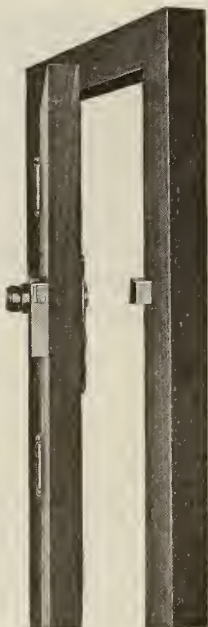
Made in electric or spring driven models, in various types to meet all demands, and can be used in conjunction with the International synchronized time system or with the impulse or battery system.

International Time Recording Lock.

FUNCTIONS—This lock is installed in connection with the International autograph time recorders and offers one of the greatest protections that can be secured.

It can be installed on any door for the purpose of recording the time when place of business is opened and closed; who opened it and who closed it; from which side of the door the key was used; whether anybody was in the establishment outside of business hours, and if so, how long; the time each employee arrives in the morning, goes to lunch, returns from lunch and the time each leaves at the close of business; amount of time each employee spends in the establishment each day.

This lock will not interfere with the ordinary operation of the door, nor will it detract from its beauty or appearance.



ILLUSTRATIONS SHOWING INTERNATIONAL TIME RECORDING LOCK INSTALLED ON DOOR

Its action is positive and as many as 8 locks and 8 different keys are available in each unit.

Made to fit wood or metal doors of any thickness, either right hand or left hand.

The record of 8 locks and 64 watchmen's boxes can be recorded on each time recorder.

Standard finish is dark golden oak. Special finishes made to order.

OPERATION—The simple turning of the key in this lock makes a record in the recorder. Every key prints its identity and positively identifies the user with the record made.

KEYS—Duplicate keys will be furnished to users only on their order, providing additional security.

Prominent Installations.

Below is given a partial list of prominent installations of International time systems and time recording equipment:

Adams Express Co., New York, N. Y.
 American Brass Co., Waterbury, Conn.
 American Car & Foundry Co., Detroit, Mich., and Depew, N. Y.
 American Radiator Co., Chicago, Ill.
 American Sugar Refining Co., New York, N. Y.
 American Telephone & Telegraph Co., New York, N. Y.
 Ansco Company, Binghamton, N. Y.
 Armour & Co., Chicago, Ill.
 Atchison, Topeka & Santa Fe R. R., Chicago, Ill.
 Babcock-Wilcox Co., Barberton, Ohio
 Bethlehem Steel Co., Bethlehem, Pa.
 Burroughs Adding Machine Co., Detroit, Mich.
 Chicago Pneumatic Tool Co., Chicago, Ill.
 Colgate Co., Jersey City, N. J.
 Colts Patent Fire Arms Co., Hartford, Conn.
 E. I. du Pont de Nemours Co., Wilmington, Del.
 Endicott, Johnson & Co., Endicott, N. Y.
 Erie R. R. Co., New York, N. Y.
 Federal Shipbuilding Co., Newark, N. J.
 Ford Motor Co., Detroit, Mich.
 General Electric Co., Schenectady, N. Y.
 International Harvester Co., Chicago, Ill.
 International Paper Co., New York, N. Y.
 Interborough Rapid Transit Co., New York, N. Y.
 Morris & Co., Chicago, Ill.
 National Biscuit Co., New York, N. Y.
 Pittsburgh Plate Glass Co., Pittsburgh, Pa.
 Remington Arms Co., Ilion, N. Y.
 Remington Typewriter Co., New York, N. Y.
 Sears, Roebuck & Co., Chicago, Ill.
 Southern Pacific R. R. Co., San Francisco, Cal.
 Standard Oil Co., New York, N. Y.
 United Cigar Stores, Chicago, Ill.
 United States Steel Corporation, various branches
 Western Electric Co., Chicago, Ill.
 Winchester Repeating Arms Co., New Haven, Conn.
 Youngstown Sheet & Tube Co., Youngstown, Ohio



FACTORY OF THE INTERNATIONAL TIME RECORDING COMPANY OF NEW YORK, ENDICOTT, N. Y.

ESTABLISHED 1884

INCORPORATED 1888

THE STANDARD ELECTRIC TIME CO.

SPRINGFIELD, MASS.

SALES OFFICES AND SERVICE STATIONS

NEW YORK, N. Y., 50 Church Street
BOSTON, MASS., 261 Franklin Street
CHICAGO, ILL., 1363 Monadnock Building

SAN FRANCISCO, CAL., 461 Market Street
BIRMINGHAM, ALA., Brown-Marx Building
COLUMBUS, OHIO, Arcade Building

Products.

The "STANDARD" ELECTRIC TIME SYSTEMS, which include Electric Self-winding Master Clocks or Regulators, Electric Secondary Clocks, Program Clocks, with Bells, Horns, Whistles, etc.

Also, Tower Clocks, Street Clocks, Time Stamps, Employees' Time Registers, or Synchronizers for keeping other makes of clocks in perfect unison with the "Standard" time systems.

"Standard" Factory Time System.

"Standard" electric clocks furnish a reliable, uniform time and signal service throughout any plant and can be arranged to operate any number of secondary clocks, employees' time registers and time stamps, whistles, bells, etc., depending on the size and arrangement of plant. They require no winding, oiling nor individual setting; everything is automatic and electrically operated and the system secures the promotion of more careful use of paid-for time and greater efficiency.

"Standard" equipment has been perfected as the result of years of practical experience. It is an effective, simple and reliable system, free from experimental features or devices likely to give trouble.

"Standard" Master Clock.

The master clock, or regulator, is the source of time for the whole plant, or system. "Standard" master clocks are self-wound every minute and are fitted with dead beat escapement and platinum contacts throughout. The master clock should preferably be of seconds beat type with mercurial compensating pendulum for greatest accuracy.

It is so arranged that it will electrically operate and control any number of secondary clocks, bell signals, synchronizers or other time keeping apparatus.

Secondary Clocks.

"Standard" centralized control permits secondary clocks to be located at the most advantageous point of observation, regardless of accessibility. They can be used for service that wind-up clocks will not adequately meet; are not affected by temperature or vibration, and never require oiling.

Automatic Control.

"Standard" electric time systems are now furnished with full automatic control of battery charging, reducing care and attention to a minimum.

Finishes.

"Standard" cases for master clocks and secondaries are of oak, in three shades: light, medium and dark. Other finishes are supplied when desired to match the interior trim of the building.

Secondary clocks in metal cases, or with marble faces and with special hands, furnished in accordance with the engineer's designs.

References.

This company will be glad to supply a list of manu-

facturing concerns where "Standard" electric time systems have been installed.



ANY MAKE OF TIME RECORDER CAN BE SYNCHRONIZED OR ELECTRICALLY DRIVEN BY THE "STANDARD" SYSTEM



CALLING INSTRUMENT AS FURNISHED WITH "STANDARD" ELECTRIC TIME SYSTEM

Operates on same signals used for sounding factory schedule

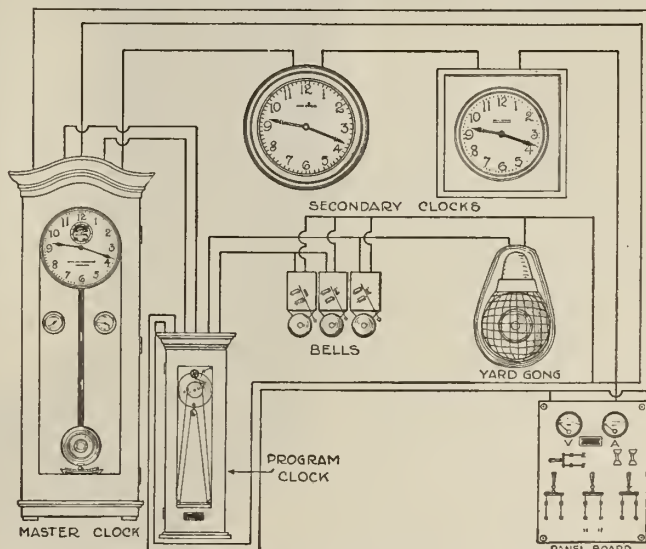


DIAGRAM SHOWING METHOD OF OPERATION AND DIFFERENT PARTS OF THE STANDARD ELECTRIC TIME CO.'S SYSTEM

CHICAGO WATCHMAN'S CLOCK WORKS

1526 South Wabash Avenue
CHICAGO, ILL.

EASTERN BRANCH: 9 Church Street, NEW YORK, N. Y.

Products.

The CHICAGO PORTABLE WATCHMAN'S CLOCK.

Chicago Watchman's Clock.

The Chicago watchman's clock is a clock of the portable type and of the highest possible quality, possessing radical advantages.

The container case is a die-cast product, aluminum, combining lightness with strength and rigidity. As shown in the illustration a partition separates that portion of the case containing the movement from the section which contains the registering mechanism and the dial rotating device.

The movement used in this clock is the highest quality production of the famous Waltham Watch Co., and is manufactured by them exclusively for the CHICAGO WATCHMAN'S CLOCK WORKS.

This clock is sold with any number of stations from six up to the limit permitted by the Insurance Underwriters.

Individual Advantages.

(1) 8-day, 15-jewel, special Waltham movement, stem wind and set.

(2) Special die-cast, aluminum container case.

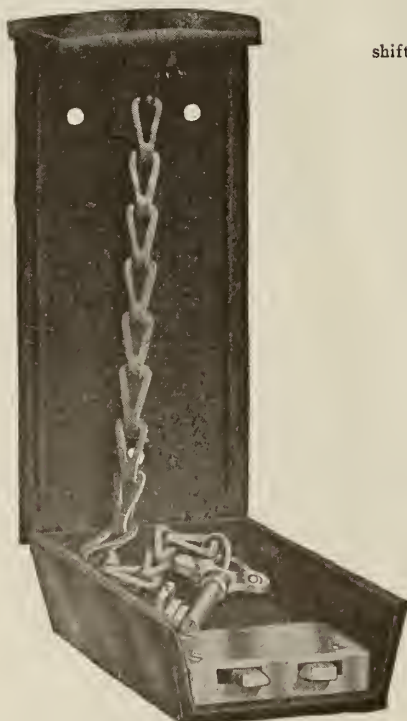
(3) Frictionless key action.

Catalogue.

Write for catalogue with detailed description.



LOCK STATION BOX
CLOSED



STATION BOX OPEN
Showing key and chain



CLOCK IN LEATHER CASE READY FOR SERVICE

Showing case with fixed guard to protect crystal. This or one with shifting plate supplied at buyer's option



CLOCK WITH CASE OPENED
Showing dial in place and partial registration

THE ARMOR CLAD MFG. CO.

Steel Bins, Shelving and Lockers

CANTON, OHIO.

Products.

ARMOR CLAD STEEL BINS and SHELVING; ARMOR CLAD STEEL LOCKERS.

Armor Clad Steel Bins and Shelving.

GENERAL—The main uprights are well formed and stiffened from one piece of sheet steel. Shelves are flanged on all four sides, for strength and stiffness; and are adjustable, up and down, on 2-in. centers, by simply removing bolts. Label holders are put on all fronts of shelves and bins. The entire structure is held securely together by 1/4-in. through bolts and nuts, which can be drawn up tightly with a wrench, thus affording strength and rigidity not always found in the slip-joint method of fastening.

CLOSED TYPE SHELVING—Made in double and single face. In double face, one back is used between front and rear. Compartment dividers, on 3-in. centers or bin fronts, 3 in. high, can be installed at any time without taking down the shelving.

SKELETON TYPE SHELVING—This type, sometimes called "racks," can be conveniently and economically

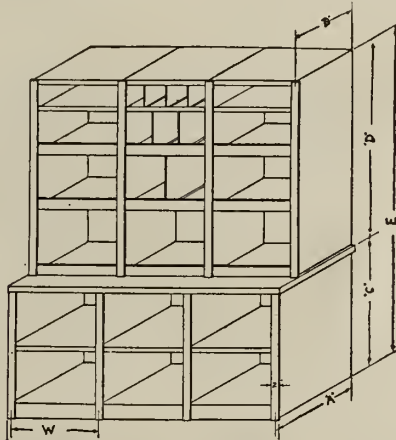
used for storing articles of such shape and size that they will not roll off the shelves. Made in both single and double face. The general construction is the same as the closed type of shelving. No bin fronts or dividers for pigeonholes are ordinarily used in this type of shelving, but each shelf has a label holder, holding a card 7/8 by 6 in.

OPEN TYPE SHELVING AND BINS—This is the same as the closed type, except that the back is left off. Made both in single and double face. Bin fronts and vertical dividers are furnished, if desired. This type of shelving is, however, usually used with plain shelves.

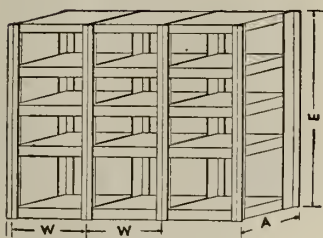
CLOSED TYPE LEDGE BINS AND SHELVING—The large bins are at bottom, to facilitate handling, and the shallow shelving is at the top. Made in either single or double face. Bin fronts are furnished, or may be ordered later. Removable compartment dividers, in multiples of 3 in., furnished, when desired.

Armor Clad Steel Lockers.

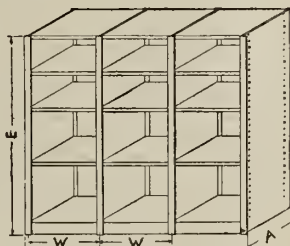
Sheet steel "uprights" are strong and stiff. Top and bottom brace, No. 16-gage, across front of lockers, is flanged on two sides. Doors are of one-piece high finish steel, re-folded, ribbed and welded. Door jambs are 1-in. angles. The 3-point locking device is exceptionally simple and strong. Lock catches are welded on. Locks, flat-key type.



Closed Type



Skeleton Type



Open Type

ARMOR CLAD STEEL BINS AND SHELVING

STANDARD DIMENSIONS

Furnished in any combinations of the following sizes:

Widths "W"—18, 24, 27, 30 and 33 in.

NOTE—Closed Type is also made in 21-in. width.

Depths "A"—12, 14, 18, 22, 26 and 30 in.

Heights "E"—36, 42, 48, 60, 72, 84, 96, 108 and 120 in.

LEDGE TYPE

Widths "W"—18, 24, 27, 30 and 33 in.

Depth "A"—24, 27, 30, 33 and 36 in.

Height "B"—14, 18, 22, 26 and 30 in.

Height "C," Ledge Height—30 and 36 in.

Height "D," Top Height—36, 42, 48, 60 and 72 in.

NOTE—For total heights of Ledge Bins and Shelving, add "C" and "D."



Style No. 130

Style No. 175

Style No. 150

ARMOR CLAD STEEL LOCKERS

STANDARD DIMENSIONS

Width, in.	Depth, in.	Height, in.	Width, in.	Depth, in.	Height, in.
STYLES NOS. 175 AND 150					
12	12	60	12	12	72
12	15	60	12	15	72
15	15	60	15	15	72
15	18	60	15	18	72
18	18	60	18	18	72

NOTE—Vented doors, hat shelf and 3 hooks. Any combinations of the above sizes. Total height over all, including legs, 68 in. for the 60-in. lockers and 80 in. for the 72-in. lockers.

STYLE NO. 130					
12	12	36	12	12	42
12	15	36	12	15	42
15	15	36	15	15	42

NOTE—Total over all height, including legs, is 80 in. for 36-in. lockers, and 92 in. for the 42-in. lockers.

DURAND STEEL LOCKER COMPANY

TELEPHONE:
CENTRAL 6302

1538 Fort Dearborn Bank Building
CHICAGO, ILL.

NEW YORK OFFICE, 938 Vanderbilt Building—Telephone, Beekman 1182
FACTORY, CHICAGO HEIGHTS, ILL.

AGENCIES

ATLANTA, GA., FIELDER & ALLEN Co., 44 Marietta Street—Telephone, Ivy 800
BALTIMORE, MD., H. G. LELAND, 120 West Fayette Street—Telephone, St. Paul 4053
BOSTON, MASS., C. S. ANGELL Co., 146 Summer Street—Telephone, Main 4677
BUFFALO, N. Y., WM. KRAETZ, 710 Ellicott Square—Telephone, Seneca 3554
CINCINNATI, OHIO, METALLIC EQUIPMENT Co., 810 Union Central Building—Telephone, Main 3783
CLEVELAND, OHIO, A. S. HOLDEN, 504 Swetland Building—Telephone, Prospect 1887
COLUMBUS, OHIO, DICK OFFICE SUPPLY Co., 202 Hartman Building—Telephone, Bell 5439
DENVER, COLO., HINE DESK & FIXTURE Co., 1640 California Street—Telephone, Main 8134
DETROIT, MICH., C. A. MARION, 816 Union Trust Building—Telephone, Main 2598
EL PASO, TEX., GEO. S. THOMSON Co., 104 Leon Street
GRAND RAPIDS, MICH., A. C. SLOSS, 912 Grand Rapids Savings Bank Building—Telephone, Main 2116
SEATTLE, WASH., S. W. R. DALLY, 322 Pioneer Building—Telephone, Main 678
INDIANAPOLIS, IND., J. J. TUTE Co., 501 Fidelity Trust Building—Telephone, Main 2476
LOS ANGELES, CAL., E. L. BOWEN, 908 South Hill Street—Telephone, Sunset 531
KANSAS CITY, MO., HOYLE JONES, R. A. Long Building—Telephone, Main 5975
MILWAUKEE, WIS., ROBT. B. PETLEY, 1418 Majestic Building—Telephone, Grand 1806
LOUISVILLE, KY., BELKNAP HARDWARE & MFG. Co., 13th and Washington Streets
MINNEAPOLIS, MINN., H. S. NESBITT Co., Builders Exchange—Telephone, N. W. Main 1268
OMAHA, NEBR., OMAHA PRINTING Co., 13th and Farnam Streets
PITTSBURGH, PA., M. H. BUFFINGTON Co., 608 Renshaw Building—Telephone, Grant 3986
PORTLAND, ORE., GLASS & PRUDHOMME Co., 65 Broadway—Telephone, Broadway 1158
ROCHESTER, N. Y., CHAS. ZIMMERLI, 156 Main Street, East—Telephone, Stone 5510
SAN FRANCISCO, CAL., GEO. H. TRASK, 76 Sacramento Street—Telephone, Sutter 3474

Products.

STEEL LOCKERS and WARDROBES; STEEL SHELVING, RACKS and BINS for factories, warehouses, foundries and stores.

Stationery and Storage Lockers.

Specifications for Durand Steel Lockers.

STANDARD SIZES—

Width, 12", 15", 18", 24" and 36".

Depth, 12", 15", 18" and 24".

Height, double tier, 36" or 42"; single tier, 60" or 72".

All except the 42" lockers stand on 6" legs; this must be added to get the over all height. The 42" lockers stand on 3" legs.

MATERIAL AND CONSTRUCTION—Locker doors to be made of No. 16 U.S.S. gage steel, and ventilated by means of louver vents or round hole perforations. Doors to be flanged on all four edges for reinforcement, and all doors 18" or wider to have additional reinforcement consisting of a $\frac{3}{4}$ " x $\frac{3}{4}$ " x $\frac{1}{8}$ " angle, electrically welded to inside of door in the shape of a K-brace.

Doors to be hung in a strong and rigid frame composed of 1" x 1" x $\frac{1}{8}$ " angles, welded together at the corners. Angles are to be machine polished before enameling.

Doors to be hung by means of strong and secure hinges (two to a 36" door, three to a 42" door, three to a 60" door and four to a 72"

door). Hinges to be firmly riveted both to door and to door frame to prevent any hinge from working loose.

Body of locker to be made of not lighter than No. 22 U.S.S. gage sheet steel. Backs to be flanged and firmly bolted to partitions and ends by means of special bolts, spaced not over 8" apart on centers. All bolts exposed on ends to be flat head end slotless.

Bottoms to be made flush with front cross piece, so that dust and dirt settling on bottom can be easily brushed out.

Tops to be flat. (They can be made slanting, thus making locker 6" higher at back than at front, and the average extra cost for slanting top is 8% of the total cost of locker.)

Lockers to be built on the unit principle. Each door having its own complete frame surrounding that door. All similar parts cut to gage and interchangeable. All shearing, punching and perforating shall be done so as to leave no burrs or fins anywhere exposed.

LOCKING—Doors to be locked by means of Durand multiple locking device, locking door at two points on 36" or 42" lockers and at three points on 60" or 72" lockers. This device to be operated by lift handle; handle to be malleable. The following types of locks can be furnished to control this multiple locking device:

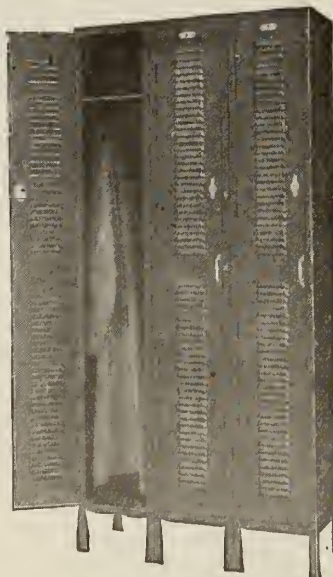
Flat key locks.

Combination locks.

Padlocks.

Or if no padlocks are desired, just padlock attachment without locks.

EQUIPMENT—All 60" and 72" lockers to be fitted with shelf spaced 10" from the top. All lockers fitted with electrogalvanized rustproof hooks. Lockers measuring 12" wide and 12" deep to be fitted with 4 hooks; lockers measuring 15" wide and 15" deep to be fitted with 5 hooks; lockers measuring 18" wide and 18" deep or deeper to be



SINGLE TIER LOCKERS
Type F. L. S.



DOUBLE TIER LOCKERS
Type F. L. D.

fitted with 7 hooks. Lockers measuring 24" deep to be also fitted with cross rod for coat hangers.

NUMBERING—Each locker to be numbered by means of a brass plate with sunken and black enamel figures.

FINISH—All parts to be thoroughly cleaned and then given 2 coats of best quality baked enamel, either black or olive green; each coat applied by dipping, and baked on separately.

SHIPMENT—Lockers are usually shipped knocked down, and in this way take the lowest freight rate; all parts are well crated.

On large equipments the company can also arrange to send mechanics to the building and install the lockers ready for use.

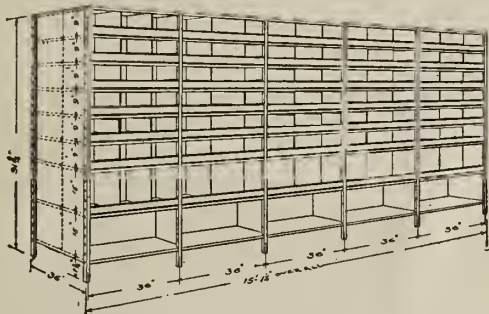
Durand Steel Rack Construction.

Durand steel racks are simple in construction and interchangeable throughout and are made in two types: Durand Standard and Durand Skeleton.

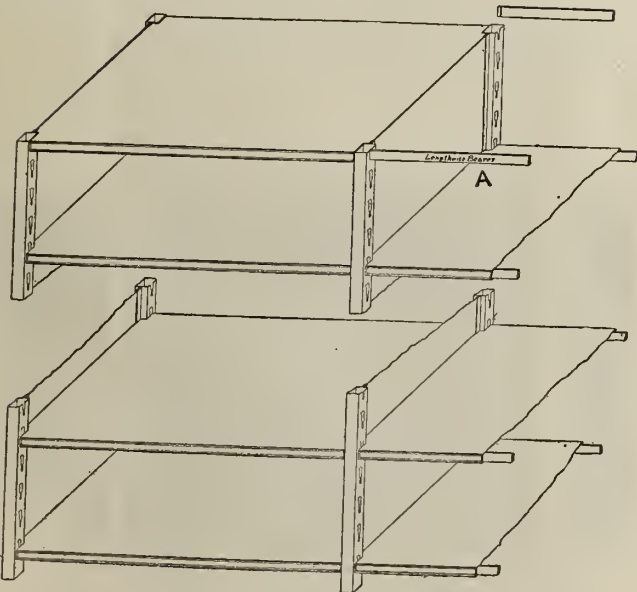
DURAND STANDARD—A closed type of shelving consisting of uprights and shelves, to which can be added interchangeable compartment dividers, bin fronts, counters, backs and label holders.

DURAND SKELETON—An open boltless structure for storage of patterns and packaged stock.

DURAND SHELVES—Both Standard and Skeleton types have sustained a load of 1000 lbs. per sq. ft. without exceeding their bending strength, and will carry an unevenly distributed load of 200 to 400 lbs. per sq. ft., depending on their area, without taking a permanent deflection.



ASSEMBLY OF DURAND STEEL RACKS



ISOMETRIC VIEW OF STANDARD RACK, SHOWING DETAILS OF CONSTRUCTION
A. Lengthwise bearer

Specifications for Durand Steel Racks.

STANDARD UPRIGHTS—To be composed of two 1/4" square tubes of No. 16 U.S.S. gage steel with a flat sheet welded between. (These sheets vary from No. 22 to No. 16 U.S.S. gage, according to the depth and height of the uprights.)

SKELETON UPRIGHTS—To consist of two 1/4" square tubes.

All uprights punched on 3" centers for shelf adjustment.

STANDARD SHELVES—Shelves in standard racks to be made of No. 16 U.S.S. gage steel flanged downward 1" and back 5/8" at front and back, and downward 1" at sides. Front and back of shelves to be carried on, and reinforced by, 1/4" x 1" high carbon bars (lengthwise bearers) and at sides fastened to the uprights by 1/4" bolts.

SKELETON SHELVES—Shelves in skeleton racks to be flanged at front and back the same as standard shelves, and at sides downward. These shelves to be carried front and rear on 1/4" x 1" high carbon bars (lengthwise bearers) and at sides on 1" x 5/8" x 1/8" angles (crosswise bearers), no bolts being used.

LENGTHWISE BEARERS—To be 1/4" x 1" rolled steel bars grooved at ends, grooves being tapered so that they are a wedging fit in the shelf adjustment slots.

CROSSWISE BEARERS—To be 1" x 5/8" x 1/8" angles having tapered notches that wedge on lengthwise bearers and lugs that engage in slots in upright tubes. Long legs of angles have tangs pressed out to bear side flanges of shelves.

BACKS—To be a flat sheet varying in gage according to size.

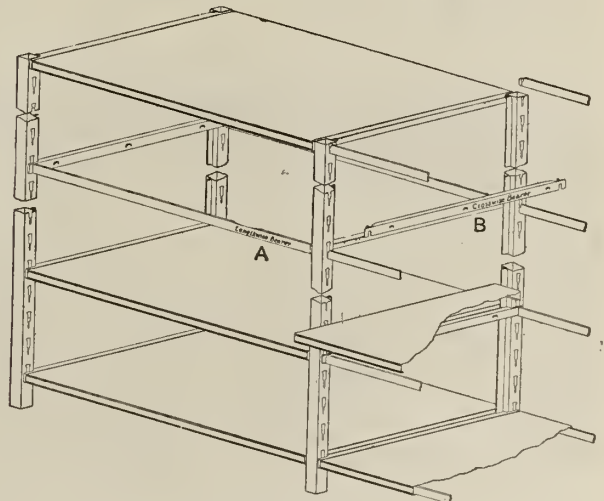
BIN FRONTS—To be formed of No. 16 U.S.S. gage so that a label card the full length of front can be inserted if desired, and fastened to uprights by clips that enter shelf adjustment slots and bolt to bin fronts.

LABEL HOLDERS—To be 1 1/8" wide and full length of shelf; drawn from No. 22 U.S.S. gage steel.

FINISH—Black japan and olive green enamel baked on are this company's two standard finishes. Black will stand a higher temperature in baking and therefore is recommended where shelves are to receive rough usage.

STANDARD SIZES STEEL RACKS

Uprights.....	Depth..	12"-15"-18"-21"-24"-30"-36"-42"-48"
	Height..	49 3/16"-55 3/16"-61 3/16"-67 3/16"-73 3/16"-79 3/16"-85 3/16"-97 3/16"-109 3/16"-121 3/16"-133 3/16"-145 3/16"
Shelves.....	Width..	24"-30"-36"-42"
	Depth..	12"-15"-18"-21"-24"-30"-36"-42"-48"
Backs.....	Width..	24"-30"-36"-42"
	Height..	49 3/16"-55 3/16"-61 3/16"-67 3/16"-73 3/16"-79 3/16"-85 3/16"-97 3/16"-109 3/16"-121 3/16"-133 3/16"-145 3/16"
Bin fronts.....	Width..	24"-30"-36"-42"
	Height..	3"-4"-5"-6"
Crosswise dividers..	Depth..	12"-15"-18"-21"-24"
	Height..	6"-9"-12"-15"-18"-21"-24"-27"-30"
Lengthwise dividers..	Length..	24"-30"-36"-42"
	Height..	6"-9"-12"-15"-18"-21"-24"-27"-30"



ISOMETRIC VIEW OF SKELETON RACK, SHOWING DETAILS OF CONSTRUCTION
A. Lengthwise bearer. B. Crosswise bearer

FEDERAL STEEL FIXTURE COMPANY

CHICAGO, ILL.

CHICAGO OFFICE, 607 Security Building
DETROIT OFFICE, 913 Dime Bank Building
MILWAUKEE OFFICE, 1334 First National Bank Building

NEW YORK OFFICE, 706 Park Row Building
CLEVELAND OFFICE, 403 Marion Building
MINNEAPOLIS OFFICE, 609 Fifth Avenue, South

Products.

FEDERAL STEEL LOCKERS and SHELVEING.
Metal Racks, Bins, Boxes, Filing Cabinets, Metal Furniture, Hospital Equipment.

Federal Unit Steel Lockers.

Simple in design, with all parts thoroughly standardized, interchangeable and uniform. The welded angle steel frame and special overlap door absolutely guarantees against door troubles. The Federal locker has fewer parts, erects more easily and is clean cut, handsome and strong.

SPECIFICATIONS

Doors—Full pickled, cold rolled furniture steel, No. 16 U. S. gauge (.0625 in. thick) if 15 ins. wide by 72 ins. high or larger; smaller sizes No. 18 U. S. gauge (.05 in. thick). Doors shall have reinforcing panels of hard steel angle bars ($\frac{3}{4}$ by $\frac{3}{4}$ by $\frac{3}{32}$ in.) riveted or welded to reverse side. Doors shall overlap locker frame and allow $\frac{1}{2}$ -in. clearance between door panel and locker frame to prevent binding.

Frames—Front frames shall be of hard angle steel (1 by 1 by $\frac{1}{8}$ in.) assembled by oxy-acetylene weld. They shall be unit in principle to give absolute squareness and rigidity and allow for rearrangement of lockers.

Body—Locker body shall be pickled and cold rolled steel No. 22 U. S. gauge (.0312 in. thick). Single row lockers shall have angle steel framed backs ($\frac{3}{4}$ by $\frac{3}{4}$ by $\frac{3}{32}$ in.) for each second unit. All parts shall be properly flanged or braced to give uniform strength.



Section of Door and Locker Frame



Key Lock



Time Lock



Adjustable Legs Cove and Regular



Regular Door Handle



Handle with Padlock Loop



Side Hook



Coat Rod Hook



Ceiling Hook



Back Hook

PARTS OF FEDERAL UNIT STEEL LOCKERS

Tops—Tops shall be inserted below top cross angles at front and back and shall overlap adjoining top 1 in. Slant tops shall have 6-in. pitch with $\frac{1}{4}$ -in. eave at front.

Bottoms—Bottoms shall be flush and supported by 1 by 1 by $\frac{1}{8}$ -in. angle reinforcement.

Shelves—Shelves shall be 9 ins. below top. They shall be flanged on all sides with double $\frac{1}{2}$ -in. smooth edged flange at front.

Locking Device—Locking device shall be 3-point, operating with quarter turn of handle to engage locker frame immediately opposite lock and on top and bottom cross bars. Locking bars shall be $\frac{1}{2}$ in. by No. 10 gauge stock. Door handles shall be provided with loop for padlock. (Quote extra for Eagle, Miller or Yale R381 $\frac{1}{2}$ -master-keyed locks with 2 keys each, or Miller 3332 B combination lock.

Hinges—Hinges shall be 2 $\frac{1}{2}$ -in. fixed pin heavy steel butts with concealed flanges. 72-in. doors shall have 3 hinges, smaller doors 2 hinges.

Hooks—Hooks shall have sherardized, rustless finish. Locker backs shall have 2-point hook for coat and hat. Sizes 15 ins. or less shall have a single prong hook attached with 2 bolts. Larger sizes shall have special 2-prong hooks with $\frac{3}{8}$ -in. steel rod for coat hanger on 60-in. or 72-in. sizes. A 2-prong ceiling hook shall be supplied if coat rod is omitted.

Legs—All front legs shall have a simple screw adjustment (to allow for any unevenness in floor). Back legs in single row locker sections shall be of $\frac{3}{4}$ -in. angle steel and shall be integral part of locker frame.

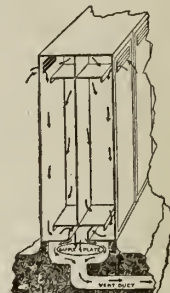
Ventilation—Doors shall have embossed, hooded or louver ventilators. They shall be 7 ins. long and 1 in. apart on centers with $\frac{1}{4}$ -in. opening at lower edge. There shall be nine embossings near top and also near bottom.

Numbers—Lockers shall be numbered with black figures $\frac{3}{4}$ in. high sunk in polished brass plates near top of door.

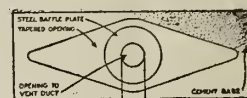
Finish—Two-coat olive green or pigment black enamel baked at a temperature of 300° Fahr.

STANDARD SIZES—Any combination of dimensions as listed:
12 ins. wide, 12 ins. deep, 36 ins. high, on 6-in. legs
15 ins. wide, 15 ins. deep, 42 ins. high, on 6-in. legs
18 ins. wide, 18 ins. deep, 48 ins. high, on 6-in. legs
60 ins. high, on 6-in. legs
72 ins. high, on 6-in. legs

NOTE—36-in. and 42-in. sizes made 2 lockers high.



SECTION OF FEDERAL VENTILATED LOCKERS



PLAN OF CEMENT BASE FOR VENTILATED LOCKERS



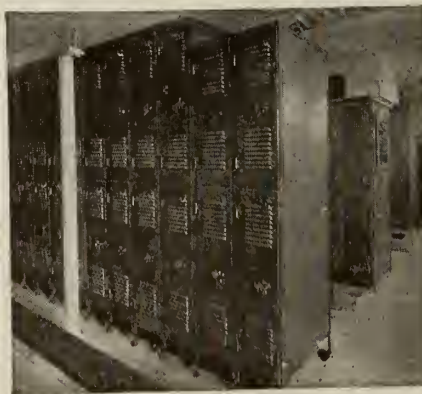
SINGLE TIER LOCKER



FEDERAL LOCKERS, SINGLE TIER WITH SLANT TOPS



DOUBLE TIER LOCKER



DOUBLE TIER FEDERAL LOCKERS, DOUBLE TIER WITH SINGLE AND DOUBLE TIER IN BACKGROUND



FEDERAL EXPANDED METAL LOCKERS

Federal Steel Shelving and Racks.

WEIGHT SAVING—Non-essentials have been eliminated by our engineers who have centralized strength so that floor load may be used to support more materials stored with less weight of shelving used. The Federal patented shelf formation with locked, full section flanges gives upward of 25% greater shelf strength.

STANDARDIZATION—Second only to the value of sturdy strength is standardization, simplicity, adaptability, extensibility. From the simple rack type (open verticals and shelves) to the completed equipment (closed sides, closed backs, bin fronts, shelf dividers, box dividers, box stops, hinged doors, sliding doors, ledge fronts) there is not a single item that must be discarded or substituted. The fewness of parts and their simple smoothness and uniformity make Federal shelving the ultimate in standardization, extensibility and adaptability.

ADJUSTABILITY AND TIME SAVING—The Federal patented shelf lock gives shelf adjustment in about half time. A hammer blow will either lock or disengage the shelf. This ease of adjustment and simplicity of parts makes for an economy of shelf space because compartments of proper size may be more readily provided.

Economy of shelf space used, means economy of time to stockkeepers.

SPECIFICATIONS

General—All shelving and rack parts shall be uniform and interchangeable. They shall adjust independently, and be so constructed that there shall be no exposed edges, and so that an equipment may be added to, separated, and parts inserted or removed without disturbing any but the one opening involved.

There shall be but one type

STANDARD SIZES FEDERAL SHELVING PARTS

PART NO. 1. UPRIGHT PARTITIONS
Heights. 48"-54"-60"-66"-72"-78"-84"-90"-96"-102"-108"-114"-120"-126"-132"-144"-156"-168"
Depths. 9"-12"-15"-18"-24"-30"-36"

PART NO. 11. SKELETON UPRIGHTS
Same as Upright Partitions

PART NO. 2. SHELVES
Widths. 18"-24"-30"-36"-42"-48"
Depths. 9"-12"-15"-18"-24"-30"-36"

PART NO. 3. BACKS
Heights. Same as Upright Partitions
Widths. 18"-24"-30"-36"-42"-48"

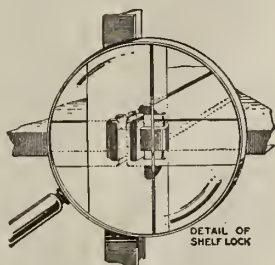
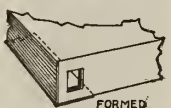
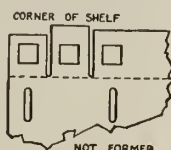
PART NO. 4. BIN FRONTS
Heights. 2"-3"-4"-5"-6"-8"
Widths. 18"-24"-30"-36"-42"-48"

PART NO. 5. LABEL HOLDERS
Heights. 7/8"-1 1/8"
Widths. 18"-24"-30"-36"-42"-48"

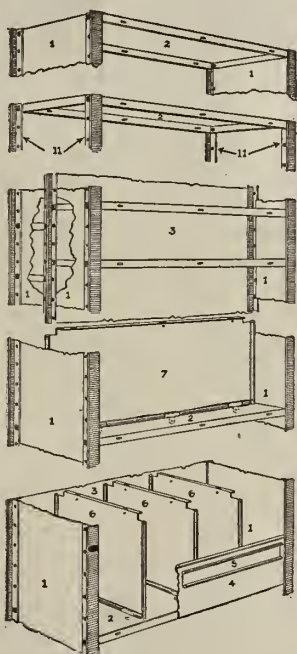
PART NO. 6. SHELF DIVIDERS, CROSSWISE
Heights. 6"-9"-12"-15"-18"-21"-24"
Depths. 9"-12"-15"-18"-24"-30"-36"

PART NO. 7. SHELF DIVIDERS, LENGTHWISE
Heights. 5"-8"-11"-14"-17"-20"-23"
Widths. 18"-24"-30"-36"-42"-48"

PART NO. 8. LEDGE SHELVES
Widths. 18"-24"-30"-36"-42"-48"
Depths. 12"-15"-18"-24"



Federal Shelf Corner and Shelf Lock
Construction patented



CONSTRUCTIONAL VIEWS
FEDERAL STEEL SHELVING

of upright, shelf, etc. Double faced sections shall be such that they may be separated and used in single row arrangement.

Uprights—The vertical load shall be carried by 1 1/2 by 1 1/2 by 1/8-in. hard steel T-bars, which shall provide for 3-in. [optional 1 1/2-in.] vertical shelf adjustment (closed uprights shall include No. 20 U. S. gauge [.0375 in. thick] cold rolled sheet steel).

Shelves—Shelves shall be of No. 18 U. S. gauge (.05 in. thick) cold rolled flat steel properly reinforced to support 150 lbs. per sq. ft. of shelf [optional—specify maximum safe load required.]

All shelf flanges shall be 1 in. deep with 1-in. return at front and rear. Flanges shall be full section, continuous and locked together under compression with the vertical T-bars. To prevent tearing or shearing, square washers 7/8 by 1/10 in. thick shall reinforce the shelf flange corners.

Backs—Closed backs shall be of No. 20 U. S. gauge (.0375 in. thick) cold rolled steel and shall attach with clincher bolts or in such manner that they may be added or removed without moving rack sections.

Double row shelving shall have full length backs.

Bin Fronts—Bin fronts shall be of No. 18 U. S. gauge (.05 in. thick) cold rolled steel. They shall overlap and engage the shelf or the bin front immediately below. The end wings shall attach to the T-bar adjustment holes.

Shelf Dividers—The shelf or compartment dividers shall be of No. 20 U. S. gauge (.0375 in. thick) cold rolled steel. They shall have 1/4-in. vertical beads and shall attach through the shelf with no raw flanges exposed.

Ledge Shelves—Ledge shelves and ledge uprights shall be of same materials as main sections. They shall attach with a close smooth fit to front of main equipment.

Label Holders—Label holders shall be of No. 24 U. S. gauge (.025 in. thick) steel. They shall be 7/8 in. high [optional 1 1/8 in. for bin fronts], shall extend entire length of shelf opening, and attach with bolts or clincher bolts.

Doors—All doors, whether hinged or sliding, shall be of No. 18 U. S. gauge (.05 in. thick) cold rolled, flat steel. They shall overlap and be so constructed that they can not bind.

Door hinges shall attach to main vertical adjustment holes so that doors may be added to any part of equipment entirely without special fitting, filing or drilling.

Sliding doors shall travel in double steel channels, shall have ball bearing rollers, and operate freely and easily.

Enamel Finish—The entire shelving shall have an olive green [optional—pigment black] baked enamel finish which shall be applied after machining is completed and to surfaces thoroughly clean and free from rust. The enamel shall bake at not less than 300° Fahr.

Special Service.

Our service department will be glad to co-operate in planning equipment and in suggesting features suited to individual requirements.



FEDERAL STEEL SHELVING, MEZZANINE FLOOR AND STAIRWAY,
DIAMOND CHAIN AND MFG. CO., INDIANAPOLIS, IND

THE HART & HUTCHINSON COMPANY

Steel Lockers

NEW BRITAIN, CONN.

BRANCH OFFICES

BOSTON, MASS., 654 Oliver Building
CHICAGO, ILL., 73 East Lake Street

NEW YORK, N. Y., 9 East 40th Street
PHILADELPHIA, PA., Real Estate Trust Building

Products.

STEEL LOCKERS; STEEL SHELVING.

Standard Lockers.

BRIEF SPECIFICATION—Metal—All sheet metal used is best grade cold rolled U. S. standard gage, free from scale and buckle. Partitions (intermediate sides and ends), tops, shelves and bottoms No. 21 gage. Backs No. 20 gage. Door frames and doors No. 14 gage.

Door Frames and Backs—Made from one sheet each, flanged 1-in. on both edges, formed at bottom to provide 6-in. legs.

Sides—Securely bolted to door frame and back.

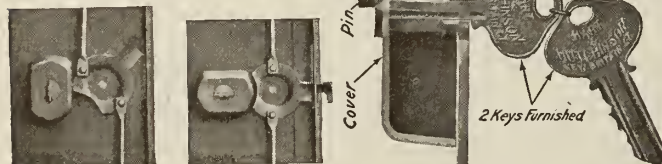
Top Member—Projects over and locks on to front frame, giving a finish. Flat top is standard.

Bottoms—Formed without ledges so they can be brushed out easily.

Locking Device—Operated by rustproof T-handle, engages door frame at 3 points. So arranged that manipulation of latch is impossible when thrown.

Doors—Type "B-C," 6-louvered openings top and bottom; one piece with steel channel reinforcing; hung to door frame with 3 solid 2-in. fast pin butts.

Type "A-C," same as "B-C," except panels are perforated with $\frac{5}{8}$ -in. square holes on 1-in. centers.



Unlocked Position Locked Position $\frac{1}{2}$ SIZE OF LOCK, SHOWING BACK OF DOOR SHOWING LOCK COVER DETAILS

Equipment—All standard lockers have a solid brass, pin tumbler, paracentric master-keyed lock, with 2 keys to each lock; 5000 changes.

Each locker has suitable number of 2-prong rustproof hooks of ramshorn design, a towel or coat hanger rod and a solid brass number plate with $\frac{1}{2}$ -in. numerals etched in black.

Single tier lockers have hat shelf 3 ins. below top with rounded front edge.
No shelf in double tier.

Optional Equipment—21° angle sloping tops. Combination

SIZES AND SHIPPING WEIGHTS STANDARD LOCKERS

SINGLE TIER				DOUBLE TIER			
Dimensions, ins.			Weight, lbs.	Dimensions, ins.			Weight, lbs.
W	D	H		W	D	H	
12	12	60	65	12	12	36	35
12	15	60	70	12	15	36	40
12	18	60	75	15	12	36	45
15	12	60	70	15	15	36	50
15	15	60	75	15	18	36	55
15	18	60	80	12	12	42	40
18	15	60	85	12	15	42	45
18	18	60	90	15	12	42	50
18	24	60	95	15	15	42	55
24	18	60	100	15	18	42	60
24	24	60	110				
12	12	72	75	12	12	48	50
12	15	72	80	12	15	48	55
12	18	72	85	15	12	48	60
15	12	72	85	15	15	48	65
15	15	72	90	15	18	48	70
15	18	72	95				
18	15	72	95				
18	18	72	100				
18	24	72	115				
24	18	72	125				
24	24	72	135				

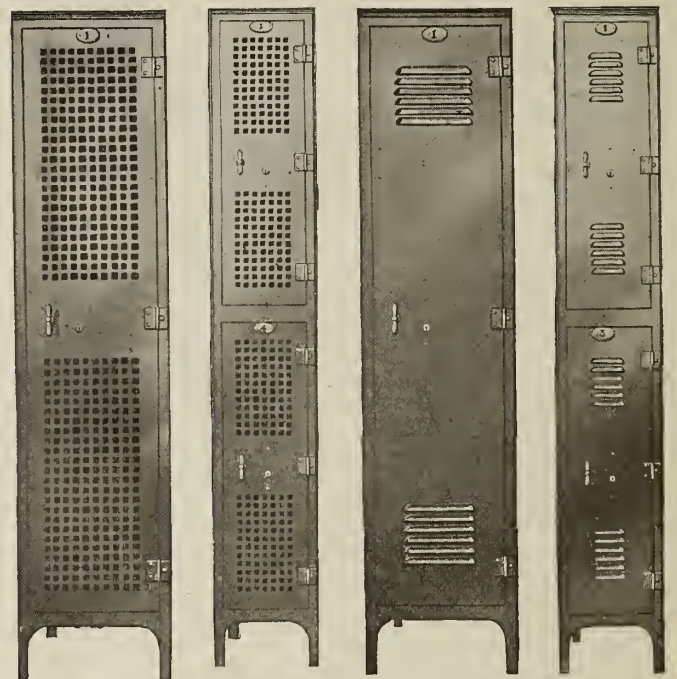
In double tier style each compartment constitutes a locker.

and keyless locks or padlock attachment.
Extra shelves for storage.

Finish—Standard olive green or black. Special finishes are produced to suit requirements.

SIZES—Tabulated sizes are carried in stock for prompt shipment.

SHIPPED—Knocked down flat, with assembling instructions, or shipped erected and crated, or erected in place by an efficient corps of trained mechanics.



"A-C" Single Tier "A-C" Double Tier "B-C" Single Tier "B-C" Double Tier

REPRESENTATIVE UNITS, "H & H" STEEL LOCKERS
Furnished in sections of any number of units. Details on following page

Standard Universal Unit Shelving.

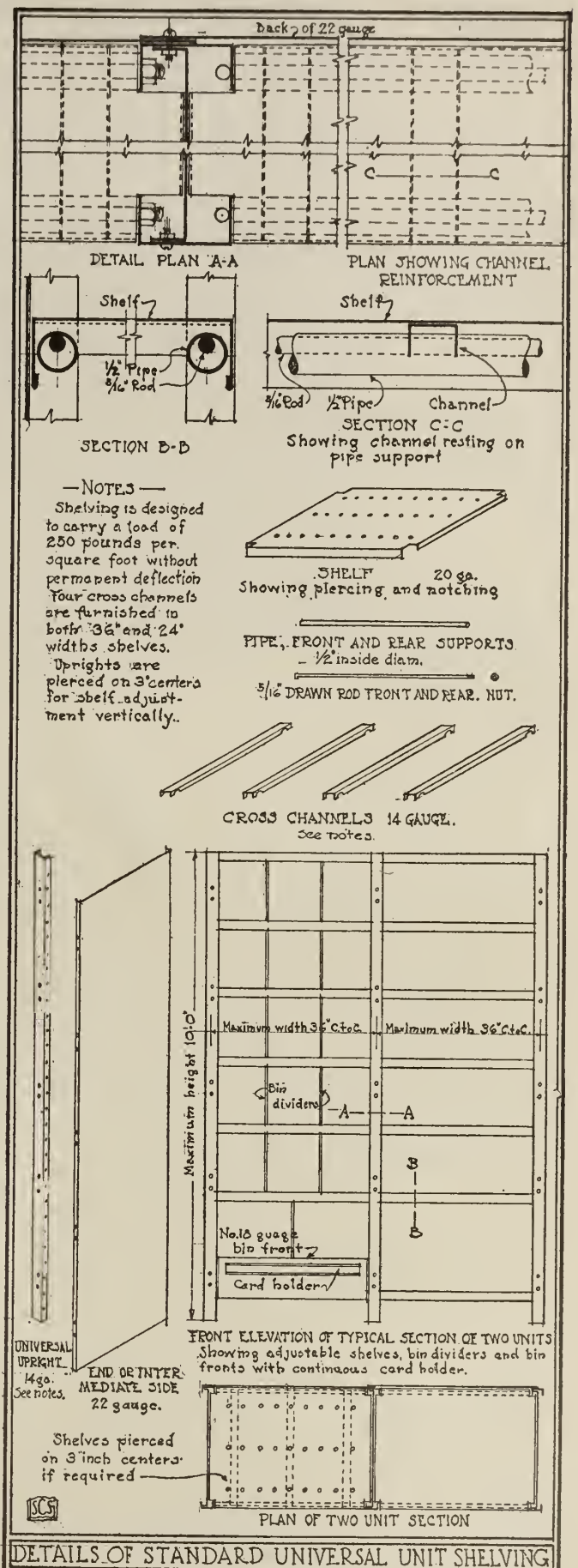
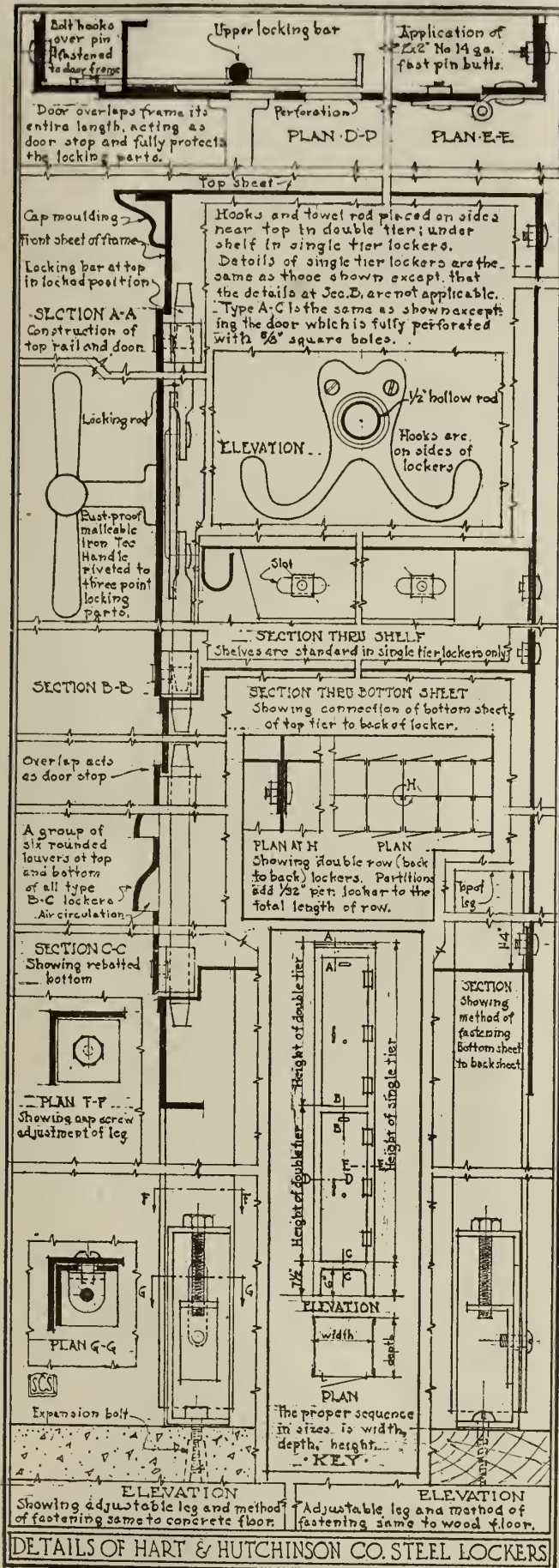
A standard unit type of steel shelving built on the "mill construction" principle. Substantial channel uprights are bolted together by rods incased in pipe separators and on these rest channel cross supports (or girders) that carry the loads imposed on the shelves. The load is not carried by the shelf but by the structural members under it.

Each section is a separate unit with ends and back; and dividers, bin fronts, card holders, etc., are furnished to suit the desired conditions.

Made in heavy and light weight.

STANDARD DIMENSIONS OF UNIT SHELVING PARTS IN INCHES

SHELVES		UPRIGHTS	
Width	Depth	Length	Length
24	12	60	90
27	15	63	93
30	18	66	96
33	21	69	99
36	24	72	102
		75	105
		78	108
		81	111
		84	114
		87	117
			120



LYON METALLIC MFG. CO.

Manufacturers of Steel Shelving and Steel Lockers

AURORA, ILL.

CHICAGO OFFICE, 835 Peoples Gas Building
NEW YORK OFFICE, 299 Broadway
CINCINNATI OFFICE, 2305 Union Central Building
PITTSBURGH OFFICE, 629 Oliver Building

DETROIT OFFICE, 812 Penobscot Building
ROCHESTER OFFICE, 1110 Granite Building
BOSTON OFFICE, 161 Devonshire Street
PHILADELPHIA OFFICE, 519 Bulletin Building

Products.

LYON ADJUSTABLE and EXTENSIBLE STEEL SHELVING and STORAGE RACKS; STEEL LOCKERS.

Also, Steel Cabinets, including Blue Print and Stationery Cabinets; Steel Boxes, Barrels, Tool Boxes and Bench Drawers; Steel Benches and Tables; Steel Factory Desks, and Steel Enclosure Panels.

Lyon Steel Shelving and Racks.

STANDARDIZATION—Both "Open" (Skeleton) and "Closed" shelving are assembled from the same standard parts, which are interchangeable, reversible and adjustable. No special construction is required and racks may be easily rearranged to meet changing conditions.

FEATURES OF LYON STANDARD SHELVING—Simplicity—Weights less for guaranteed load than other types, fewer parts, easy to assemble.

Rigidity—Each stack rigid in itself. No fastening to floor or ceiling or bracing required.

Strength—Carries greater guaranteed load per weight of shelving than any other rack made.

Space Saving—Construction requires minimum floor area.

Fireproof—Approved by insurance authorities.

LYON STANDARD SHELVING FOR HEAVY LOADS—Each shelf is put under compression against the face strip by two $\frac{7}{8}$ -in. diameter rods, on which it rests. The one-piece steel face strip is rolled and grips the partition sheet, to which it is spot welded, on both sides.

The face strip design avoids the usual pocket behind the upright. With an ample factor of safety, Lyon shelves will support from 200 to 350 lbs. per sq. ft.

LYON COMMERCIAL SHELVING—Shelving consists of three members: uprights, shelves and shelf supporting clips. The shelves may be adjusted on $1\frac{1}{2}$ -in. centers. A screwdriver is the only tool required for erection. The commercial type shelving is particularly designed for loads which do not require the great strength of the standard shelving.

SUGGESTED USES OF LYON SHELVING

Standard Open (Skeleton)	Standard Closed	Commercial Open (Skeleton)	Commercial Closed
For heavy material which piles or stacks	For heavy material requiring bins or pockets	For material which piles or stacks	For material requiring bins or pockets
Metal pattern storage	Public service corporation shops	Wood pattern storage	Repair shop
Wholesale hardware houses	Warehouses	Wholesale drug houses	Garages
Machinists supply houses	Tool rooms	Mercantile establishments	Retail hardware stores
Printing establishments for paper stock	Supply houses	Wholesale groceries	Supplies
Binderies	Machinesthops	Stationery houses	Repairs
Factories	Factories	For display purposes in retail supply houses	Light hardware
Warehouses	Stock rooms		

Complete plans, specifications and estimates on proposed installations will be furnished without charge.



SIZES OF LYON STANDARD RACK PARTS

PART NO. 1. UPRIGHT PARTITIONS
Heights. .48"-54"-60"-66"-72"-78"-84"-90"-96"-102"-108"-114"-120"-126"-132"-144"-156"-168"-180"-192"-216"-240"
Depths. .12"-15"-18"-24"-30"-36"-42"-48"

PART NO. 18. SKELETON UPRIGHTS
Same as Upright Partitions

PART NO. 2. SHELVES
Widths. .18"-24"-30"-36"-42"-48"
Depths. .12"-15"-18"-24"-30"-36"-42"-48"

PART NO. 34. BACKS
Heights. Same as Upright Partitions
Widths. .18"-24"-30"-36"-42"-48"

PART NO. 4. CROSSWISE DIVIDERS
Heights. .5"-8"-11"-14"-17"-20"-23"
Depths. .12"-15"-18"-24"-30"-36"-42"-48"

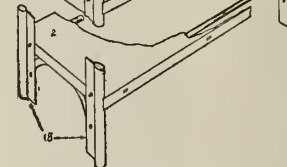
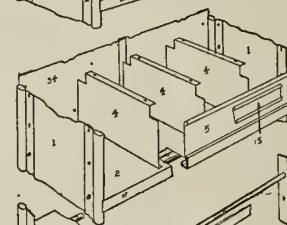
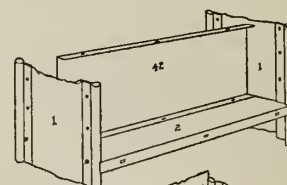
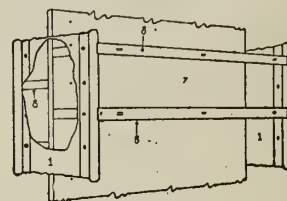
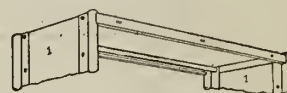
PART NO. 42. LENGTHWISE DIVIDERS
Heights. .5"-8"-11"-14"-17"-20"-23"
Widths. .18"-24"-30"-36"-42"-48"

PART NO. 5. BIN FRONTS
Heights. .2"-3"-4"-5"-6"-8"
Widths. .18"-24"-30"-36"-42"-48"

PART NO. 8. HALF SHELVES
Widths. .18"-24"-30"-36"-42"-48"
Depths. .12"-15"-18"-24"

PART NO. 7. DIVIDING BACKS
Heights. .48"-54"-60"-66"-72"-78"-84"-90"-96"-102"-108"-114"-120"
Widths. .18"-24"-30"-36"-42"-48"

PART NO. 15. LABEL HOLDERS
Heights. $\frac{3}{4}$ "-2"
Widths. .18"-24"-30"-36"-42"-48"



CONSTRUCTIVE VIEW, LYON STANDARD SHELVING PARTS

A Partial List of Lyon Shelving Installations, Each Amounting to More than \$20,000.00.

American Can Co., various Plants
American Locomotive Co., Providence, R. I.
Anheuser Busch Brewing Association, St. Louis, Mo.
Bethlehem Steel Co., South Bethlehem, Pa.
Bosch Magneto Co., Springfield, Mass.
Boston Store, Chicago, Ill.
City of New York
Chicago Telephone Co., Chicago, Ill., various Divisions
Dayton Engineering Laboratories, Dayton, Ohio
Eastman Kodak Co., Rochester, N. Y.
Fisk Rubber Co., Chicopee Falls, Mass., and Milwaukee, Wis.
Ford Motor Co., Detroit, Mich.
General Electric Co., various Plants and Branches
General Motors Co., various Divisions
General Vehicle Co., Long Island City, N. Y.
Goodyear Tire & Rubber Co., Akron, Ohio, and Branches
International Harvester Co., various Plants and Branches
International Silver Co., various Plants and Branches

Other Lyon Steel Equipment for Factories, Warehouses, etc.

BLUE PRINT CABINETS—For the storage of blue prints, drawings or other large flat pieces.

WORK BENCHES, COUNTERS, FOREMEN'S DESKS, TABLES, BOXES, BARRELS, ETC.—Stock patterns.

Bench Drawer—All-steel, with one-piece dustproof and thiefproof top, combination device for flat key lock or padlock.

Bench Leg—All-steel, non-breakable, sanitary bench leg.

Lyon Steel Locker.**STANDARD SIZES—**

SINGLE TIER		
Depth	Width	Height
12 ins.	12 ins.	60 ins.
15 ins.	15 ins.	72 ins.
18 ins.	18 ins.	
24 ins.	24 ins.	

DOUBLE TIER		
Depth	Width	Height
12 ins.	12 ins.	36 ins.
15 ins.	15 ins.	42 ins.
18 ins.	18 ins.	

Height does not include 6-in. legs.
Any combination of the above sizes makes up a Standard Locker.

SPECIFICATIONS AND EQUIPMENT—**DOOR AND DOOR FRAME**

Construction—Full pickled cold rolled furniture steel. Sheet, lapped back on both sides, to form tubular reinforcement as shown, and provides double thickness of metal where hinges, locking device and handle are attached.

Upright member $1 \times 1 \times \frac{1}{8}$ -in. hard steel angles. Horizontal member $1\frac{1}{2} \times \frac{3}{4} \times \frac{1}{8}$ -in. steel channels. All joints are lap-welded.

Hinges—Double butt hinge riveted to door frame and bolted to door. Number of hinges to be determined by height of door as follows:

- 72 ins. high, 4 hinges
- 60 ins. high, 3 hinges
- 42 ins. high, 2 hinges
- 36 ins. high, 2 hinges

Locking Device—Gravity actuated, controlled by special pivot handle and locked with either flat key, master-keyed Yale & Towne lock, or ordinary padlock. Number of locking points to be determined by height of door as follows:

- 72 ins. high, 3 locking points
- 60 ins. high, 3 locking points
- 42 ins. high, 2 locking points
- 36 ins. high, 2 locking points

Ventilation—By means of either "louver" or "standard" ($\frac{1}{2}$ in. round hole) perforations in doors. "Half" perforation as shown, or "full" perforated doors (perforations full length).

BODY

Back and Sides—Full pickled cold rolled steel, flanged on four sides to give additional strength. Reversible and interchangeable with other of same size.

Top—Full pickled cold rolled steel made either flat or sloping. Flat tops and bottoms of same size are interchangeable.

Bottom—Full pickled cold rolled steel offset to fit inside and flush with top of cross channel of door frame. Bottoms and flat tops are interchangeable with others of same size.

Legs— $1 \times 1 \times \frac{1}{8}$ -in. hard steel angles 6 ins. long; adjustable; have feet punched for securing to floor.

HAT SHELF

In single tier lockers only, placed $9\frac{1}{2}$ ins. from top in 72-in. lockers and 8 ins. in 60-in. lockers.

HOOKS

All lockers have 1 double prong ceiling hook. Lockers 12 ins. wide have 1 single prong hook on back and 1 on each side. Lockers over 12 ins. wide have 2 single prong hooks on back and 1 on each side.

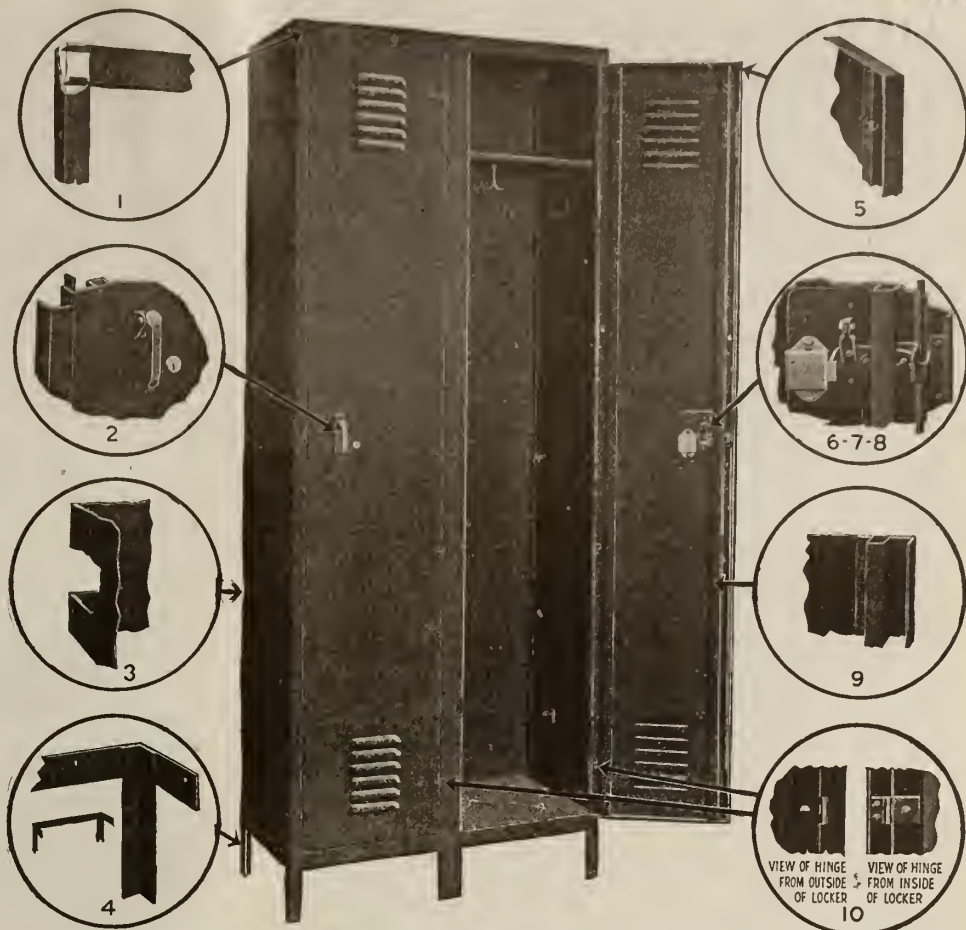
FINISH

Two coats of olive green or black enamel baked on at a temperature to secure maximum toughness and durability.

NUMBERING

Each locker is numbered by means of an etched aluminum plate with black enameled sunken figures.

METHOD OF SHIPMENT—According to existing conditions and quantity shipped, either erected or

**LYON STANDARD LOCKERS AND EXCLUSIVE FEATURES**

- (1) Door opening always true and square; reinforced one-piece door frame with welded corners.
- (2) Easily operated locking device; malleable handle; a single forward pull operates locking device and opens door.
- (3) All corner joints have double overlapping flanges.
- (4) Back legs strengthen and stiffen entire locker base.
- (5) Overlapping flanges at door corners.
- (6) Door will always shut and latch properly.
- (7) Gravity actuated locking device; engages automatically by merely pushing door shut; simple, strong, and secure.
- (8) Impossible to pry door open; three locking fingers and three door jams interlock.
- (9) Locker door, because of rigid reinforcing, can not get out of alignment.
- (10) Hinge can not be forced; securely riveted in position. Door can not swing back against adjoining locker door.

knocked down with complete erection instructions. Prices will also be quoted for lockers installed complete.

INFORMATION FOR PRICES—Prices are based on quantity, size and arrangement. Complete information of the installation desired should be furnished when possible for lowest prices. Our engineering department will make suggestions as to the arrangement of the lockers, the size required, interior fittings, etc., without charge.

Please advise on the following:

- (1) Quantity.
- (2) Size.
- (3) Arrangement: Single row (wall lockers); double row (back to back).
- (4) Sectionizing. Number of lockers or openings to each section in the above arrangement.
- (5) Furnish sketch of floor plan if possible.

Special Equipment.

All types of special steel equipment can be made, such as special cabinets, boxes, etc. Special sizes of shelving and lockers can also be made when absolutely necessary, but only at a higher cost.

Standard sizes are made in quantities and carried in stock, which enables the company to give better service with a lower cost. The wide ranges of sizes will be found to answer practically every requirement.

TERRELL'S EQUIPMENT CO.

Manufacturers of Steel Equipment

408 Hall Street
GRAND RAPIDS, MICH.

REPRESENTATIVES

ATLANTA, GA., J. M. VAN HARLINGEN, Candler Building
BALTIMORE, MD., M. L. HIMMEL & SON, 107 N. Frederick Street
BUFFALO, N. Y., NEAL COMPANY, 76 Pearl Street
CHICAGO, ILL., GEO. W. HUNT CO., 1438 First National Bank Building
LOS ANGELES, CAL., C. F. WEBER & Co., 222-24 South Los Angeles Street

NEW YORK, N. Y., STANTON M. CHILD, 395 Broadway
PHILADELPHIA, PA., PHILADELPHIA METAL FURNITURE Co., Ninth and Sansome Streets
PITTSBURGH, PA., E. H. DERMITT, 336 Fourth Avenue
PORTLAND, ORE., NORTHWEST SCHOOL FURNITURE Co., 244 Third Street
SAN FRANCISCO, CAL., C. F. WEBER & Co., 985 Market Street

Products.

STEEL LOCKERS, WARDROBES, CUPBOARDS.
Steel Shelving, Racks and Bins.

parts and construction and illustrations of this company's complete line comprising lockers, wardrobes, cupboards and shelving.

Terrell's Steel Lockers.

Built on the unit principle. Supporting frames made of special drawn steel angles 1 by 1 in. of not less than No. 14-gage U.S.S. steel. Corners mitered and acetylene welded. Bodies of high grade steel and smooth surface of not less than No. 24-gage U.S.S. or No. 22-gage B.&S.S. Ends reinforced with 2 strips of No. 20-gage steel welded inside of panel. Tops and bottoms reinforced with flanges on all sides. Backs have a flange on all sides. Doors made of No. 18-gage U.S.S. or No. 16-gage B.&S.S. high grade steel with smooth surface. Reinforced with special channels drawn from smooth strip steel. Panels welded to frames.

STANDARD EQUIPMENT—Three 2-prong hooks. Brass number plates numbered serially. Hat shelf in 60- and 72-in. lockers. Rod for hangers in 24-in. width and depth. Additional hooks furnished if desired.

STANDARD SIZES—Width, 12, 15, 18 and 24 in. Depth, 12, 15, 18 and 24 in. Height, single tier, 60 and 72 in.; double tier, 36 and 42 in. For over all height, add 6 in. for legs.

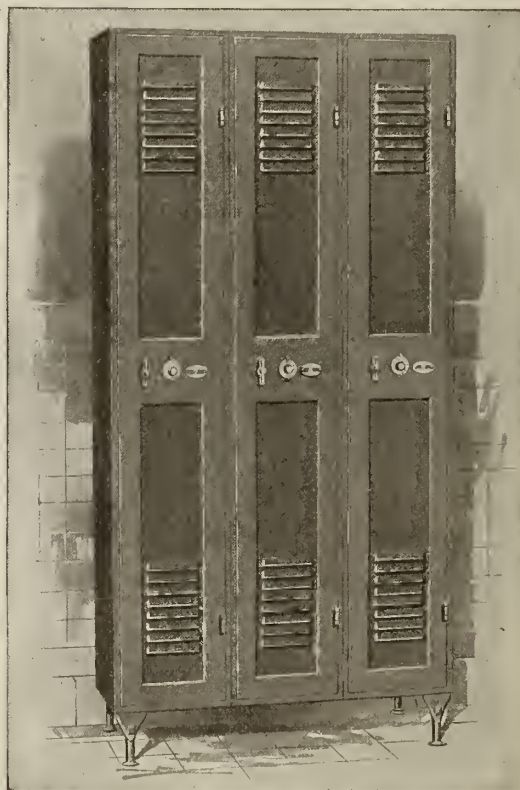
VENTILATION—Doors furnished with louver ventilation, with perforations or with ventilation omitted.

LOCKS—Master-keyed flat key locks, master-keyed padlocks and combination keyless locks.

FINISH—Baked enamel in olive green, black, grained oak and grained mahogany.

Literature.

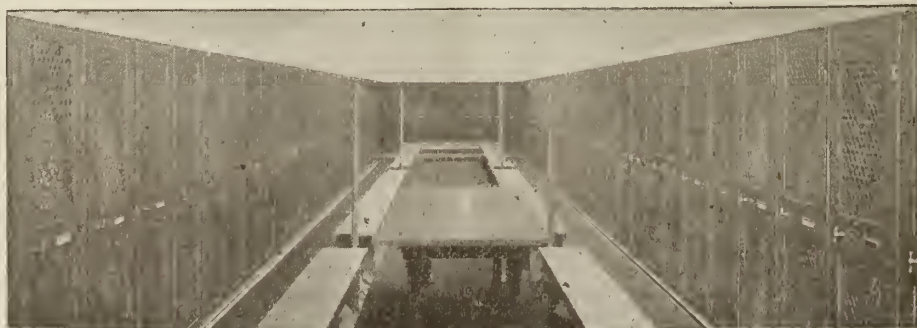
Ask for catalogue No. 7, which shows details of



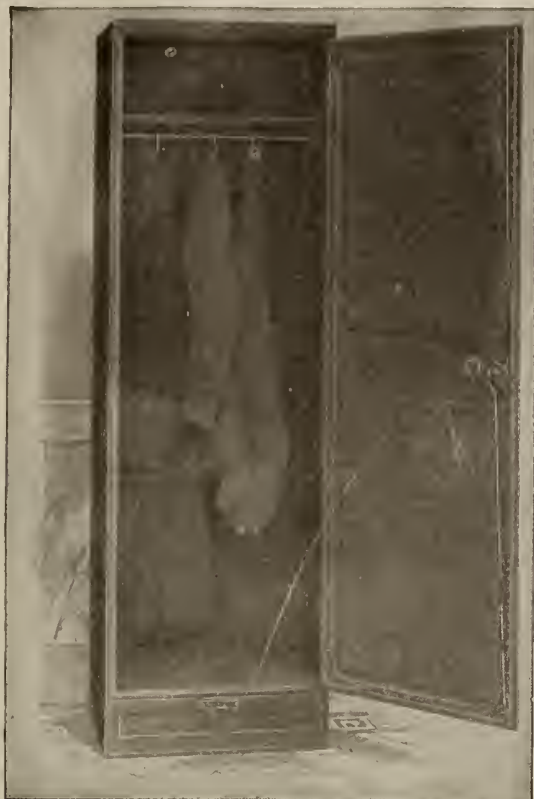
STEEL LOCKER TYPE N-L

Width, 12, 15, 18 and 24 in. Depth, 12, 15, 18 and 24 in. Height, single tier, 60 and 72 in.; double tier, 36 and 42 in. For over all height, add 6 in. for legs.

Finish, baked enamel in olive green, black, grained oak and grained mahogany

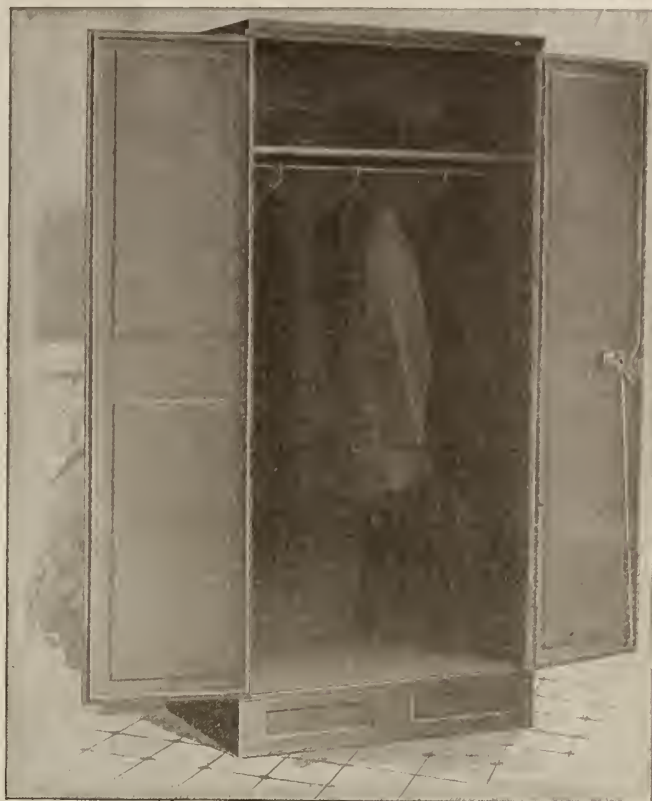


TYPICAL INSTALLATION OF TERRELL'S STEEL LOCKERS



STEEL WARDROBE N-W-S

Width, 24 in. Depth, 15, 18 and 24 in. Height, 60 and 72 in. For over all height, add $6\frac{3}{4}$ in.
Made of heavier material than the clothes lockers described on the preceding page



STEEL WARDROBE TYPE N-W

Width, 30 and 36 in. Depth, 15, 18 and 24 in. Height, 60 and 72 in. For over all height, add $6\frac{3}{4}$ in.
Made of heavier material than the clothes lockers described on the preceding page



STEEL CUPBOARD TYPE N-C-S

Width, 24 in. Depth, 12, 15, 18 and 24 in. Height, 60 and 72 in. For over all height, add $6\frac{3}{4}$ in.
Shelf adjustment on 1-in. centers.
Vertical divider adjustment for pigeon holes on 2-in. centers.
Made of heavier material than the clothes lockers described on the preceding page



STEEL CUPBOARD TYPE N-C

Width, 30 and 36 in. Depth, 12, 15, 18 and 24 in.. Height 36, 42, 60 and 72 in. For over all height, add $6\frac{3}{4}$ in.
Finish, olive green, grained mahogany and grained oak.
Can be shipped knocked-down, flat or assembled.
Made of heavier material than the clothes lockers described on the preceding page

EUREKA MACHINE CO.

Manufacturers of Superheaters and Cooperage Coating Sprays

2615 Vega Avenue
CLEVELAND, OHIO

MATTHEW WYLIE & CO., GLASGOW, SCOTLAND, SOLE AGENTS FOR GREAT BRITAIN

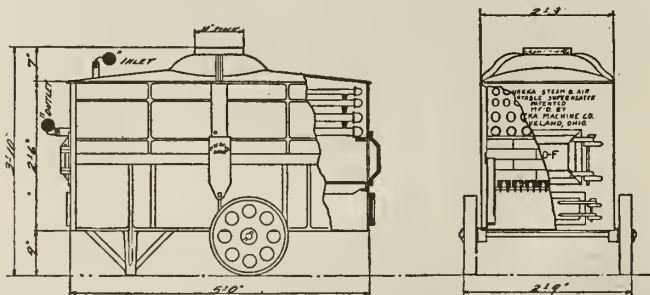
Products.

SUPERHEATERS; COOPERAGE COATING SPRAYS; BARREL STERILIZING and COATING MACHINES.

Also, Pitch, Tar and Steam Jacket Kettles; Branding Machines; Number Brands.

Eureka Portable Superheater.

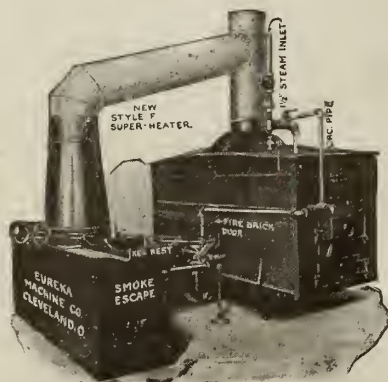
Designed for superheating ordinary saturated steam to extremely high temperature and for compounding, cooking and rendering materials of heavy consistency such as tar, pitch, fats, heavy greases and oils, where fire is ordinarily used.



DIMENSION DIAGRAM EUREKA PORTABLE SUPERHEATER
Weight 2000 lbs. Two smaller sizes

The Eureka superheater is indorsed by the National Board of Fire Underwriters, as a safety appliance where high temperature is applied to combustibles.

This machine can be placed convenient to the using point and give a steady flow of high temperature steam with low steam pressure, thus saving the strain on steam boilers.



STYLE "F" SUPERHEATER WITH SMOKE ESCAPE (STERILIZER)

With this appliance the superheater can be used for removing old coatings of pitch, paraffin, stearin or any greasy substance from barrels. It does it twice as fast as live steam and with far better results

Cooperage Coating Spray.

For coating the interior of barrels, tubs and buckets with glue, paraffin, silicate of soda, pitch or any protective lining.

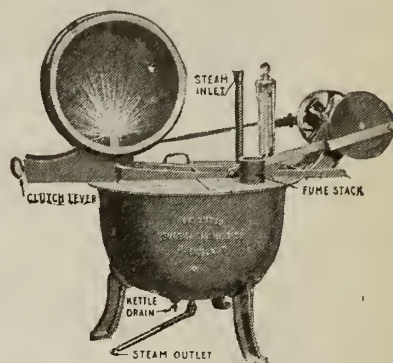
One of these sprays will do the work of three men and do it far better with a saving of time and material. As none of the coating reaches the outside of the barrel it is not smeared with coating. Inside, it is a perfectly lined package. The spray will throw any liquid coating 40 ft. and will cover the interior of a 100-gal. cask as

readily as that of a small bucket. It does not matter how much coating is forced into a package, only a thin coating will adhere and the surplus immediately flows back into the kettle again.

The operation is very simple. A package is laid over the spray nozzle, the clutch is thrown in and after pump has made from 5 to 6 strokes the clutch is thrown out and the package is coated.

PRESSURE LEVER DEVICE—After the barrel is rolled over the nozzle, the pressure lever is pushed down, which forces the sliding bung into the bunghole of barrel. The clutch is thrown in and the barrel is coated and tested at the same time. A great advantage in this device is that the operator has the barrel in a convenient position and it is then an easy matter to plug leaks. Enough pressure is generated to force the coating into and through any worm or seed holes.

When the barrel is coated and inspected the pressure lever is pulled up which releases the bung allowing the surplus coating and pressure to escape. All coating flows back into the kettle.



COOPERAGE COATING SPRAY
Weight, 675 lbs.; floor space, 3 by 5 ft.; capacity, as fast as operator can handle cooperage. Three sizes, hand or power



A NEW DEVICE ATTACHED TO POWER SPRAY OUTFIT TO TEST BARRELS FOR LEAKERS

This will give 3 lbs. pressure in 30 seconds which is far more than the old way of bunging and rolling

Price List.

Write for descriptive circular and price list.

Partial List of Firms Using Eureka Machines.

Armour & Co.	Ohio Varnish Co.
Morris & Co.	California Barrel Co.
H. J. Heinz Co.	Southport Mill, Ltd.
Procter & Gamble Co.	Capitol Refining Co.
Grasselli Chemical Co.	American Electro Products Co.
Michigan Sugar Co.	Standard Chem. Iron & Lum-
E. I. du Pont de Nemours Co.	ber Co.
Magnolia Petroleum Co.	

These machines have also been placed in Scotland, England, Ireland, Spain, Portugal, Russia, Japan, China, Australia, Brazil, Cuba.

THE JOHN VAN RANGE COMPANY

Equipment for the Preparation and Serving of Food

CINCINNATI, OHIO

BRANCH OFFICES

DETROIT, MICH.

CHICAGO, ILL.

Products.

EQUIPMENT for the PREPARATION and SERVING of
FOOD in Factories, Institutions, Hotels and Restaurants:

Glassware
Chinaware, "Shenango"
Hall's China (fireproof)
Silverware
Woodenware
Brushes
Cutlery
Dining Room Tables
Dining Room Chairs
Pyrex Glass Cooking Ware
Aluminum Cooking Ware
Cast Iron Cooking Ware
Vegetable Peelers
Vegetable Slicers and Cubers
Bread Slicers
Full Line of Bread and Biscuit Tin Pans
Bakers' Machinery
Trays
Electric Chocolate Warmers
Electric Toasters
Electric Ranges
Electric Window Grills
Gas Ranges

Experience.

For over 70 years THE JOHN VAN RANGE COMPANY has been planning, manufacturing, and installing equipment for the cooking and serving of food on a large scale. They have equipped hotels, restaurants and institutions of all kinds, in every part of the country.

Quality.

This company points with pride to the high quality of their goods which stand up under every test and give complete satisfaction. The latest labor saving devices are incorporated in their equipment.

Ability.

Years of knowing how, are behind every job THE JOHN VAN RANGE COMPANY handle. This experience and knowledge is available for customers. The completeness of the service is attested to by thousands of satisfied customers all over the nation.

Wire, write. Let THE JOHN VAN RANGE COMPANY take charge of that cooking or serving equipment installation.



NORDYKE-MARMON RESTAURANT

Outfitted by THE JOHN VAN RANGE COMPANY, Cincinnati, Ohio

